

Article begins on following page.

Please note:

Copyright Agency Limited (CAL) licensed copy. Further copying and communication prohibited except on payment of fee per Copy or Communication and otherwise in accordance with the licence from CAL to ACER. For more information contact CAL on (02) 9394 7600 or info@copyright.com.au

Who gets in, and who doesn't
Selecting Medical Students: an Australian Case Study

Annette Mercer
The University of Western Australia

*An earlier version of this study was presented for the degree of Doctor of
Philosophy of Murdoch University in 2007.*



Education Research and Perspectives

Joint Editors Clive Whitehead & Marnie O'Neill

Layout Designer Amy Deverell

Consulting Professor David Andrich, *The University of Western Australia*
Editors' Board Professor Phillip Hughes, *The University of Tasmania*
Emeritus Professor Peter W. Musgrave, *Monash University*
Professor R. J. W. Selleck, *Monash University*
Professor Geoffrey Sherington, *The University of Sydney*
Dr William B. Stephens, *University of Leeds*
Sir William Taylor, *The University of London*

*Education Research and Perspectives is an internationally refereed journal which is published bi-annually by the Graduate School of Education, The University of Western Australia. The journal provides an international outlet for articles on all aspects of education. It began life in 1950 as *The Educand* but was renamed *The Australian Journal of Higher Education* in 1961. The present title was adopted in 1974.*

The views expressed in this journal are those of the writer and are not necessarily shared by the editors or the Graduate School of Education.



THE UNIVERSITY OF
WESTERN AUSTRALIA
Achieving International Excellence

ISSN 0311-2543
Published by the Graduate School of Education
in the University of Western Australia

Education Research and Perspectives

Vol. 36, No 1, June 2009

Contents

Editorial	
Preface	1
Chapter 1	Introduction 5
Chapter 2	Literature Reviews 18
Chapter 3	Contextual factors in the selection of medical students 52
Chapter 4	Selection procedures in Australian undergraduate medical schools 67
Chapter 5	Methodology: A Case Study 91
Chapter 6	Results of qualitative analyses 108
Chapter 7	Results of quantitative analyses 131
Chapter 8	Summary and conclusions 137
Appendix	153
Case Studies	154
References	159

Editorial

As foreshadowed last December, this issue is devoted to a modified and updated doctoral study on new ways of selecting students for medical school. The research is based on changing methods of selecting students for the medical school at The University of Western Australia [UWA] but the issues involved and the new procedures that have been introduced in recent years are common in varying degrees to all medical schools in Australia, New Zealand, and the United Kingdom. The ethical and educational issues raised in this study are by no means confined to the selection of medical students. Increasingly, they apply to a wide variety of courses in which student demand for entry far exceeds the number of places available. Traditionally success in formal academic style examinations was regarded as the only criterion that was fair and objective but that reasoning has been challenged in recent times on the grounds that it unfairly advantaged special interest groups and excluded many students who would have made excellent medical practitioners. Perhaps the most significant finding that prompted changes in selection procedures was that many students who did not get into the 98th or 99th percentile in final secondary school examinations were perfectly capable of completing a medical course. This is a study relevant not only to the medical profession but to all those university administrators and government bureaucrats responsible for public selection policies across a wide field of occupations in which demand far exceeds supply.

The author of this study – Professor Annette Mercer – is a West Australian by birth and upbringing. She started out in life as a secondary school mathematics teacher and later as a mathematics tutor at UWA before joining the Education Faculty at Murdoch University. It was there that she became involved in the study of educational measurement in association with Professor David Andrich, a leading world authority on Rasch measurement theory, and a long-standing member of the Editorial Advisory Board of *Education Research and Perspectives*. While at Murdoch she completed a Masters degree in educational measurement and also worked on a project to develop tests for the Western Australia's Department of Education statewide testing of mathematics and the arts. She then returned to UWA as Director of the Institutional Research Unit and soon became closely involved in the selection of medical students. Her doctorate, under the supervision of Professor Andrich, was completed in 2007. She is also the author of one and co-author of another of the two reports which resulted in major changes in the policy of selecting students for entry into medicine at UWA. She is currently a Professor in the Faculty of Medicine and Dentistry.

Readers are advised that the December 2009 issue will revert to the traditional format of miscellaneous articles.

CLIVE WHITEHEAD

Editor

Preface

In 1997, whilst working as the Director of the Institutional Research Unit at The University of Western Australia (UWA), I was contacted by Associate Professor Judy Straton from the Faculty of Medicine and Dentistry. The faculty was doing the background work to introduce a new process for selecting its students, to be implemented in 1998 for the 1999 cohort of students. My task was to devise a method of combining the three component entry scores (an academic score, a score on an aptitude test and an interview score) so that they had equal weight in producing the final ranked list, from which offers of a place would be made. This was a typical task for the Institutional Research Unit. Under normal circumstances I would have worked on it over several weeks and it would have been complete. However this task led me to becoming involved in the construction of the interview questions and rating scales; membership of the Interview Working Party and the Faculty Selection Committee; and a long-term involvement and interest in issues related to the selection of medical students.

Two undergraduate medical schools in Australia, at the Universities of Newcastle and Adelaide, had already introduced a new selection process, using the same three components as proposed by UWA. Their method consisted of using the component scores as successive thresholds, with the interview score as the final ranking mechanism. Representatives from the three schools sectors in WA did not approve of this method as they felt that it did not do justice to the hard work done by students and their teachers in the twelve years of formal schooling. Clearly thresholds needed to be set on each component, but they asked the faculty to include the results of the tertiary entrance examinations in the final ranking. Hence the task set for me.

As a UWA graduate in mathematics and education I had started my career as a secondary mathematics teacher. This led to becoming a tutor in mathematics units at UWA, to training pre-service teachers at Murdoch University and eventually to working as an educational researcher at both these institutions. In 1990 I completed a Masters in Education, in educational measurement, at Murdoch under the supervision of Professor David Andrich, followed by enrolment in a PhD on a topic in psychometrics. However, life events took over, PhD studies faded into the background and I started work in the Institutional

Research Unit. The problem set for me by the Faculty of Medicine and Dentistry was to spark an interest which endured.

Over some years, in the early 1990s, the recognition that medical practitioners require more than simply a high level of academic ability to function successfully in their profession, together with a sharp increase in the number of academically qualified applicants to medical courses, had led to new ways of selecting medical students. Consequently the selection of students into the high-stakes course of medicine has become an area of considerable interest and research activity. The issues involved in selection are now prominent in the medical and medical education literature published in the UK, the USA, Australia, New Zealand and Canada, and in some European countries. At the same time as the introduction of new selection procedures, and independently of it, due to advances in pedagogy the nature of the medical curriculum has also changed. Changes have been characterised by the use of problem-based learning, and an emphasis on self-directed learning, as well as an increase in interaction between the students in classes and between students and their teachers. The recognition that problem-solving, communication and interaction skills in the courses, in addition to the requisite intellectual capacity, would enhance performance as practitioners, has reinforced the need for students to be selected on a different set of attributes from those used previously.

Issues such as these, together with a growing interest in issues of equity and diversity, had been the initial impetus for the medical faculty at UWA looking to change the selection of its students from a process relying entirely on high tertiary entrance scores, which tended to favour students from particular types of secondary schools. Secondary education in Australia and indeed in many countries is not a 'level playing field'. However, introducing a new selection process into a profession with long-standing traditions of academic excellence and successive generations of doctors within families, had its own set of problems. The aptitude test and the selection interview were both regarded with considerable scepticism from within the profession. To some extent, with several cohorts of graduates from the medical course now working in hospitals, the fears that this new process would be the downfall of the profession, have abated. The new graduates are still intelligent, hard-working individuals most of whom communicate well with their peers and their patients.

The emphasis in issues related to selection has changed from concern with the selection instruments into other areas. Whilst there are still

detractors for the 'new' process, challenges such as the small number of clinical training places available for the graduates, a shortage of rural doctors and the emergence of other areas of unmet need within the profession are prominent. Issues of equity of access and diversity among the cohorts, with the changing demographics of the Australian population, have taken centre stage. Some parts of the profession perceive problems in filling places in the 'hard' specialties and in producing future researchers. Such concerns are not confined to the study of medicine. At the secondary school level students are not taking up the so-called 'hard options' in science and mathematics as they did previously. Such issues are for society in general, not just for the medical profession or secondary schools. Members of Generation Y make choices based on lifestyle and their personal preferences. Who knows, maybe the global financial crisis will have some ramifications for these issues. The characteristics of Generation Z are yet to emerge.

Universities are now addressing the problems of equity of access for students from a range of backgrounds on the basis of differences in socio-economic status, culture and geographic location. The growth of graduate medical courses in Australia has been significant in the last ten years. I see this as a positive step in overcoming some of the inequities inherent in the secondary school system. Applicants to graduate medical courses have completed at least three successful years of tertiary study, many have significant work background and life experience and their motivation for wanting to study medicine is likely to be their own, rather than that of their parents or their school. A downside of this of course is the reduced number of years that they will potentially work in the profession. Furthermore, issues such as effective selection methods have not diminished with this trend towards graduate entry. Rather the location of the problems has moved from the end of secondary education into the tertiary sector.

Medicine is a profession with a long history of research and high standards of methodological rigour and evidence-based decision-making. These standards are being transferred into medical education. Universities are starting to collect high-quality data on their admissions systems. This has not been a short-term proposition. Medical courses are long and the ultimate aim is to produce effective members of the profession rather than effective medical students, although one must precede the other. Deciding whether selection processes have 'worked' is not a question which can be answered quickly. I consider the study which follows here, which is a case-study of the introduction of a new

selection process at UWA, to be merely a preliminary piece of work which documents the context and the issues surrounding the early days. Already the context and issues have changed and there is a great deal yet to be done.

In 2002, in collaboration with personnel from the Australian Council for Educational Research I became involved in a two-stage research project, culminating in 2006 in a report published for the UMAT Consortium. This report was known as *UMAT: A Validity Study, A review of the underlying constructs and an analysis of the content of the Undergraduate Medicine and Health Sciences Admission Test* and was a joint project between UWA and the Australian Council for Educational Research (ACER). Brief summaries from this report are found in Chapter 4 in the section on UMAT. My thanks go to ACER and the UMAT Consortium for permission to include these summaries.

In 2003, I made the decision to undertake doctoral studies in the selection of school-leaver applicants to Medicine, beyond the ongoing research that was required for the Faculty of Medicine, Dentistry and Health Sciences. Subsequently, in 2005 the Vice Chancellor of UWA and Dean of the Faculty of Medicine, Dentistry and Health Sciences together initiated a review of the selection process of students into Medicine and Dentistry at UWA. I was appointed to undertake this review, which dealt with the admission of both Standard (school-leaver) and Non-standard (some tertiary study) students into both these courses. The faculty gave me permission to use, in my own research, data which were collected in the course of the review. The study presented here represents a part of the area covered by the review, namely the admission of school-leaver students into Medicine. This aspect was of particular interest to me due to the many factors surrounding it, such as the effects of different types of secondary schooling.

I am grateful to the faculty for giving me access to this data and to Professor Ian Puddey, the Dean, for his on-going interest and his work on predictive validity. Most of all I am grateful to the faculty for posing such an interesting question to me twelve years ago.

Chapter 1

Introduction

This chapter provides the background to the study and documents the reasons for changing the process of selecting undergraduate medical students in Australia. The process changed from one which depended entirely on high academic achievement at the secondary school level to one in which other criteria became important and in which the required level of academic achievement, whilst still high, was marginally reduced.

Until recently, the selection of students into medical courses has been relatively straightforward in universities in Australia, the United Kingdom (UK), Canada, New Zealand and to a lesser extent the United States of America (USA). Practices in these countries form the context of this study; however, many of the countries in Europe deal with comparable issues in the selection of students in a similar way (Andrich and Mercer, 1997).

In the past, selection was based on academic merit and, in some cases, a relatively unstructured and informal entry interview. In the last ten years this situation has changed. The reasons for these changes, the nature of the procedures currently employed and the consequences of the changes are explored in this study. Methods of selection of students into the undergraduate medical course at The University of Western Australia (UWA) and the contextual issues surrounding this serve as a case study of modern practice in this complex and often controversial area. In particular, the selection of school-leaver applicants has been the most problematic and is the major focus of the study. Moreover, school-leavers have traditionally formed a high proportion of the intake in any one year, and while this proportion has decreased with the introduction of a graduate course, school-leavers still form the majority of entrants to medicine at UWA in any one year.

In each of the countries cited above, membership of the medical profession has been both prestigious and well-paid, however, this is not to imply that these are the main motivators for entry into the profession. Medicine is a very demanding profession and is often seen as more of an all-consuming vocation than as merely an occupation. The dedication and altruism demonstrated by many members of the profession are an indication of the personal sacrifice that many have been prepared to make to belong to this elite group.

Part of that prestige is related to the widespread perception that members of the profession are part of an academic elite because of the high levels of academic achievement long associated with entry to university medical courses. Until the late 1990s, it was commonplace for students from the independent school system in Australia (Story and Mercer, 2005) and the UK (McManus, Powis, Wakeford, Ferguson, James and Richards, 2005), to comprise a high proportion of applicants and entrants to medical courses. This was attributed to the high academic standards set by these schools and the consequent success of their students in gaining tertiary places in high-stakes courses such as medicine and law. Membership of the medical profession has also frequently been a family tradition. The circle of events in which doctors are sufficiently well-paid to send their children to independent schools; the promotion of high academic standards in independent schools, and entry to medicine being based purely on academic achievement, has meant that the system of recruitment has been largely self-perpetuating (personal communication, Professor L Landau, 2005).

Several significant changes to the medical recruitment process have taken place in the countries cited above in the last twenty years. Firstly, the proportion of any age-level cohort entering tertiary institutions has increased from 5 – 10% to well over 30% (Andrich and Mercer, 1997). Secondly, the nature of the community has changed, particularly in Australia and the UK, and is now multi-cultural due to deliberate post-war immigration policies and the more recent flood of refugees seeking refuge from other countries. A third change is the rate at which factual knowledge in medicine has increased, giving rise to a need for a different style of learning, in which solely learning by rote is no longer feasible or desirable. Instead, a different skill set is required for success in university medical courses. Allied to this is the proliferation of technological advances which requires university students and members of most professions to be able to access information and communicate in ways which differ from the past. Furthermore, secondary education is no longer seen as a 'level playing field', with research showing that students from independent sectors in Australia (Miller, 2004) and the UK (Nicholson, 2005) achieve higher tertiary entrance results than their counterparts from the government sector and hence gain entry to high-level tertiary courses at greater rates; however, their success rate in tertiary education is not as good as that of students from government schools with comparable secondary results (Miller, 2004).

Alongside these societal changes there have also been changes in the medical profession and in medical courses in universities. The way in which medical practice is conducted has changed in the hospitals and in local contexts, in part due to the large number of people accessing these services and also due to a change in the client-oriented way in which the services are currently provided (Smith and Hayling, 1998). One consequence of these changes is a different set of expectations on the part of the clients (Leahy, Cullen and Bury, 2003), who now require their medical practitioners to have personal qualities such as good communication skills (Wagner, Jester and Moseley, 2001), as well as the medical knowledge to deal with their ailments (Hughes, 2002). Paralleling these changes, the nature of the curriculum has changed in universities to deal with the expansion of knowledge and the use of technology. Students are expected to be more self-directed; to interact effectively with their fellow students as well as their teachers; and to engage in a problem-based style of learning which makes use of new technologies. These sorts of changes mean that medical students and young doctors are required to work effectively in group situations, to communicate well with their peers and their patients, and to relate to people from a diverse range of cultural and socio-economic backgrounds (Caan, 2003). The former view that certain groups of medical practitioners would become research scientists and thus avoid this level of interaction with the public is no longer a credible argument.

In recent years, given these complex and diverse circumstances, the numbers of secondary school students qualifying academically to enter such high-stakes courses such as medicine and law has increased. At the same time, the number of places in medical schools has not increased at the same rate. As a result pressure to gain admittance has increased. The reasons why the number of available places has not increased proportionally is not investigated in this study. However, the consequence of selection being made solely on academic achievement when the number of available places is limited, is that the academic score needed to gain a place is very high. In Australia, the level of this academic score rose to the point at which approximately the top 1 - 2% of secondary students were being selected for medical courses (UWA Academic Council, 1997), however, this level of academic performance was not required to succeed in the medical courses. This became apparent in Australia during the 1990s and was one of the main forces for change in the way in which medical students are selected. During the 1990s other criteria were added to the selection processes for medical students in Australia. At the same time the academic threshold

required for entry was lowered. The new criteria included the widespread use of an aptitude test called the Undergraduate Medicine and Health Sciences Admission Test (UMAT), and an interview, intended to assess some of the personal characteristics considered to be desirable in future members of the profession (Tutton, 1997).

In Australia the limitation on the number of university medical places is strictly controlled by the Commonwealth government. The length of the course (usually 6 years) together with the high-resource nature of medical education makes it very expensive for the universities and for the individuals involved. Clearly those with the financial means to improve their chances of selection are likely to make use of any form of assistance available to them. In the past this has included attendance at independent schools and the use of private tutors. In the current climate in which additional criteria are assessed for entry, coaching clinics for aptitude tests and interviews can now be added to this list of strategies.

It is against this backdrop of selection issues in Australia and similarly in countries such as New Zealand, Canada, the UK and the USA, that this study examines the diverse issues and the very rapid rate of change involved, even in the last ten years, in new selection processes for medical students; the implications of these for the profession; and possible future trends as these selection processes become more refined. For the purposes of this study, the experience in the medical faculty at The University of Western Australia serves as one detailed example of the way in which these changes have been introduced. Reference is also made in less detail to the development of these processes in other Australian undergraduate medical schools and to a lesser extent to the ways in which other countries have dealt with these issues. The remainder of this chapter examines the recent history of the selection of medical students at UWA and the reasons for the changes which occurred in the late 1990s.

An historical perspective

The Medical School at The University of Western Australia (UWA) was established in 1956 to ensure an adequate supply of doctors for Western Australia and to provide opportunities for young West Australians to study Medicine without having to travel interstate (Stanley, 1982). The Faculty confers the degrees of Bachelor of Medicine and Bachelor of Surgery (MBBS). A major teaching and learning goal of the now renamed Faculty of Medicine, Dentistry and

Health Sciences is 'to produce doctors, dentists, scientists and other health practitioners with appropriate knowledge, skills and attitudes to perform to their maximum potential for the requirements of Western Australia and the wider national and international communities'. (Faculty website)

Pertinent to the present study is a further goal 'to ensure that differences in background, gender, race, religion and any other personal characteristics which are irrelevant to the work of the Faculty and to its ethical concerns do not interfere in any way with the right to study, to work, to be employed, to be promoted, to take responsibility or to achieve positions of influence'. (Faculty website)

Selection of school-leaver medical students

During the 1960s and 1970s, selection of medical students was made at the end of first year in the BSc course at UWA. Students were required to have studied Physics, Chemistry and Mathematics during first year and were selected into Medicine on the basis of these results. Competition was intense within this group and stories abound of the very personal nature of the competition, given that all those competing for the places were attending the same classes. In the late 1970s this system was replaced by direct entry from school into Medicine, based on the results of state-wide examinations known as the Tertiary Admissions Examinations (TAE), which were held at the end of Year 12 or the final year of high school. This shifted the location of the competition to enter the medical course from the tertiary sector back into the secondary schools.

In 1986, the TAE was renamed and reshaped as the Tertiary Entrance Examinations (TEE). Henceforth, changes were made to the way in which an aggregated score was calculated for admission to all university courses. The aggregated score was known as the Tertiary Entrance Score (TES). In the period from 1986 to 1997 (for admission in 1987 to 1998) selection of school-leaver medical students was based solely on their academic score in the form of the TES. The TES was calculated from a 50:50 combination of the results in the TEE and school-based assessments. Various processes of moderation (taking account of differences between schools), scaling (taking account of differences in subject difficulty) and averaging, produced a mark with a maximum value of 500. In addition, 10% of the result of a scaling test,

the Australian Scholastic Aptitude Test, was added to this mark giving a final possible maximum score of 510.

In the early years of the TES, the calculation was based on the 'best' combination of either 3, 4 or 5 subjects. This was later amended to the best of 4 or 5 subjects (Andrich, 1989). In addition, students had to include at least one subject from each of two groups of subjects known as List 1 (Humanities/Social sciences) and List 2 (Quantitative/Sciences). UWA also had a literacy requirement of a scaled score of at least 50 in either English or English Literature. Certain subject combinations (eg Biology and Human Biology) could not be included in the calculation of the TES.

Admission for Australian residents to courses at all public universities in Australia is based on supply and demand. In the case of Medicine, demand considerably exceeds supply. School-leaver entrants at UWA are referred to as Standard entry students. Until recently, the quota for places in the Standard Medicine course was 99. This quota has increased since the introduction of the new selection process, with the allocation of more places by the Commonwealth government. The academic calibre of the students applying for the course resulted in the TES cut-off score being extremely high. In the years immediately preceding the introduction of the new selection process in 1998, the cut-off scores were 432 (1997), 434 (1996), 436 (1995) and 442 (1994) respectively. These scores represent an average combined mark of approximately 85% in each of the 4 or 5 subjects used in the calculation of the TES and these scores were minimum requirements. Under this selection process only students in the top 1% of their age group (or less in some years) and the top 2% of the TEE cohort, were eligible to enter the Medicine course as school-leavers.

Effects of the Medicine cut-off score on the schools

The very high average score needed in 4 or 5 subjects to achieve a TES in excess of 430 generated considerable pressure on students in their final year at school if they aspired to study medicine. This pressure was present throughout the year because half of their score for each subject was derived from school-based assessments. This pressure affected the individual as well as the group of students with whom they were studying. Teachers were likewise constantly aware of the need for high student achievement.

One of the contentious issues related to the calculation of the TES is the moderation of results for a particular school. The standardisation of the school marks for a given subject is dependent on the set of results for that school in the TEE. Schools with a large TEE cohort, particularly those with a group of very able students, will have the advantage of having a relatively good spread of scores and their school marks will be moderated to a relatively high mean score. Hence, larger metropolitan schools with a generally able cohort of students did not suffer any disadvantage in this process. On the other hand these were also the schools which were subject to the maximum pressure from their high-achieving students. The schools most likely to be included in this category were the high-profile independent schools and a group of metropolitan government schools which performed consistently well in the TEE.

At the other extreme were the rural schools and some metropolitan schools, for example, those located in the outer suburbs of Perth, with a small TEE cohort. In these schools one very able student in a small group of not-so-able students might be disadvantaged by the moderation process. It is generally accepted that a group of at least 20 students is needed for effective moderation in a given subject. In some cases, results from two small schools are combined to give a sufficiently large group of students for the process to be effective. While steps are taken to minimise any disadvantage, a student near the cut-off score, who is attempting to access a high-stakes course like medicine may be adversely affected by the group of students with whom s/he studies. A small variation in one subject mark can result in a student being just above or just below the cut-off score. In the past, students from schools with a small TEE cohort were subject to this form of disadvantage, when admission to medicine was made solely on the basis of this score. To some extent, this situation still exists, but under the new system the cut-off score has been reduced from a TES of approximately 430 (average subject score approximately 85%) to a threshold of approximately 385 (average subject score approximately 75%).

Other secondary school-related issues

Other items noted in the minutes of the Academic Council of UWA on 7 May 1997 were:

The current system of selection

- was elitist and placed too much emphasis on TES which tended to favour particular kinds of schools. The Adelaide experience indicated that the proposed system could be expected to broaden the socio-economic spectrum of students entering the course.
- had the effect of forcing potential applicants into particular combinations of TES subjects and thereby having a major distorting effect on the Year 11 and 12 choices and experiences of large numbers of students.

The latter issue refers to the tendency for students who wished to maximise their TES to study subjects such as physics, chemistry and the two mathematics units and to ignore the humanities and biological sciences. As well as opting for a science-oriented course some students restricted the number of TEE subjects studied in order to concentrate on the subjects most likely to be used in the calculation of their TES. The reason that studying such courses gives a higher TES despite the scaling procedures referred to earlier, is that the correlations among these subjects is higher than those among the humanities/social science subjects.

A further issue concerning the use of a high TES as the sole criterion for entry to medical courses was the impact on motivation to study Medicine. The prestige associated with acceptance into the course prompted some students to accept a place when they achieved the required score, in spite of low motivation to study Medicine. Simultaneously, students who were highly motivated to study Medicine were often eliminated from the selection process by achieving a TES just below the high threshold score. A letter received in 1999 by the Faculty of Medicine and Dentistry from the Dean of Studies of an independent school records:

'I have taught quite a number of able students who seemed to have all the interpersonal skills that are really needed for medical doctors and who have not quite achieved the very high TES needed for selection in previous years. At the same time, I have taught many students who have chosen Medicine only because of their very high TES.'

This letter also congratulated the Faculty of Medicine and Dentistry for the introduction of a process perceived to be fairer than the previous one, and for the level of consultation undertaken with the secondary sector during the implementation of the new process.

Reasons for change

During 1997 and 1998, the reasons for changing the selection process for medical students were documented for various committees at UWA and in the Faculty of Medicine and Dentistry. The following extracts are taken from the minutes of the Interview Working Party (Faculty) and the Academic Council (UWA) and summarise the issues which were under discussion at the time.

Minutes of UWA Academic Council 7 May, 1997:

It could not be claimed that only the top 1-2% of students could meet the academic requirements of the MBBS (medical) course. There was evidence that the success rate of students in the top 2% was much the same as that of those in the top 3 – 10% of TES scores.

It was likely that if the University did not introduce the new system, the number of applicants and enrolments from the Eastern States would increase. Already the numbers of applications and acceptances from interstate was increasing as other medical schools moved to graduate entry or first year intakes utilising factors other than the TES or equivalent. It was known that a number of schools in the Eastern States were advising their students to apply to UWA because it was still using only the TES for admission.

The current very high dropout rate of 16% from the medical course pointed to the need for a change to a selection policy which would identify the students best fitted for a career in Medicine.

It should be noted that whilst 16% would not necessarily constitute a high dropout rate from some courses, the costs associated with this level of attrition in the medical course included the high financial cost of participation in the course, as well as the opportunity cost for those applicants excluded from the course, and the ultimate cost to the profession of smaller than expected numbers of graduates. The dropout rate from the profession has traditionally been considered to be low, but no specific figures were given.

Minutes of the first Interview Working Party meeting in May 1998:

The goals of the new selection process were articulated for the benefit of the members of the Interview Working Party. They were listed in two broad categories as follows:

Benefits of the new selection process for potential candidates:

- A broader range of applicants will be eligible for entry to the medical course.
- Subject selection may be less restricted at school.

- There may be opportunity for increased participation in those activities which will assist students to become 'well-rounded' people.
- The process wishes to select students with a strong personal desire to participate in the caring professions rather than motivation based on external pressure or academic excellence alone.
- Increased enjoyment and success in their chosen career.

Experience with intake interviews (unstructured interviews held after students had been selected for the course) indicates that each year some students were admitted who had chosen Medicine because of their high academic score and other pressure. This led to the admission of poorly motivated students who were more likely to fail or to drop out of the course.

Evidence from other medical schools which had introduced new selection procedures using criteria other than academic achievement suggests that their students enjoy the Medical courses more and perform well.

Benefits of the new selection process for the Faculty:

- Selection of motivated applicants who are most likely to complete the course and ultimately, to become good doctors.
- Equity in the selection of students.
- The selection process will be clearly defined, the selection criteria will be well publicised and the process will be applied as objectively as possible.
- The comparatively high drop-out rate of either failing students or voluntary withdrawals from the course will decrease.
- There will be greater congruity between the selection process, the goals of the medical school and the style of teaching.

'The Faculty aims to select students who not only have the prerequisite knowledge to begin the course and the intellectual ability to complete the course, but the personal characteristics which are likely to enable them to make successful practitioners.

'Benefits with respect to the new curriculum:

Research has indicated that most high-achieving students favour a structured learning environment. Such students may not perform so well as the (new) courses are revised to include greater emphasis on initiative and self-directed learning. It is therefore important to ensure that the students who are selected are those who are best able to respond to and benefit from this approach.

'Benefits with respect to equity:

The process must be fair and equitable, allowing people from different socio-economic, geographical and ethnic backgrounds equal opportunity to compete for a place.'

Summary of the goals of the new selection process

The main goals of the new selection process were based on dissatisfaction with the system in place, perceived to be socio-economically elitist, which put pressure on the secondary schools with its reliance on the TES, which tended to favour particular kinds of schools; the high attrition rate within the Faculty; evidence that the success rate of students in the top 3 – 10% of TES scores was similar to that of those in the top 2%; supporting evidence from other medical schools in Australia, particularly those in Newcastle and Adelaide, whose students appeared to be strongly motivated, more diverse in their characteristics and performing well in the course.

The goals of the new selection procedures were:

- Increased diversity in the student cohorts.
- Equity in the selection of students with respect to different socio-economic, geographical and ethnic backgrounds.
- Selection of students motivated to become doctors, which, in turn, would lower the attrition rate in the course.
- Greater congruity between the selection process, the goals of the medical school and the style of teaching.
- Selection of students with the intellectual capacity to complete the course and the personal characteristics to assist them in becoming successful practitioners.

The new selection process

Based on the precedents set by the Universities of Newcastle and Adelaide, the new process set in place at UWA in 1998 for entry of students in 1999 involved the use of three components: the Undergraduate Medicine and Health Sciences Admission Test (UMAT), a structured interview and the academic score. The UMAT is a national test, developed by the Australian Council for Educational Research (ACER), originally for use by the University of Newcastle in New South Wales and subsequently used by most undergraduate medical courses in Australia; the structured interview is a local instrument developed

within the Faculty of Medicine and Dentistry; and the academic score is the Tertiary Entrance Rank (TER) based on the previously used TES, hence a statewide score with counterparts in the other Australian states. Each of these components is described in detail in Chapter 4.

There are currently nine undergraduate medical schools in Australia, the most recent having started at the University of Western Sydney in 2007. All these schools (with the exception of James Cook University in Queensland), use the UMAT in the first stage of their selection process. The UMAT is also used by two medical schools in New Zealand and by some other Australian universities for entry to courses such as dentistry and physiotherapy. With the exception of the Universities of Melbourne and Tasmania, all the medical schools use a locally developed interview. UWA is the only school using a highly structured interview. Most schools use a semi-structured style of interview based on a set of well-defined criteria, rated on pre-determined and rigorous rating scales. The academic score has different names in the different states, but with the exception of Queensland, the nature of the score is the same as the Tertiary Entrance Rank and such scores are used in an equivalent way to the TER.

There are variations in the way in which these three components are used in the selection processes of the undergraduate medical schools. UWA developed its own method of ranking the applicants in the final stage of the process. This method was developed in consultation with a number of stakeholders, including a Schools' Consultative Committee with representatives from each of the three school sectors: government, independent and Catholic. The ranking mechanism utilises in equal weight a combination of the Tertiary Entrance Rank (TER), the total score on the Undergraduate Medicine and Health Sciences Admissions Test (UMAT) and the total score from the selection interview.

The implications of this ranking mechanism; an exploration of some of the contextual issues surrounding medical selection at UWA; an overview of the selection procedures of other Australian medical schools; and an investigation of the international context are presented in the following chapters. In addition, the outcomes of both qualitative and quantitative data collected to address these issues are reported and discussed. The effects of the new selection process at UWA, and those in other Australian medical schools, are discussed and implications for future developments in selecting medical students are considered.

Indigenous students enter the medical course at UWA via a special pathway, through the School of Indigenous Studies. They do not sit the

UMAT or undertake the selection interview. This study refers only to those students who enter the course using the UMAT-TER-Interview process and as such does not deal with the entry of indigenous students. Furthermore, UWA does not admit any full-fee paying domestic students so this category of student is not relevant to this study. Similarly international students are not included in the study.

Chapter 2

Literature Reviews

Introduction

The selection of students into the high-stakes course of medicine is currently an area of considerable interest and research activity. Issues in the selection of medical students are prominent in the medical and medical education literature published in the UK, the USA, Australia, New Zealand and Canada, and in some European countries. Indeed selection into several courses, particularly in the area of health sciences, in which the number of academically qualified applicants far exceeds the available tertiary places, focuses on similar issues. At the same time new selection procedures have been introduced into medical courses, the nature of the curriculum has also changed. These changes have been characterised by the use of problem-based learning and an emphasis on self-directed learning, as well as the increased interaction amongst the students and between the students and their teachers. The need for problem-solving skills, communication skills and interactive skills in the courses, in addition to the requisite intellectual capacity, has reinforced the need for students to be selected on the basis of a different set of attributes from those used previously.

Medical schools in the USA all function at the graduate level. In the other countries cited above, both undergraduate and graduate courses are available. Whilst the emphasis in this thesis is on selection of students into undergraduate medical programmes, many of the same principles of selection apply to either type of programme. A number of the developments which initiated change in this important area occurred in the USA and are introduced in the following discussion.

Findings from the literature are presented in two parts. Part 1 deals with the context of selection and covers such issues as the rationale for change; models for change and new methodologies; predictive validity; evaluation strategies and equity issues in selection. The pivotal area of clinical reasoning follows and views on the characteristics of so-called 'good' doctors and medical students are also articulated. Part 2 deals with the instruments being used to select medical students and some of those currently under development. These include the selection interview; aptitude tests which assess various aspects of reasoning skills; and tests of moral reasoning and moral orientation. Most of the

literature dates from the late 1990s and thereafter, which reflects the emerging nature of this topic in medical education.

Words such as *empathy*, *communication*, *interpersonal skills* are used frequently in the following discussion. No attempt has been made to define these terms or to develop any common understanding of their meaning in this context. They are used as they have been used in the literature because their specific meaning is not relevant to the purpose of this thesis. Rather it is the existence of such constructs in this domain which is relevant at this point. Characteristics such as those formalised in the Five Factor Model from psychology, for example *conscientiousness*, will be well-defined in their own context. Such definitions have not been provided here. In addition, terms such as *qualitative*, *non-cognitive* and *humanistic* are used to describe personal qualities which cannot be measured by achievement or intelligence tests and which usually refer to either personality factors or aptitudes. Similarly to the terms above, they are not defined here and are used as they are in the literature.

Part 1 – The context of selection

Issues in the selection of medical students

Several developments in recent years have resulted in changes to the basis for selecting medical students. Some of these developments are related to changes within the professions and the medical schools and others are related to changes in society's norms, values and practices. The shift away from the exclusive use of academic scores has been slow and difficult (Edwards, Elam and Wagoner, 2001). Historically the definition of aptitude for medical education has not been fixed but has been socially constructed (McGaghie, 2002) and this construct has recently undergone considerable change. The issues to be explored here are the rationale for change, models and methodologies for change, predictive validity, evaluation strategies and equity issues in selection.

The rationale for change

Monash University (Tutton, 1997) articulated the major reasons for change in its selection policy as follows:

- The Doherty Committee's (Inquiry into Medical Education and the Medical Workforce) 1998 report which recommended that

personal qualities should be considered in the selection of medical students.

- Survey evidence suggesting that the community believed that academic success alone is not a suitable qualification for a medical student or doctor.
- Despite the high academic cut-off score for entry to the medical course, a significant number of students still failed in the clinical years of the course (traditionally the later years).
- The new curriculum places more emphasis than previously on humanistic issues, hence it seemed appropriate to modify the selection procedures accordingly.

One of the major prompts for the inclusion of qualitative variables in the selection of medical students has been the emergence of the managed care model of health care delivery (Smith and Hayling 1998; Edwards *et al*, 2001) . This developed in the 1990s and its emphasis on seeing patients quickly created the dilemma of upholding the values of the profession while responding to the needs and desires of institutions and businesses. This placed, and continues to place, new challenges on medical schools and teaching hospitals. Smith and Hayling (1998) believe that this shift, brought about by market forces, will require doctors of the future to have a range of new skills. Likewise, physicians of the future will practice in different settings and different economic and ethical environments (Smith and Hayling 1998) . As a result of these new directions, they propose that selection processes should become more complex, not more simplistic. The previous method of selecting solely on academic scores was simple and straightforward, however, a return to such a process appears both unlikely and undesirable.

Another development of the 1990s in the US involved a requirement by the National Board of Medical examiners that examinees seeking to be licensed to practice must pass assessments in professionalism, communication, and interpersonal skills. Other boards of registration have followed suit, leading to pressure on medical schools to ensure that, in addition to skills learned in the curriculum, entering students bring some of these humanistic qualities with them (Edwards *et al*, 2001). That selection policies should consider humanistic, non-cognitive qualities as well as academic success has become widely accepted (Fones, Kua and Goh, 1998); Reede, 1999; Edwards *et al*, 2001; Hughes 2002) . The need for diversity in the profession is also acknowledged (Hughes, 2002; Fones *et al*. 1998; Edwards *et al*, 2001). One view is that in general, higher education and the professions seem to benefit from

admitting a rich diversity of people, including some with ordinary traits, like those of the clientele (Caan, 2003). Agreement on the most important qualities has been difficult to achieve (Edwards *et al*, 2001; Lievens, Coetsier, De Fruyt and De Maeseneer, 2002), as well as the means by which to assess them according to the rules of reason, fairness and public scrutiny (Fones *et al*. 1998). As it happens, the inclusion of personal qualities has been found to add to the prediction of success in medical studies (Powis, 1994).

A further question posed in the complex area of medical selection is just what is the ultimate objective of the selection process (Hays, 2005). A worthy endpoint is the selection of more knowledgeable, skilled, honest, reliable and safe doctors of the future. However, it is difficult to predict such a range of attributes so far ahead. Hays (2005) concludes that until there is better evidence, we should really focus on predicting success as a medical student, someone who will then be subject to all the vagaries of life and society in becoming a professional person over several years of life changing events.

Hupp is critical of the over-reliance on academic scores in selection into all professional courses, including Dentistry, Medicine and Law (Hupp, 2004). His proposed solution is for admissions committees to focus more on the lives of those people they are assessing. Taking into account factors which reveal a self-less attitude, maturity, ability to overcome adversities and examples of making ethical decisions will make the process harder, but should result in a fairer result to all concerned. His proposed strategy for achieving this is to analyse the backgrounds of exceptional practitioners and to look for common characteristics to predict success and vice versa for predictors of failure. The concepts embodied in this strategy are sound, however such an undertaking is a large-scale and long-term project. Given the rate of change in the nature of society, the results of studying current practitioners may not ultimately prove useful in selecting future practitioners.

A recently-concluded Western Australian study researching, among other things, factors affecting medical course completion concluded that 'students who have lower admission scores and who are shy and timid are less likely to complete the medical course than those who have higher admission aggregates and who are more thick-skinned and uninhibited' (Ward, Kamien and Lopez, 2004, p7). These findings confirm the view that both cognitive and personal characteristics are important factors to consider in the selection of medical students.

However, there are still those who believe that places in medical schools should be given to the brightest students who have professed a desire to enter 'the most noble of professions' and that entrance requirements are becoming 'ridiculously complicated' (Watson, 2006). Attitudes such as this are still articulated by a few members of the medical profession.

Models and methodologies for change

Edwards and others have proposed a five-part model which they believe will facilitate changes in admission processes to accommodate a different emphasis. Their model involves the interaction between the applicant pool, criteria for selection, the admission committee, selection processes and policies, and outcomes. This model is intended to synthesise these elements to provide a framework for reflection by medical schools. They believe that the interplay between the criteria and selection processes is particularly important. For example, if the criteria include such attributes as compassion and respect for others then the processes need to operationalise these and determine a method of including them in the ranking of applicants. The Edwards model includes the use of such qualitative variables, but points out the need for objectivity in the selection processes. They claim that subjective information related to personal characteristics 'shows little evidence of validity and reliability' (Edwards *et al.* 2001, p 1210). They acknowledge problems with the expense in time and resources in including humanistic variables and in defending a process that may contain some elements that are perceived as subjective. This model is useful in the discussion of the implementation of changes in medical school admissions and has been an underlying structure in considering the case study which forms the basis of this thesis.

McManus (2001) suggested that selection should aim at a relatively small number of characteristics which are likely to be predictive of future professional behaviours and which can be reliably assessed at the time of application to medical school. His criteria for assessment of the selection process are validity, reliability, feasibility and acceptability. A number of authors comment on the need for development of a fair and transparent system of selection given the current conditions in which demand far exceeds supply, as well as a growing pool of highly qualified candidates (James, 2001; McManus, 2001; Nicholson, 2005; Parry, Mathers, Stevens, Parsons, Lilford, Spurgeon, and Thomas, 2006; Powis, 1998). Researchers from Nottingham Medical School also believe that a further requirement for a selection process is that the selection

criteria relate to success in the course. Their research on entrants to the course between 1970 and 1990 identified a number of A-level courses such as Chemistry and Biology as good predictors of success, while ethnicity and gender were significant predictors in some cohorts.

A recent UK study (Parry, *et al*, 2006) to describe the methods currently used to identify prospective students for the five year English medical courses, concluded that even though the stated criteria for admission to medical schools showed commonality across the country, there were considerable differences in the way in which these criteria were applied and in the methods used to achieve the final selection of students. There appears to be little evidence that one type of process is better than another. The authors recommended as a first priority the development of a clear definition of suitability for medical training. On a wider view, this study also commented on the heterogeneity of selection processes both within and between countries, noting the range of methods employed in the US and Canada, in European countries and in Australia. In suggesting a possible way of reducing this heterogeneity in the UK context, the authors put forward a possible option of implementing a centralised admissions system. A response to this proposal (Norman, 2006) was that some diversity of selection is expected and desirable and there is no compelling reason to insist on uniformity of selection. However the author believes that whilst cognitive skills are adequately assessed, assessment in the non-cognitive domain must be improved.

Lumsden and others believe that the 'aim of a medical school admissions procedure is to select those who will perform well as undergraduates and make good doctors in the future, and to exclude those who will bring the profession into disrepute' (Lumsden, Bore, Millar, Jack and Powis, 2005, p 258). They also contend that the social, cultural and ethnic backgrounds of medical graduates should reflect the diversity of the patient population. The Council of Heads of (UK) Medical Schools argues that the purpose of medical education is to meet the present and future health care needs of society. Given this diverse set of aims, the authors suggest that medical schools should actively seek entrants with a variety of personal qualities and backgrounds. Their conclusion after extensive research into the measurement of personal qualities and their relevance for medical education is that those responsible for admission to medical school have an onerous but vital role in the future bio-psychosocial well-being of the public and the profession.

A recently established UK medical school stated its requirements for using the best and fairest selection process possible and included in its principles the use of best evidence in selection methods, evaluation of selection activities and measuring the performance of the process in terms of its social accountability (Morrison, 2003). Issues such as social class and geographical location were taken into account in terms of social accountability. This project is in its early stages and results will become evident over time. However, the need for evidence based strategies for selection is foremost in their planning. McManus also supports the use of evidence based selection and medical education, in parallel with the current practices in medical research (McManus, 2001).

One of the selection instruments being tested by the medical school referred to above is a teamwork exercise designed to assess candidate suitability for a problem-based learning, small group curriculum. The authors compared performance on this instrument with performance on the formal structured panel interview. They concluded that there is very little relationship between the two and that there may be a difference between the ability to express team-sympathetic views and the ability to participate effectively in a team (Chamberlain and Searle, 2005). The team-work exercise is being developed for inclusion in the selection process, whereas the interview is already a part of the process. This group is adamant that processes for selecting medical students in the fairest and most valid way must be constantly evaluated (Searle and McHarg, 2003). They propose that this is necessary despite the difficulties of establishing which outcome indicators are desirable and the complexity of confounding factors. In commenting on the challenge to admissions committees to keep abreast of change, they pose the question 'How do we develop instruments today that will be valid for a doctor practising in the year 2030?'

Tutton and Price made a plea for faculties to trial their selection instruments before using them and to publish the results, 'just as one would with a clinical trial for a new therapeutic regimen' (Tutton and Price, 2002, p 1171). They believe that the aspects most relevant to medical school admission are hard to define and comment on Hughes' strong case for the relevance of general intelligence. One obvious aspect of this is the predictive power of previous academic success. However, they also acknowledge that intelligence is multi-dimensional and that some emphasis should be given to some of its other forms, such as emotional intelligence. Gorman and others concluded that the basis for the selection of medical students remains uncertain and they advocate

Careful tracking. They believe that given the current state of knowledge on the topic, no single parameter is suitable and that a hybrid and adaptable system is required (Gorman, Martin and Poole, 2005).

In the Netherlands a national lottery approach, from within academically qualified applicants, has been used for selection of students into medical school since 1972 (Andrich and Mercer, 1997). The government has recently requested that the medical schools experiment with qualitative selection procedures. One university is using observation procedures in simulated activities which are characteristic of medical practice. This technique is often used by employment assessment centres to determine suitability of candidates for a particular position. Early results of the study were encouraging (Cate, Smal and Anderson, 2002). As with much of the research being undertaken in this area, the outcomes are at a preliminary stage and require on-going monitoring.

Predictive validity

The question of predictive validity of selection instruments in higher education is discussed and evaluated in a Swedish study (Wolming, 1999). The predictive validity of the selection instrument, the correlation between the instrument and subsequent measures of performance, is seen as a critical element but is not sufficient for an assessment of the validity of a selection. The researchers contend that other questions should be asked. What do the instruments actually measure? Are the criteria for assessment of performance actually relevant? What are the consequences of the use of a particular selection instrument? When should data be collected for the criterion variable? The concept of validity has changed over time and its definition has been expanded. There are few occasions when a single form of validity is used appropriately. The validity of a selection process should include elements of all aspects of this multi-faceted concept.

Another Swedish study examined the use of situational tests in the selection of medical students (Lievens *et al*, 2002). Situational tests place the test-taker in situations simulating or closely resembling a 'real-life' criterion situation. The outcomes of the study showed these tests to be a useful complement to the traditional selection procedures. Predictive validity was enhanced, adverse impact of testing was reduced and the construct being tested was broadened. McManus and others (2005) also commented on the use of situational selection tests in Flemish medical

and dental schools, which were found to predict performance in the final first year examinations.

Questions are also posed on the extent to which students' entry characteristics predict their performance in the course (Groves, O'Rourke and Alexander, 2003). A range of authors claim that pre-entry academic scores predict performance in the pre-clinical years (Hughes, 2002; Lievens *et al*, 2002) but not in the clinical years, postgraduate training or as a doctor (Cooper, 2003; Ferguson, James, O'Hehir and Sanders, 2002;). Hughes (2002) cites studies in which science subjects, which tend to be favoured by students planning to study Medicine or Dentistry (Lievens *et al*, 2002; Lippell, 2002), show an association with written examinations in medical school. However, the association decreases later in the course (Tutton and Price, 2002) and in the longer term makes no difference to success or failure. Some research shows that students with superior academic scores on entry are no more likely to perform well as medical students and physicians than those with lesser records (Reede, 1999) and that selecting medical students on the basis of ability alone, especially when the measurement of ability is largely based on performance in science, is tenuous and needs to be examined (Lippell, 2002). It is, however, accepted that general intelligence is a good predictor of achievement (Howes, 2002; Hughes, 2002). It has been suggested that academic scores should be used as thresholds only and that some assessment of personal qualities should then be used for selection (Albanese, Snow, Skochelak, Huggett and Farrell, 2003). These authors highlighted the increasing importance that the Association of American Medical Colleges has placed on the assessment of applicants' personal qualities. They also comment on challenges to developing better personal quality measures including selecting and operationally defining the most important qualities, measuring the qualities in a cost-effective manner, and overcoming resourceful adversaries who can potentially invalidate such measures. The authors discuss potential methods of measuring personal qualities and propose an integrated approach to the assessment of these qualities.

The question of the predictive validity of previous academic achievement over the duration of a medical course is contentious. A number of authors claim that it is very important over the full length of the course, while others believe its influence decreases in the latter years of the course. Whatever its ultimate status in this debate, it is clear that a high level of academic ability remains a significant factor in entry to medical school. McManus and others published the results of a 20 year

prospective study of more than 500 doctors who had started at Westminster Medical School between 1975 and 1982 with the aim of assessing whether A-level grades (achievement) or intelligence (ability) predict doctors' careers (McManus, Smithers, Partridge, Keeling and Fleming, 2003). They concluded that previous achievement in the form of A-level results was a better predictor of success in undergraduate and postgraduate careers than the results of an intelligence test. This comprehensive study is one of the few which looks at the long term outcomes of success both as medical students and as professionals. The authors note the few published studies which deal with the validation of selection procedures for medical students.

A non-cognitive factor that has been found to associate with pre-clinical performance is conscientiousness (Ferguson *et al.*, 2003; Lievens *et al.*, 2002). The findings of Lievens *et al* suggest that this personality trait and its facets (competence, order, dutifulness, achievement, self-discipline and deliberation) can be reliably assessed at the beginning of the course and that it affects academic performance during the course. High scores on conscientiousness were found to correlate with A-Level grades and pre-clinical performance by Ferguson *et al* (2003). They also suggest this characteristic being used as part of the selection process, given its relationship with academic achievement. However, Caan (2003) cautions against selecting for any form of extreme in a personal quality, giving the example of a high level of conscientiousness leading to practitioners who exhibit a narrowness or perfectionism which is detrimental to their performance. Ferguson *et al* (2003) also found that a teacher's reference does not correlate well with performance at medical school, but the information provided in a personal statement when evaluated by a numerical index, together with A-level scores and a score for conscientiousness, could aid selection for interview.

Evaluation of strategies

In 2003, the Association of American Medical Colleges in the USA launched the Institute for Improvement in Medical Education. The major objectives of the Institute are to identify the deficiencies in medical education and to make recommendations for addressing them. This initiative was in response to concerns about the overall quality of medical care in the US of which medical education is a part. The group involved in the Institute acknowledges the 'unparalleled changes (in medical education) in an era of healthcare instability' (Pritchard, 2003, p

678). They claim that medical education must reflect the evolving nature of societal needs, business practice and scientific developments.

Powis (2003) reported on the experiences at the University of Newcastle in Australia with respect to the evaluation studies on their alternative methods of selection, which showed that Newcastle graduates perform very well in clinical practice. The University of Newcastle first introduced new selection procedures in 1987 with half of their cohorts being selected by the new methods and the other half being selected on marks alone. In the early 1990s they adopted the alternative method in its entirety following further development of the selection procedures during that time. Powis concluded that Australian medical schools have reached a point where there is sufficient evidence to adopt a more comprehensive method of selecting students, which sets an academic threshold and then selects on the basis of good communication and interpersonal skills, empathy and appropriate ethical orientation.

The University of Adelaide first introduced its three part selection process (academic threshold, UMAT and oral assessment) in 1997. In reporting on early results the authors, Turnbull, Buckley, Robinson, Mather, Leahy and Marley (2003), noted that oral assessment can be reliable when training and retraining of the interviewers is incorporated into the process; that increased access results in wider representation of schools and of students from rural backgrounds; and improved psychosocial outcomes i.e. students reporting less family pressure in their choice of medicine as a career; and better student awareness of the length of study involved in the course. Subsequent research by the University shows that the three selection components have a role to play either independently or when taken into account alongside the other components in predicting how well students perform in the University of Adelaide program (Turnbull and Robinson, 2005).

A study at Nottingham University in the UK (Yates and James, 2006) identified a group of students in five consecutive cohorts who were classified as 'strugglers'. These students formed 10 – 15% of each year's intake and experienced either academic or personal difficulties that affected their progression in the course. The study was set up as a case control study using a ratio of four controls to each case, the controls being selected at random from the cohort. The outcomes confirmed that some of the factors which predicted 'strugglers' were male gender and those with lower A-level grades and non-white ethnicity. In addition, they found that late acceptance on the course and

the presence of 'negative comments' in the academic reference were also risk factors. Selection practices at Nottingham already use previous academic achievement and the critical review of students with negative references, thus lending support to some of their findings. The study concluded that students who were initially rejected or who were 'reserves' may require additional support in their course. This study is interesting in that it is one of the few which focuses on negative rather than positive outcomes; as such it has the potential for providing remediation and student support rather than just focusing on and rewarding success in the medical course.

A further study which supports some of these findings was reported by Lumb and Vail (2004). The study was conducted only on the first three years of a UK medical course, but was in keeping with the findings of other studies, showing that males and those from ethnic minorities showed relative underperformance on the course. Arulampalam and others in a UK study of factors affecting the probability of first year medical student dropout, found that males were about 8% more likely to drop out in their first year than females (Arulampalam, Naylor and Smith, 2004). A further finding of this study was the influence of the level of prior educational attainment and the subjects studied previously. Higher A-Level scorers and those who had scored well in biology, chemistry and physics were less likely to drop out of medical school in first year. The authors propose that if academic entry levels are to be reduced, then it may also be appropriate to design support for students to minimize the risk that wider access policies may have on student retention. The authors also found that social background was not a factor in the probability of dropping out in first year.

Equity issues in selection

Access to medical education from under-represented groups is problematic. Some universities use policies which are specifically designed to increase access for such groups. One major aspect of this is the lowering of the academic thresholds for students from lower socio-economic status (SES) groups. The basis for this step is evidence that students from higher SES groups have an advantage in secondary education. Admission for racial minorities is controversial. Some people believe that doctors from racial minorities would practise within their own racial group but the issue of adequate academic qualifications for entry to medicine is the ever present barrier. A global problem, which

has an obvious application in Australia, is the shortage of doctors in rural areas. Issues such as these are examined in this section.

In 2003, it was noted that in the UK there was emerging evidence to support universities and medical schools accepting candidates from different backgrounds with lower academic results than usually required, because of the tendency of government school students to do better than their independent school counterparts when they enter with equivalent grades (Smith, 2003). One prominent UK university has had to defend accusations of social engineering, operating quota systems and exercising bias against independent schools in its desire to improve access for previously under-represented groups. It seems that the dominant social class will 'continue to look for opportunities to fight back against policies designed to redress imbalances, whether these are based on race, gender or socio-economic status.' (Searle, 2003, p 851). Powis (2003) believes that one good argument for lowering the academic threshold of admission of medical students is that it allows students from lower socio-economic groups to enter medical education. If access policies are to be successfully widened then the marks threshold needs to be revisited. It must be noted here that lowering the marks threshold has implications for medical schools with respect to teaching and student support, given the earlier discussion which suggests that previous academic achievement appears to be a good predictor of achievement at least in the early years of the medical course.

Affirmative action policies for racial minorities have long been a controversial topic in the US. Whitcomb and Bollinger, (2003) promote the need for racial, ethnic and other kinds of diversity in higher education. They believe there to be a special urgency about diversity in medical education because physicians from a minority background are more likely to practise professionally in areas where there are high concentrations of minority groups. Whitcomb (2003) believes that efforts to improve the representation of minority groups have failed mainly because of the gap between the academic qualifications of such groups and those of their white and Asian counterparts. He believes that medical schools have made concerted efforts to create more diversity, but this area is still a major challenge for the schools. He recommends the integration of cultural competence into medical curricular and into the continuing education of practising physicians.

Searle (2003) sees the major areas of challenge for greater equity in the UK as social class and geographical deprivation. She supports diversity policies which focus on all areas of equity and strongly

advocates the collection of longitudinal data to assess the long term outcomes against selection attributes as she believes that such evidence will enable schools to withstand the inevitable legal challenges which will follow.

This principle of affirmative action in selection according to background also applies to rural applicants. Wilkinson and others undertook a study in Australia to determine the association between rural and undergraduate training, rural postgraduate training and medical school entry criteria favouring rural students, on the likelihood of working in rural Australian general practice (Wilkinson, Laven, Pratt and Beilby, 2003). They note that the shortage of rural doctors is a global problem and that is it multi-factorial in its causes. They concluded from this study that there is increasing evidence for enrolling more students with a rural background into medical school, and continuing to expand both rural undergraduate and graduate opportunities. Similar studies have been undertaken in the US. One such study showed that not adjusting for rural status in the admission process at one university would have markedly reduced the number of rural applicants offered medical school interviews (Basco, Gilbert, Chessman and Blue, 2002). A recent Canadian study also concluded that adapting medical school admissions policies to admit more candidates with a rural background should be part of a multi-dimensional approach to increasing the number of rural practitioners (Woloschuk and Tarrant, 2004). These findings are supported by evidence that students from a rural background who graduated from a family medicine programme were approximately 2.5 times more likely to enter rural practice than their urban counterparts. A study comparing geographic distributions of the Australian primary health workforce in 1996 and 2001, showed that over that time period, the number of general medical practitioners showed an increase of 10% in outer regional areas, but that there was no change in remote areas. (Joyce and Wolfe, 2005). This suggests that the strategy is effective in some areas, but not in the areas of greatest need such as remote areas in Australia. Furthermore, all these studies ignore the teaching and student support issues inherent in affirmative action strategies which lower the academic threshold for specific groups.

Another approach to diversity is to be found in Elliott and Epstein's comments on the role of graduate medical programmes in Australia (Elliot and Epstein, 2005). They support the view that while graduate medical programmes might not produce better doctors in the future,

they might produce doctors with a different range of skills and opinions from those currently in undergraduate schools and that diversity in medical courses is essential. Graduate programmes and their students are not a focus of this thesis, but experience from the recent introduction of a graduate entry programme at UWA supports this view.

Clinical reasoning

Clinical reasoning is central to the effective practice of medicine. As well as knowledge and clinical skills, a major component of this ability is a combination of reasoning and problem solving. A pre-disposition to critical thinking, logical reasoning and problem solving skills appears to make for an easier transition to effective clinical reasoning. The inclusion of this section in the literature review is justified because of the importance of these skills in the practice of medicine and an apparent link to the assessment of a pre-disposition of these skills in the use of aptitude tests in selection.

Clinical reasoning has been characterised as a complex and often unconscious integration of critical thinking and data-collecting procedures aimed at patient care. Critical thinking is subsumed in the clinical reasoning process in that in order to increase the probability of a desirable outcome, clinicians must analyse information, use inductive and deductive reasoning to determine diagnoses, establish and prioritise patient care plans, and make inferences and reach conclusions on the basis of available information. Pre-existing critical thinking ability has been shown to be an important predictor of medical student performance and future clinical judgment (Williams, Glasnapp, Tilliss, Osborn, Wilkins, Mitchell, Kershbaum, Schmidt, 2003). Williams *et al* concluded that assessing the critical thinking skills of students seeking to enter medical training would be a useful predictor of performance in clinical reasoning.

The notion of clinical competence embodies three elements: clinical skills, knowledge, and problem solving ability in which a prerequisite of successful problem solving is proficiency in clinical reasoning (Groves, Scott and Alexander, 2002). Prediction of clinical performance in medical school is difficult (Basco *et al*, 2000). Some selection factors have been identified by individual medical schools, whereas others find it more difficult to find associations, *let alone* cause and effect relationships. A group of medical education researchers developed a medical reasoning aptitude test designed to assess aptitude for clinical

problem solving in medical school applicants (Vu, Dawson-Saunders and Barrows, 1987). They refer to the complexity of the behaviours involved in clinical performance and the lack of relationship between academic scores on entry to medical school and clinical performance. Whilst academic ability as measured by Grade Point Averages (GPAs) and Medical College Admission Test scores generally reflects cognitive knowledge, clinical performance involves additional skills which go beyond knowledge. One aspect of this is skill in problem solving, i.e. the ability to use and apply knowledge.

The previously cited study by Vu *et al* (1987) on assessment of medical reasoning looked at the complex relationship between cognitive and reasoning abilities in a clinical setting. Scores on their test comprised aspects of forming initial hypotheses; appropriateness of action taken; effectiveness of action taken; and evaluation of their hypotheses. These scores assisted in predicting performance in the latter years of the medical course. In particular they identified students who will perform at the extremes, that is, near the threshold or at exceptional levels. They concluded that the assessment of clinical reasoning is possibly a combination of reasoning and medical knowledge and that their test was useful in predicting students' overall performance, a measure of combined clinical knowledge and reasoning skills.

In commenting on the increasing use of problem-based learning in medical education, Elstein and others concluded that problem-solving in this context refers to the processes of deciding what information to obtain in a particular case, interpreting this information and planning further action (Elstein, Sprafka and Bordage, 1979). This sequence is not just a case of rearranging some initial information, but usually includes some element of data collection to provide the basis for solving the problem. The whole area of problem-solving has become a central theme in psychology and in medical education at a time when medical practitioners are increasingly called upon to use problem-solving skills to reduce the emphasis on knowledge of scientific content. The authors developed a model of clinical problem-solving based on a cycle of four elementary processes. Firstly, cue or data acquisition in which information is obtained from a variety of sources; secondly, hypothesis generation in which alternative formulations of the problem are retrieved from memory and data is collected to supplement various structures which retain data in working memory; thirdly the data are interpreted in the light of the alternative hypotheses being considered;

and finally, the data are processed to determine if one of the competing hypotheses can be supported. If not, the cycle starts again.

The authors recognized that reasoning strategies are not employed in the abstract but are interdependent with the contents of memory. Given the time constraints inherent in the clinical setting, which restricts the ability to undertake significant research on each occasion, the problem-solving exercise becomes a mixture of strategies and processes, as described above, as well as knowledge. It could best be described as an effective blending of clinical strategy and clinical memory. Thus the extent to which these strategies or a pre-disposition to learning them are present in students' repertoires, the more easily they are likely to adapt to effective clinical reasoning. Woods, in discussing the work of Elstein (Woods, 1997) also comments on the need for a good grasp of the content and the central role played by long term memory. Problem solving skills were found to be difficult to develop in medical students, even with some well-developed heuristic methods, which took time to inculcate into the students' repertoires.

Characteristics of 'good' doctors/medical students

An understanding of the characteristics of a successful medical practitioner is evolving and continually changing and there is an increasing volume of literature on the topic. Changes in society's values and expectations, consumer expectations, the nature of the workplace and aspects of medical education have all contributed to changed perceptions in the characteristics which are seen as desirable. In addition, the characteristics are likely to be different depending on the audience. However, there is general agreement from most quarters that both interpersonal and cognitive characteristics are important qualities for doctors to possess. In addition, different skill sets, such as information literacy, may also be relevant to practitioners of the future.

This section presents an understanding of the characteristics of 'good' doctors/medical students as portrayed in the literature. Some of these characteristics are reported as aspects of personality factors, which are not relevant in the context of this thesis. However, these studies provide useful background because they emphasise the increasing relevance of personal qualities in the study and practice of Medicine. The reported findings are from a range of stakeholders. Some are from the perspective of the profession, the staff of medical schools and

medical students, while others report views from the general public, both as patients and as consumers.

At a general human resource level, an article on the complex relationships among personality traits, job characteristics and work behaviours (Van Den Berg and Feij, 2003) reported studies showing that conscientiousness and emotional stability are valid predictors of job proficiency across job criteria and occupational groups. Hughes (2002) reports the existence of consistent evidence that for work involving complex tasks, the best predictor of effectiveness is some measure of mental ability. In addition, predictability can be improved by including some measure of integrity and conscientiousness, which do not necessarily correlate with IQ.

In investigating the link between medical students' personality characteristics and academic performance, a study using the Five Factor Model (FFM) of higher order personality factors (Lievens *et al.*, 2002), found that higher scores for *extraversion and agreeableness*, two dimensions defining the interpersonal dynamic, may be beneficial for doctors' collaboration and communication skills in future practice. The researchers also concluded that students who scored high on *conscientiousness* are more likely to succeed in the preclinical years. The results of their study are more likely to be useful for student guidance and counselling than for selection, but it is valuable to note that they believe that personal qualities have an impact on performance both as a student and as a practitioner. Cooper (2003) in a review of medical schools and their applicants, reported that performance as a physician correlates well with proficiency in the humanities and with personal characteristics such as motivation, conscientiousness, integrity, empathy and a robust psychological constitution.

The California personality inventory has been used in a variety of studies on the prediction of success in medical school (Ferguson *et al.*, 2002). Eight subscales emerged consistently as predictors of success in medical training: dominance, tolerance, sociability, self-acceptance, well being, responsibility, achievement via conformance and achievement via independence. Some of these may relate to 'conscientiousness' in the Five Factor Model. The meta-analysis reported in this study recommended that future research should take a more multi-variate approach to studying predictors of success in medical training. They caution that predictors are likely to be intercorrelated, as are outcome measures. Few studies have examined the effects of learning styles, interviews, personal statements and references in relation to

achievement in medical training. Evidence suggests that work on learning styles is likely to be fruitful. The researchers believe that there is sufficient preliminary data indicating an impact of personal qualities on performance to warrant further research.

Hughes (2002) posed questions about the stability of personal characteristics over adult life. She cites studies which show that doctors who are psychologically well in middle life had the following characteristics as students: good self esteem; an open, flexible approach to life; a warm relationship with their parents; little anxiety and depression and low anger under stress. In contrast, doctors exhibiting behaviours consistent with substance abuse and burnout had lower scores on psychological health as students. She sees the ability to deal with stress as vital in a vulnerable profession. Issues such as alcoholism, drug abuse and suicide are more relevant to the practice of Medicine than to some other professions. She lists characteristics that have emerged from a variety of recent studies as fundamental to the effective practice of Medicine. These include the intellectual ability to do the job, honesty, integrity, conscientiousness, helpfulness and willingness to co-operate. From a patient's perspective, a high priority is given to interpersonal skills and empathy.

Medical educators at the Medical College of Georgia in the USA have placed considerable focus on communication skills, professionalism and an awareness of how personal characteristics may influence the care of patients. In a study to measure the emotional intelligence of their students they concluded that even though most students have been selected into medical school based on a history of academic and cognitive successes, the practice of Medicine requires 'the ability to understand the views and needs of a wide variety of people, remain sensitive and empathic to patient concerns, and be able to keep his or her personal emotional reactions in perspective, and promote social responsibility...' (Wagner *et al*, 2001, p.507).

Medical educators at Jefferson College in the USA (Hojat, 2003) also claim that evidence indicates that a doctor's interpersonal skills and empathy are important in how well a patient fares. They see empathy as central to this ability and seek to develop programs to teach this quality and to develop interpersonal skills in their students. A study of the attitudes of medical students towards the use of life-sustaining treatments for themselves and for elderly persons (Carmel, 1998) revealed the need for programs in medical schools which develop communication skills that focus on issues of life-threatening disease,

dying, and the ability to elicit responses from patients on their preferred model of doctor-patient relations.

Compassion, commitment to community service and fervour for social justice were identified as some of the characteristics indicating a readiness for medical education (McGaghie, 2002); however, the writer acknowledges the disagreement among medical school staff about which qualities should be evaluated and the difficulties inherent in the measurement of such qualities. A project instigated in the 1970s in the US identified the characteristics most frequently required by admissions committees as compassion, coping capabilities, decision-making ability, inter-professional relations, realistic self-appraisal, sensitivity in interpersonal relations and staying power, both physical and motivational (McGaghie, 2002).

A study in the Netherlands (Jung, Wensing and Grol, 1997) investigated the opinions of patients and doctors on what constitutes good general practice care. Areas of similarity and difference among the groups emerged. For the purposes of this study, the major area of interest from the perspective of the patients was communication. Patients were interested in being able to understand their own medical problems and to access the health care they required. The authors believed that one purpose for a study such as theirs is the need for medical education to produce doctors who are more responsive to the expectations of patients. One of these expectations is the ability to communicate clearly and effectively with patients. Medical education should inculcate the values and qualities valued by both members of the profession and the general public (Fones *et al*, 1998). Fones *et al* concluded that medical knowledge and reasoning are of prime importance and that emphasis should be placed on moral-ethical issues and communication. They believe that selection criteria for admission to a medical education, and that education itself, should consider 'humanistic, non-cognitive' traits.

Leahy and others asked members of the general public in Ireland what characteristics they thought were important in doctors who would treat them or a member of their family. They considered it to be necessary to understand this in order to inform practising doctors as well as to help set priorities for medical education (Leahy *et al*, 2003). Respondents identified a range of qualities. Of the top 21, eight were interpersonal, four were cognitive, three were conative (related to motivation), two were emotional and one was moral-ethical. The authors concluded that it was not possible to determine whether

interpersonal or cognitive characteristics were more critical. Rather it seemed that both areas should be viewed as central to setting priorities for the education of doctors for the future.

In a US study, medical students themselves identified qualities they believed important for future doctors (Elam and Rudy, 2000). The top ten of these were compassion, intelligence, adaptability, honesty and integrity, dedication, professionalism, empathy, strong character, a moral-ethical dimension and problem-solving ability. These perceptions were used by the researchers to develop aspects of medical education related to professional development.

An Australian study (Wilhelm and Lapsley, 2000) on unprofessional interpersonal behaviour in doctors concluded that disruptive behaviours may be ameliorated if all doctors understand that good medical practice requires communication and interpersonal skills as well as the demonstration of knowledge and ability. Changes to the workplace including reduced resources, calls for greater accountability, accessible complaint mechanisms and more assertive patients create a climate in which there is an increased sensitivity to disruptive behaviour. They note that medical schools are introducing professional development into the curriculum and that large organisations in general consider ongoing education in interpersonal skills to be important for all professionals.

Hughes (1993) explored the notion of a 'culture of complaint' in American society. This rising consumerism is also prevalent in Australian society and the establishment of Health Care Complaints Commissions in most states is an indication that governments take it seriously. Daniel and others found that a significant proportion of complaints in NSW were related to rudeness or poor communication (22%) and unethical or improper behaviour (14%) (Daniel, Burn and Horarik, 1999). They advocate the development of an improved understanding of what consumers see as a breakdown in aspects of good medical practice.

The changing nature of medical education also calls for students who can interact well with other students. An increased emphasis on group work and problem solving is characteristic of Problem Based Learning, which features in the curriculum of most Australian medical schools. Nursing and medical education literature suggests that pre-existing critical thinking ability may be an important predictor of student success and clinical judgment. A recent Australian study (Dean, Barratt, Hendry and Lyon, 2003) in considering the preparedness for hospital practice of graduates from a problem-based program, concluded that

graduates from such programs were generally more prepared and were better communicators than graduates from traditional programs. This applied particularly to students from graduate-entry programs, but was also relevant to those from an undergraduate problem-based background.

McManus (2001) names four canonical traits for selection as intelligence, learning style and motivation, ability to communicate and conscientiousness. A UK study of the admissions processes of all five year medical courses (Parry *et al*, 2006) found that the common elements in the stated criteria for selection were academic ability coupled with a 'well rounded' personality demonstrated by motivation for medicine, extra-curricular interests, and experience of team working and leadership skills. Nicholson (2005) notes that attributes such as general mental ability, critical thinking, problem solving, communication skills, empathy, psychological robustness, and integrity are some of the qualities commonly cited as being required of medical students.

Elam and others discuss emotional intelligence as the ability to monitor one's own and others' emotions, to discriminate among them, and to use the information to guide thinking and actions (Elam, Stratton, Wilson, Scott and Tekian, 2001). They see these characteristics as crucial to clinical interactions with patients, their families and other health care providers. An editorial in the *British Medical Journal* in 1998; commenting on a proposed recertification or revalidation process, designed to encourage doctors to respect changes in societal values and to integrate into their practices innovations that are shown to enhance patient care, suggested that doctors should be evaluated among other things on their ability to find, integrate into practice and communicate specialised information. This skill set is termed information literacy. In addition, traditional continuing medical education centres should be replaced by activities that facilitate team learning and performance enhancement in multidisciplinary practice settings. In a discussion of doctors recruited into the National Health Service in the UK, (White, 2005) it was suggested that a more rigorous approach needed to be taken to recruitment to ensure appropriate placements and avoid the high costs of 'getting it wrong'. This followed an appraisal of the characteristics of doctors whose performance gave cause for concern and for whom strengths had become distorted by pressure and stress. It was pointed out that applicants at lower levels in the profession tended to be scrutinized more closely than those at higher levels. It was also noted that A level study in secondary schools in the

arts and humanities rather than the sciences might help future doctors to cope better with the unpredictability and uncertainties of medicine.

This section of the literature review does not attempt to present views on the suitability of particular characteristics in members of the medical profession. Rather it attempts to highlight the preponderance of such views in the literature and the apparent relevance of personal qualities to the study and practice of Medicine. However, it is relevant to note that communication and interpersonal skills in some form are ubiquitous in these studies and there is a general agreement among researchers that it is no longer sufficient for either medical students or doctors to exhibit high-level cognitive skills at the expense of effective relationships with other people. In relation to effective clinical reasoning skills, it is clear that critical thinking ability and problem solving are fundamental.

Part 2 – Instruments used in selection

In the countries which form the context of this thesis, namely Australia, Canada, New Zealand, the UK and the US, the most common elements currently used in the selection of medical students are the academic score, an aptitude test and an interview. There are other instruments which are used in specific universities. For example, Harvard University in the US requires among other things, an essay from the applicant and letters of recommendation from relevant others (Harvard University website); and the University of Manchester in the UK requires a personal statement from the applicant and a reference from the applicant's secondary school (University of Manchester website).

In this section of the literature review, the selection interview, aptitude tests for medical selection and instruments under development are considered in detail. These particular instruments have been chosen over other instruments because of their relevance to the Australian context.

The selection interview

An interview of some sort has long been included in the admissions process of many medical schools in the UK and the US. However, the type of interview previously used has been different from the types of interviews which are now used throughout Australia and in Canada, New Zealand, the UK and the US. Much of the early literature from the

US and the UK, pre-1990s, commented on the lack of reliability and validity of such interviews, which tended to be informal, unstructured and usually conducted by a single member of the faculty. Because of these features and because of the importance currently placed on selection processes into medical schools, it has been recognised that such informal interviews were not adequate in this context and have mainly been either eliminated from the process or replaced with a more formal structure. It is important, therefore, when evaluating the contribution of an interview to a selection process to understand the nature and objectives of the interview. Most universities now using a selection interview have adopted an approach which includes a clear statement of criteria with rating scales and scoring mechanisms which have been developed to assess these criteria. Examples follow of the literature pertinent to some Australian universities, and several examples from overseas, in which issues such as reliability and validity of the instruments are explored.

The Australian context

The University of Newcastle was the first Australian medical school to introduce an interview into the selection process. In commenting on the need for reliability and validity in the interview, Powis (1998) believes that the interview is valid only if structured and is reliable only if performed by people trained for the task. Bias can be reduced by not giving the interviewers any information about the candidate that is not pertinent to the data gathering (interview) exercise. The task of the interviewers becomes to provide a score on a calibrated scale on each of the pre-determined qualities being assessed. The interview should focus on qualities that can be directly assessed and interviewers should not investigate any other areas. Parry *et al* (2006) support these views on the interview with respect to the requirements for reliability and validity and methods to achieve these characteristics.

Monash University conducted a pilot study of its semi-structured interview on entrants to the medical course in 1991 and 1992. The faculty was interested in establishing whether or not the interview scores were sufficiently independent of the academic scores used at that time for selection and whether high interview scores were associated with personal attributes which seemed appropriate for medical students and doctors (Tutton, 1993). They found inter-rater reliability to be acceptably high between the three groups of interviewers, namely community, medical graduate and faculty staff. They did not find any

gender bias in the interview results but were concerned to find some association between the scores and both SES and attendance at an independent school (Tutton, 1994). Overall they were pleased with most of the outcomes of the interview process and their view was that it seems unreasonable to select medical students by a single mode of evaluation, namely the academic score.

Tutton followed these early papers with a report on the predictive capacity of the TER and interview scores for performance in the first four years of the medical course (Tutton, 1997). The results were quite mixed, showing the predictive value of the interview scores to be quite different from the TER in both Years 1-3 and Year 4. In fact, the interview showed negative correlations with some of the more academic sections of the course categorised as Cell and Tissue Studies and System Units. However, the various parts of the interview scores emerged as good predictors of success in Clinical and Communication Skills. The existence of negative correlations between the interview scores and some units caused considerable alarm initially. Further exploration of this issue showed that these same sections of the course also correlated negatively with desirable personality traits as measured by the California Personality Inventory. This provided some reassurance to the researchers and led them to conclude that finding a single selection component that predicts success in all aspects of the medical course is unlikely and is almost certainly an unreasonable expectation. Academic results show good predictive capacity for the academic sections of the course, but the interview showed superior prediction in the more humanistic aspects of the course. These findings have been upheld in the case study presented in this thesis and will be discussed in more detail in Chapter 7.

Non-Australian universities

In 1996 the University of Iowa Medical School in the USA reinstated an interview into its selection process (Patrick, Altmaier, Kuperman and Ugolini, 2001). Previously the interview had been unstructured and had been eliminated from the selection process for a number of years due to perceived problems with such an interview style. The new interview was developed according to the most recent research at that time. Medical School staff developed a structured interview with a 5-point rating scale for each of nine criteria as well as an overall score, together with training for the faculty interviewers who worked in pairs to conduct the interviews. Because of the difficulties associated with

consistency of rater pairs it was not practical to calculate a kappa statistic for inter-rater reliability. However, the percentage agreement on each question was calculated and found to be relatively high. The percentage of rater pairs whose scores differed by one point or less for each criterion ranged from 87% to 98%. A final interview score was determined as the average of the two raters' interview scores. Distributions of scores of individual criteria were examined and found to be acceptable from a psychometric standpoint. Correlations with other admissions criteria were calculated and found to be low, in spite of some of these relationships being statistically significant. In the first year the weighting of the interview scores in the final admissions status of the applicants was low, but was subsequently found to correlate significantly with final status suggesting that it could be used in the selection process. Overall researchers felt justified in the high cost of the process in personnel, time and other resources. One critical issue that they felt was unanswered was the proper role of the interview in the admissions process in relation to the characteristics that can successfully be measured. They felt that it was a question for faculties to determine and that longitudinal research is needed to validate the choice of domains and their measurement.

In a subsequent article on this project, Streyffeler and others reported on the degree to which this interview, along with other admissions criteria, predicted later performance in medical school (Streyffeler, Altmaier, Kuperman and Patrick, 2005). The outcome variables were drawn from grades in a two-year course sequence that attempts to develop interpersonal, non-cognitive skills essential to good practice as a physician. They did, however, express some doubt about the effectiveness of their performance measures. Much time and effort had gone into selection measures but not into the development of well validated measures of student performance on non-cognitive skills. In line with previous research they found that GPA and Medical College Admission Test scores (cognitive measures) predicted the cognitive domains of written test scores in the first two years of the medical course. These measures did not predict the non-cognitive outcomes. The interview score did not predict non-cognitive outcomes either, however two individual criteria did have some predictive validity on these outcomes. They concluded that it is important to continue to develop multimodal measures of non-cognitive abilities and noted that recent research suggests that non-cognitive abilities do not cluster within a single domain; 'rather there appear to be a variety of non-cognitive abilities that are important'. They viewed their work on the interview as

promising and concluded that in some domains the interview-based variables did incrementally predict medical school performance, albeit in the first two years.

Parry *et al* (2006) question the justification of the costs of the interview process and note the difficulty reported by medical schools in the UK in training and recruiting interviewers. McManus (2001) also comments on the cost of interviews in terms of staff time and agrees that the reliability and validity of the process are mostly dependent on the training of the interviewers and on a clear structure. He supports behavioural interviewing, where emphasis is placed on previous behaviours of the candidate rather than on hypothetical situations which may occur in the future. In commenting on the rise in the use of aptitude testing in selection procedures, Kalkarni (2006) supports the use of face-to-face interviewing and 'holistic' appraisal of a candidate's potential, rather than reliance on 'selection by numbers' based on the results of a single test.

The use of a Multiple Mini-Interview (MMI) (Eva, Reiter, Rosenfeld and Norman, 2004) was trialled by researchers at McMaster University in Canada in a bid to assess the consistency of ratings assigned by faculty members relative to community members. The interview scores were not used in the admissions process but the process and its rating systems were analysed and developed as a result of the project. Nine stations were set up and a maximum time of eight minutes was allowed per station, with two minutes for the changeover. It was felt by interviewers that this time could be reduced in subsequent sessions. Each station assessed a different criterion and the mode of presentation varied from one station to another. Some were video presentations, others involved practical activities and other were scenarios which were to be discussed. Two examiners were assigned to each station. Scoring was on the basis of a four-item evaluation form on a scale from 1 to 7. They concluded that the Multiple Mini-Interview was a reliable evaluation instrument and that the number of stations is an important determinant of the overall reliability rather than the number of interviewers per station. This style of interview provides an independent assessment of candidates' performance in multiple situations and dilutes the chance effects of being assigned to a 'hard' or 'easy' interview panel. This method of developing the selection interview has considerable potential and could be adapted in a variety of ways.

Reiter, Eva, Rosenfeld and Norman (2007) in reporting on research to follow up students admitted to McMaster University using this instrument concluded that pre-admission measures were complemented by the use of the Multiple Mini-Interview in predicting outcomes during clerkship and on the Canadian national licensing examination. The Multiple Mini-Interview has been adopted in its entirety by several graduate medical schools in Australia. One of the graduate schools reports on using the Multiple Mini-Interview in its set of admissions instruments and concludes that admissions interviews can be streamlined and efficient, yet remain informative (Harris and Owen, 2007). They have a longitudinal study in place to evaluate the value of their admission processes in predicting successful graduation to medical practice.

Summary

The nature of the interview needs to be articulated when considering its contribution to a selection process. An unstructured interview administered by an individual, which is the original model, is unlikely to show any desirable outcomes in the current circumstances. On the other hand, a structured (or semi-structured) interview conducted by a panel specifically trained for the task is likely to show some reliable characteristics. This level of structure involves at least the statement of specific criteria with rating scales to match them.

Interviews are generally seen as costly in time and resources and are therefore required to be effective. Most published research shows that interview scores predict different aspects of course outcomes compared to academic scores. The domains that can successfully be assessed by an interview are still problematic and research in this area is ongoing. The use of a multiple mini-interview (MMI), such as the format being developed by McMaster University eliminates some of the problems associated with a candidate being assigned to a 'hard' or an 'easy' panel and hence increases overall reliability. Literature on the use of well-developed medical selection interviews is relatively new and is likely to become more prolific in the near future.

General aptitude tests of reasoning and problem-solving

The following description of aptitude tests is adapted from the UMAT Validity Study (Mercer and Chiavaroli, 2006):

Most psychological tests can be placed in one of two broad categories: mental ability tests and personality tests. Mental ability tests originate with efforts to measure general mental ability. This broad class of tests includes intelligence tests, aptitude tests and achievement tests (Weiten, 1992). Personality tests (or scales) measure various aspects of personality including motives, interests, values and attitudes. Ability tests aim to assess intellectual potential rather than previous learning or accumulated knowledge. Aptitude tests assess specific types of mental abilities (e.g. general reasoning, visuo-spatial ability), while achievement tests gauge a person's mastery of various subjects and measure previous learning (Weiten, 1992). The difference between an achievement and an aptitude test is important because it reflects how a selection test differs from the kind of tests most applicants would be familiar with through their schooling.

Aptitude tests for medical selection

Aptitude tests which assess some form(s) of reasoning ability have become routine in selecting candidates for interview in the medical school selection process. These cognitive aptitude tests have been introduced to assist in discriminating among the increasing numbers of candidates who are academically qualified to enter these courses. Some authors see these tests, such as the BioMedical Admission Test and the Medical School Admission Test as 'adding value' to academic achievement. As indicated in the literature review, one important side effect may be to widen participation and to hedge against the inequities inherent in academic systems such as the A-Levels.

The lack of published evidence on their predictive validity is a negative aspect of the widespread use of such tests. However, cognitive tests specifically designed for selection into Medicine have a relatively short history and there is a need for more evidence-based research to support their long term use. These issues are now discussed in greater detail.

The sequence of events in Australia originated with the University of Newcastle's cognitive tests and developed into the UMAT and its graduate counterpart, the Graduate Australian Medical Student Admissions Test, both constructed by the Australian Council for Educational Research. Aptitude tests are usually used as part of the mechanism for selecting for interview and may subsequently be used again in some form in the final ranking of students. It seems to be a natural progression from the significant skill of clinical reasoning, as

detailed in an earlier section of this chapter, that reasoning and problem-solving ability would be included in this form of testing. However, writers such as Nicholson (2005), as detailed below, believe that such testing has other benefits, such as operationalising equity issues in a system in which success in secondary schooling relies on socio-economic background.

A recent article by McManus and others comments on the proliferation of intellectual aptitude tests for the selection of medical students (McManus, *et al*, 2005). One of the major reasons for this phenomenon in the UK is the difficulty in distinguishing between the growing numbers of applicants achieving three A grades at A-Level. A similar situation exists in Australia with a high proportion of medical school applicants achieving high TERs. The authors explored a series of questions related to aptitude testing for school-leavers in the UK on the assumption that medical schools need selection procedures that are evidence based and legally defensible. They detail two further problems associated with the use of A-Levels for selection, in addition to the clustering of medical applicants at the top end of the grade distribution. These are social exclusion and type of schooling. The profile of entrants to medical school has remained in the higher SES levels for many years and is not showing signs of changing. Furthermore, the minority of students attending independent schools are over-represented among university entrants, 'possibly because as a group they achieve higher A-Level scores'.

McManus *et al* (2005) cite a range of studies which demonstrate a clear relation between A-Level grades and university outcomes. They believe that this predictive value of A-Levels may be connected to the substantive content of what they assess (ie the knowledge gained) as well as their surrogate assessment of motivation to succeed. In medicine the content referred to shows A-Level Chemistry and to a lesser extent Biology as good predictors of success. They claim that measures of intelligence and intellectual aptitude alone are poor predictors of performance at university. Their preferred options for the development of medical school selection are to use a more finely developed marking system at the top end of the A-Level grades or to commission a new test which assesses high grade scientific knowledge and understanding. The authors note that the implied criticism of intellectual aptitude tests, in particular in this case the BioMedical Admission Test, comes in the absence of published evidence on the predictive validity and reliability of those already in use.

Responses provide a counterbalance to this provocative article (Bell, 2005; Nicholson, 2005). Nicholson (2005) claims that there is an urgent need to screen the large number of academically qualified applicants by a process that is not only appropriate, fair and transparent, but also adds value. She is of the opinion that an important reason for the inclusion of aptitude tests is the concern that some groups are underrepresented in medicine in the UK, because A-Levels reflect educational background and social class, and the use of such aptitude tests may go some way to widening participation, as a useful adjunct to A-Levels. She sees tests such as the BioMedical Admission Test, the Medical School Admission Test and the Graduate Australian Medical Schools Admission Test as adding value alongside the A-Levels by assessing desirable non-academic attributes. She also notes the need for a selection process to have construct validity, but ultimately to predict performance in the potential doctor. She believes that the experience so far in the UK, Australia and New Zealand is positive, but comments that further validated data are needed to confirm the prediction of long term outcomes.

Bell (2005) urges the reader to consider the content validity of the BioMedical Admission Test. The test is designed to assess thinking skills 'because they are considered important'. He cites some of the skills expected of a doctor (selecting relevant information, determining and applying appropriate procedures, understanding arguments by identifying reasons and assumption, and drawing conclusions) and reminds the reader that the test is designed specifically for medical admissions. This is a similar view to that put forward by Nicholson, in which he refers to the nature of the tests and their construction for the specific purpose of assessing skills seen to be important to the practice of the medical profession. A-Levels have been around for a long time and opportunities have been available for determining their long term predictive validity in many different arenas. The use of custom designed aptitude tests for medical selection has a relatively short history. Bell also points out that students with low scores on the BioMedical Admissions Test are rarely admitted and that academic selection tests 'can only predict those who can, not those who will'.

Standardised tests, in particular the Scholastic Assessment Test (SAT), previously known as the Scholastic Aptitude Test or the Scholastic Achievement Test, or the American College Test (ACT), have been used for entry to tertiary education (at the college level) in the USA for over a century (Andrich and Mercer, 1997). Recently these

tests reflect achievement in particular subject areas, however the SAT Reasoning test is still widely used as a measure of potential for academic achievement. The results of these tests are used in conjunction with the grade point average to facilitate selection procedures into college courses. The combination of the two scores (GPA and SAT/ACT) is found to be a strong predictor of college performance. Furthermore, a recent meta-analysis of predictive validity studies of the Medical College Admission Test showed that the predictive validity of this test ranges from small to medium for both medical school performance and medical board licensing examination measures (Donnon, Paolucci and Violato, 2007).

Instruments under development

New selection instruments are being trialled by other groups (Morrison, 2005). A questionnaire designed to measure moral orientation is being developed and tested. It is intended to predict the possibility of inappropriate behaviour in medicine. In addition, this questionnaire, known as the Mojac, is used as part of a battery of tests which form the Personal Qualities Assessment (PQA). The other two components are a test to measure individual differences in cognitive reasoning and one to measure personality trait differences. The Personal Qualities Assessment is being assessed in a longitudinal study in Scottish medical schools in a research project designed to test the predictive ability of the instrument. One noteworthy outcome of the research so far is the discovery that if this instrument were used for selection, male applicants and those from state-funded schools would not be disadvantaged. Morrison (2005), in reporting on this project concludes that while it is unlikely that a single instrument or procedure will ever be perfect, a mixture of measures covering a wide range of attributes is likely to provide the basis for selection of future doctors. Powis (2006), one of the developers of the Personal Qualities Assessment, cites its credentials with respect to reliability and construct validity and on-going research into the predictive validity of the instrument.

The Mojac, referred to above, purports to measure moral orientation rather than the more commonly assessed moral reasoning skill. The authors see tests of moral reasoning as inappropriate for use as selection instruments and see greater value in considering individual differences in moral orientation. They hypothesise a continuum from 'libertarian' (individualistic) to 'communitarian' (group/society needs) and believe that it is useful to consider aspects of an individual that determine their

opinions, their decisions and their actions rather than their ability to focus on the justifications that an individual might give for their decisions (Bore, Munro, Kerridge and Powis, 2005). The latter is seen as an aspect of moral reasoning. They conducted a study which examined the influence of a range of factors on moral orientation. The study provided empirical evidence of the validity of the Mojac as a measure of moral orientation. Age, gender and cultural factors provided small but significant differences in test scores. Older respondents, females and respondents from an Israeli background tended to be more communitarian and this may point to the need for different norms for these groups. Further work on relating the scale to well validated personality scales showed that those scoring at the extremes on the scale (both libertarian and communitarian) may demonstrate characteristics which make them less suitable for medical practice. In using such a test for medical school selection they propose that the usual method of selecting high scorers should possibly be replaced with a process which eliminates those at the extremes and establishes the large group in the middle as the most likely to behave in an ethically appropriate way in the practice of medicine. This concept of 'selecting out' for undesirable characteristics as well as 'selecting in' on desired traits and experience is supported by other authors (Eva, 2004).

Other work undertaken by this group on personality factors possibly underlying ethical behaviour in medical students and doctors indicated the importance of two primary dimensions, empathy and narcissism (Munro, Bore and Powis, 2005). They constructed instruments designed to measure these traits which were administered to large samples of medical students in New Zealand and Scotland. Their report on the construct validation of the instruments points to separate dimensions for narcissistic aggression and empathic relationships. Their proposal is that the instrument could be used for screening of prospective entrants to medical school, rather than as a direct selection device. The empathy factor correlates with other measures that indicate positive relationships with others, while the narcissism factor relates to aggression and generally unpleasant reactions to others.

Supporters of the moral reasoning approach (Self, Baldwin and Bunch, 2000) propose that appropriate use of assessment of moral reasoning as a selection criterion for medical school and residency training in the US, could follow from the outcomes of research which hypothesises that higher levels of moral reasoning may serve as an effective predictor of clinical performance. The suggestion is that the

demonstrated behaviours associated with high levels of moral reasoning relate to the ability to make decisions that are more morally just and which take greater account of patient rights, institutional requirements, and peer and societal expectations.

Overview

Some of the major themes which have emerged in the recent abundant literature on the topic of medical selection are:

- Prior academic achievement is important, whether it is used as a threshold or as part of the selection algorithm. This factor appears to be a better predictor than intelligence, as measured by general intelligence tests. Intelligence is multi-faceted and more emphasis needs to be given to some of its aspects other than those related to academic ability, for example emotional intelligence.
- There is general agreement on the need for the inclusion of qualitative/humanistic variables in selection, but little agreement on which qualities, how to operationalise them and how to use them in the selection mechanism.
- A requirement for the development of fair, open and transparent selection methods, is that they are valid, reliable, feasible and acceptable.
- Selection processes should be multi-faceted, adaptable and evidence-based.
- The collection of longitudinal data on the outcomes of selection processes is required.
- A variety of new instruments are being developed, trialled and evaluated. Some are useful for screening rather than for selection ie they 'select out' rather than 'select in'.
- New processes are expensive in time and resources, but are deemed necessary given the increasing number of academically qualified applicants.
- There is a dilemma attached to selection today for the professionals of tomorrow. Influences of market forces, different ranges of skills required, different economic and ethical environments and different settings in the workplace make it difficult to predict suitable characteristics for a future workforce. Some believe that it is preferable to select people who will succeed in the medical course rather than to focus on those who will be successful practitioners.

Chapter 3

Contextual factors in the selection of medical students

Introduction

Several factors have had an effect on the outcomes of the new selection procedures in Western Australia. Some of these were pre-existing and others have evolved over the course of introducing and implementing the new procedures. Two pre-existing factors were the gender balance in the medical course and equity issues related to the representation in the medical student cohorts of students from particular types of secondary schools. Allied to both of these is the changing trend in students' preferences in course selection, for those students eligible to apply for the medical course. These factors will initially be examined by considering trends in school-leaver applications to universities in Western Australia.

Contextual developments in the last few years are mainly related to Commonwealth government initiatives in the area of funding of medical student places, with a view to future workforce implications. Such issues are related to the rural medical workforce and to the provision of doctors in areas of unmet need. In this chapter these factors and developments will be articulated and the way in which they have impacted on the selection procedures and the outcomes of those procedures will be discussed.

Trends in first preferences for WA students eligible to study Medicine

Students who achieve a TER of 96+ , representing an average of at least 75% in their best 4 or 5 subjects, are eligible to apply for the undergraduate medical course at UWA. Each year a small percentage of these students enter the course from interstate, but the majority have undertaken their secondary school study in WA. In an attempt to examine trends in preferences in the cohort of WA school-leavers eligible to apply for Medicine, data were provided by the Institutional Research Unit at UWA for 2003 – 2005 entry to tertiary study. The data consisted of the first preferences for tertiary study of all students in WA with a TER of 96 or above. These data were aggregated for the

three years, resulting in first preferences for 3270 students of whom 1775 (54%) were females and 1495 (46%) were males.

The preferences by institution were as follows:

Table 3.1: Student preferences in WA for 2003-2005 for TER

	Females	Males	Females	Males	Total
UWA	1269	1202	38.8%	36.8%	75.6%
Curtin UT	343	237	19.5%	7.2%	17.7%
Murdoch University	126	46	3.9%	1.4%	5.1%
ECU	37	10	1.1%	0.3%	1.4%
Total	1775	1495	54.3%	45.7%	100%

Over the three years, the first preference for 76% of these secondary students was to attend UWA, 18% the Curtin University of Technology, 5% Murdoch University and 1% Edith Cowan University. Of the first preferences going to UWA, 51.3% were from females and 48.7% from males.

The data were then inspected for courses at each of the universities which attracted at least 40 preferences from these students over the three years, that is an average of 13 per year. The trend per year in female first preferences was calculated over the three years. This figure, which is shown in the final column of Table 3.2, is an indication of whether more (positive) or less (negative) females are applying for each course over that time period. The courses for which figures are quoted are mainly the professional courses at each of the public universities, given that these are the courses for which students of this level of ability (TER of 96+) will apply. The results are shown in Table 3.2.

Table 3.2: Trends per annum in female first preferences for the main courses

<i>Course</i>		<i>No. of first prefs</i>			<i>% of first prefs</i>		<i>Trend p.a. in F prefs</i>
		F	M	Total	F	M	
CUT	Pharmacy	41	26	67	61.2%	38.8%	-1.00%
	Physiotherapy	71	44	115	61.7%	38.3%	0.60%
	Occ. Therapy	38	1	39	97.4%	2.6%	0.00%
MU	Law	28	12	40	70.0%	30.0%	0.20%
	Vet Science	48	10	58	82.8%	17.2%	1.00%
UWA	Arts	48	12	60	80.0%	20.0%	-0.40%
	Arts/ Comm or Econs	31	18	49	63.3%	36.7%	-8.60%
	Arts-Science	29	17	46	63.0%	37.0%	-8.20%
	Commerce	23	26	49	46.9%	53.1%	-3.10%
	Commerce/Engineering	20	114	134	14.9%	85.1%	2.40%
	Dentistry	52	49	101	51.5%	48.5%	-4.80%
	Engineering	9	81	90	10.0%	90.0%	-3.30%
	Law combined	321	238	559	57.4%	42.6%	1.30%
	Medicine	494	359	853	57.9%	42.1%	0.60%
	Science or Sci/Comm/Econs	88	70	158	55.7%	44.3%	-3.70%
	Science-Engineering	19	99	118	16.1%	83.9%	-3.40%

Female first preferences were higher than male first preferences for all of these courses over that time with the exception of Commerce, Commerce/Engineering, Engineering and Science-Engineering, all at UWA. Several smaller courses in Computer Science at UWA (not shown in the table) when combined, show first preferences from females and males in the ratio 13% to 87%.

The trends over the three years for female first preferences were relatively stable for most of the larger courses listed above with the

exception of combined Arts degrees in which the female preferences decreased by approximately 8%.

To summarise, for school-leaver applicants in WA with a TER of 96+, i.e. those eligible to be considered for medicine, over these three years:

- Of the total group 54% were females and 46% males.
- UWA attracted three quarters of the first preferences from the group.
- Of those whose first preference was UWA, 51% were females and 49% were males.
- In the professional courses at Curtin UT and Murdoch University, including health professions, the proportion of females with first preferences is significantly higher than the proportion of males.
- At UWA, when considering courses which attracted at least 40 preferences over the three years, the only areas in which the first preferences of males are higher than those of females are Commerce, Commerce/Engineering, Engineering, Science-Engineering and Computer Sciences.

It seems that males in the group with a TER of at least 96 were interested in commerce, engineering and computer science rather than the more traditional professional areas such as law, medicine and veterinary science or the health professions such as physiotherapy. It appears that preferences in most of the larger courses have been relatively stable over these three years, suggesting that the higher interest from females in most of these courses is now well established. With respect to Medicine, 34.5% of all the first preferences going to UWA over this time were for the medical course and of these students, 58% were females. A further relevant factor, because of its relationship to issues of equity, is the representation of schools from the different sectors (Government, Catholic and Independent) in tertiary study. Recent evidence points to government school students being increasingly under-represented in the higher levels of the TER. Data generated by the Institutional Research Unit for the same period, 2003 to 2005 as shown in Table 3.3 below, demonstrate that for school students in WA with a TER of 96 and above, on average approximately 70% enrolled at UWA, 23% at Curtin University, 7% at Murdoch University and 1% at Edith Cowan University. Figures for the Roman Catholic Notre Dame University were not available. Of those who enrolled at UWA during this period, almost half were from Independent

schools (48.5%), 34% from Government schools and the rest from Catholic schools. The trend over the three years (shown in the final column of Table 3.3) has been for the representation of the Independent schools sector to increase by 3% per annum at UWA in the high levels of TER and for the other two sectors to remain relatively stable.

Table 3.3: School-leaver enrolments (TER >96) by school type for the public universities, 2003–05

Institution	School Type	Over the 3 year period				Trend (p.a.)
		2003	2004	2005	Average	
UWA	Catholic	12%	12%	13%	13%	0.6%
	Government	24%	24%	23%	24%	-0.5%
	Independent	31%	33%	37%	34%	3.0%
UWA Total		67%	69%	74%	70%	3.1%
Curtin	Catholic	6%	5%	5%	5%	-0.5%
	Government	11%	9%	10%	10%	-0.3%
	Independent	8%	9%	6%	8%	-0.6%
Curtin Total		24%	23%	21%	23%	-1.5%
Murdoch	Catholic	1%	1%	1%	1%	0.0%
	Government	3%	3%	2%	3%	-0.4%
	Independent	4%	3%	1%	3%	-1.3%
Murdoch Total		8%	8%	4%	7%	-1.8%
ECU	Government	0%	1%	0%	0%	0.1%
	Independent	0%	0%	0%	0%	0.0%
ECU Total		1%	1%	1%	1%	0.1%
		100%	100%	100%	100%	0.0%

Overall, the effect is that in the 96+ range of TER scores, the proportion of students enrolling at UWA increased by approximately 3% between 2003 and 2005, and this increase came from the Independent sector. It should be noted, of course, that the number and variety of Independent schools has increased over the last 10 years with the opening of 'low-fee' Anglican and Uniting Church schools and several Islamic schools. Hence the nature of independent schools has also changed during this period.

The implications are that given the same high level ($TER > 96$) of scholastic achievement at secondary level, students from independent schools are more likely than those from government schools to gain a place if selection is made solely on academic scores.

Gender balance in the course

In the first three years of the new selection process (for entry in 1999 – 2001) the combined application figures for the three years show a ratio of 54% to 46% of females to males. This ratio has remained relatively stable since that time. To further investigate the gender balance in the undergraduate medical course, the enrolments of domestic students in the undergraduate medical course for 2005 were examined. In 2005, all the cohorts represented had been selected by the new selection process (entry from 2000 to 2005). Table 3.4 shows the enrolments for domestic students in that year:

Table 3.4: Distribution of enrolments in Medicine in all Year levels in 2005

	<i>Year 1</i>	<i>Year 2</i>	<i>Year 3</i>	<i>Year 4</i>	<i>Year 5</i>	<i>Year 6</i>	<i>Total</i>
Female	77	115	81	77	59	56	465
	52.0%	58.4%	56.3%	55.0%	49.2%	50.5%	54.1%
Male	71	82	63	63	61	55	395
	48.0%	41.6%	43.8%	45.0%	50.8%	49.5%	45.9%
Total	148	197	144	140	120	111	860

There is considerable variation across the Year levels. However, the net result is a higher proportion overall of females to males (54% compared to 46%) who were enrolled in the undergraduate programme in 2005. This stands in contrast to the proportion of school-leaver females to males in the last three years of the old selection process, which based on data from the Institutional Research Unit at UWA, was found to be approximately 40% to 60%. It would be safe to conclude that the gender balance has changed since the introduction of the new selection process. The factors in the new selection process which caused this change are not immediately clear.

Two possible reasons for the change in gender balance were investigated. Firstly, the existence of some form of gender bias in the new process and secondly, the changes brought about by lowering the academic threshold from 99+ to 96. The latter reason was considered by looking at the number of applications received each year. Table 3.5 shows the total number of applications for Medicine for entry from 1995 to 2001:

Table 3.5: Total applications for Medicine at UWA, 1995 - 2001

1995	1996	1997	1998	1999	2000	2001
504	561	535	898	1325	1424	1369

These numbers have continued to increase. Figures for 2004 and 2005 entry show that the total Medicine applications were 1520 and 1687 respectively. Hence the total number of applications for Medicine more than trebled from 1995 (504) to 2005 (1687). From 1999, early in the new selection process, until 2005, the number of applications increased by 27%. Over that period (1999 – 2005) the proportion of female to male applications has been approximately 55% to 45% (Faculty records). Reliable evidence is not available for the old academic selection process (1998 and before), but anecdotally it appears that these proportions were reversed during that time ie at most 45% female applications to 55% male applications.

The alternative explanation of some form of gender bias in the new process was monitored in the early years by considering the proportion of males to females at several major stages in the process. Table 3.6 shows the aggregated proportions of females to males for the first three years (1999 – 2001) of the new process at three major stages.

Table 3.6: Proportions of females to males at major stages, 1999 - 2001

	Females	Males	Proportion
Applied	54%	46%	1.17
Invited for interview	52.5%	47.5%	1.11
Offered a place	52.3%	47.7%	1.10

The proportion of females to males at these three major stages remained relatively stable. The change in the female:male ratio of

students in the course appears to be related to the ratio of female:male applications received. In the round of applications in 2004 for 2005 entry the proportion of females to males was 57% compared with 43%. Table 3.4 shows that in Year 1 in 2005 (the same cohort of students), the proportion of females to males entering the course was 52% to 48%. It seems unlikely that this trend will be reversed, so the overall proportion of females to males in the course could be expected to remain at approximately 54% to 46% overall.

Representation of the schools sectors

One of the issues stated as a reason for change in the period preceding the introduction of the new selection process was the need to increase access to the medical course from a broader cross-section of people, allowing people from different socio-economic, geographical and ethnic backgrounds equal opportunity to compete for a place. It was considered that the original system was elitist and placed too much emphasis on the TES which tended to favour particular kinds of schools; in the main these schools were from the non-government sectors. The experience in South Australia when the University of Adelaide introduced their new selection process, with the same three components, was for the number of schools from which medical students were drawn to increase (Minutes of UWA Academic Council, 1997). It was anticipated that this would also occur in Western Australia and that one of the indicators of an increased socio-economic base would be increased representation of 'lower SES' schools. The implication at the time was that these schools would be from the Government sector.

Tables 3.7 and 3.8 show the results of an investigation of the school sector attended by the school-leaver Medicine entrants for the five years before (1994 – 1998) and after (1999 – 2003) the introduction of the new process. Table 3.7 shows the number and percentages of entrants from each of the school sectors (Government, Catholic and Independent) for the ten-year period 1994 – 2003.

Table 3.7: Number and percentage of students from each school sector for each year, 1994–2003

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Government	40	37	43	32	39	29	34	24	34	38
	40.4%	41.6%	43.9%	35.2%	41.9%	33.3%	37.4%	26.7%	34.7%	40.0%
Catholic	22	14	13	17	12	14	17	20	18	14
	22.2%	15.7%	13.3%	18.7%	12.9%	16.1%	18.7%	22.2%	18.4%	14.7%
Independent	37	38	42	42	42	44	40	46	46	43
	37.4%	42.7%	42.9%	46.2%	45.2%	50.6%	44.0%	51.1%	46.9%	45.3%
Total	99	89	98	91	93	87	91	90	98	95

For the five years prior to the introduction of the new process the overall percentages of Government to Catholic to Independent school students was 40.5%, 17%, 42.5%. This changed to 34.5%, 18%, and 47.5% for the first five years of the new process. The main change to be noted here is the decrease in the proportion of students from the Government sector with a corresponding increase from the Independent sector. At first glance this appears to be counter to expectations and counter to intentions. It is, however, consistent with the results reported above, that in WA in the 96+ TER group the proportion of students coming from the independent sector is increasing and in particular that these students are choosing to study at UWA. This phenomenon is not related specifically to the medical course. It should also be noted that interviewers involved in the selection interviews for Medicine are told only the candidate's first name and do not know any other information about them, including the secondary school they attended.

Table 3.8 shows the number of schools from which the cohorts were drawn in each sector. The results reflect the same trends as those in Table 3.7. The percentages of Government to Catholic to Independent schools represented changed from 47%, 22%, 31% to 40%, 24%, and 36% from the five years 1994–1998 to the five years 1999–2003. Once again there is a small increase from the Catholic sector and a 5% increase from the Independent sector, with a 7% decrease from the Government sector.

Table 3.8: Number and percentage of schools represented by school sector, 1994-2003

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Government	20	20	23	20	20	18	21	17	15	17
	43.5%	48.8%	50.0%	46.5%	47.6%	45.0%	45.7%	38.6%	32.6%	36.2%
Catholic	14	9	8	8	8	8	11	12	11	11
	30.4%	22.0%	17.4%	18.6%	19.0%	20.0%	23.9%	27.3%	23.9%	23.4%
Independent	12	12	15	15	14	14	14	15	19	18
	26.1%	29.3%	32.6%	34.9%	33.3%	35.0%	30.4%	34.1%	41.3%	38.3%
Total	46	41	46	43	42	40	46	44	45	46

Closer inspection of the actual schools shows that in the five years 1999-2003 there were at least seven Independent schools and six Catholic schools which had not previously been represented in medical cohorts. All of these schools are classified as relatively low SES schools based on their Modified A Ross Farish index (Chant and Lingard, 1991), which is used to classify non-Government schools. This suggests that even though the change in selection procedures has not resulted in increased numbers from Government schools per se, the net result is that a broader socio-economic range of students is being represented in the cohorts from the non-Government sector.

The so-called elite schools from the Independent and Government sectors are still well-represented. There is a group of 25 schools which have all been well-represented over the ten year period under consideration (1994-2003), i.e. both before and after the introduction of the new selection process (with an average of at least 1 entrant per year). Of these schools, 8 are Government, 5 are Catholic and 12 are Independent. However, the total representation of these schools from the first 5-year period to the second 5-year period has decreased by approximately 5%.

It seems that even though changes in the representation of schools and the socio-economic mix have not been radically different there are signs that subtle changes are occurring and that these changes are in the

desired direction. This leads logically to the effects of the rural quota on the representation of schools in the medical course. The implementation of the rural quota and its implications for the composition of cohorts of medical students is discussed in the next section.

The rural quota

The Rural Undergraduate Steering Committee (RUSC) Program was developed by the Commonwealth government in the 1990s as part of the Rural Incentives Program, as a strategic long-term initiative to increase the number of medical graduates adopting a career in rural or remote practice. The Program operates on the basis that selection of students for medical education from rural locations; increased exposure to rural medicine during the course; and enhanced support for students and rural educators would lead to more doctors adopting a career in rural medicine. The RUSC Program provides resources to Departments of General Practice, through medical schools, to facilitate these three initiatives. The specific aspect of the Program which affects this discussion is the implementation of a 25% rural quota in medical school intakes.

At UWA in the early 1990s, medical faculty policy stated that a further 5 places (over the quota of 120) may be allocated by the Matriculation and Admissions Committee to applicants who have lived in the rural area of WA for a minimum period of two years and who, during that period, completed Years 11 and 12 at a secondary school in a rural area (defined as the area outside a radius of 75 km from Perth City Centre). Such applicants had to achieve a TES above a minimum approved each year by the Faculty of Medicine and Dentistry (usually no lower than 400 or equivalent to a TER of 98+) but below the cut-off score for other school-leaver entrants (TES of 430+ or equivalent to a TER of 99+). Selection was to be based on academic merit only.

By 1998 Faculty policy allowed for six school-leaver and four non-standard places in Medicine to be filled by rural students. This small percentage (approximately 8% overall) was to be gradually increased each year until the desired target of 25% was achieved. In 2005 the quota of rural students had increased to 21% and by 2006 the 25% target was finally achieved. However, over that time the threshold values for the UMAT score, the TER and the interview score were relaxed slightly for some individuals classified as rural to allow that year's quota to be filled. In 2005 the definition of a rural applicant was

also revised to be comparable with that of the other states, hence allowing more applicants to be considered under the rural definition. Furthermore, the lowering of the TER cut-off from 99+ to 96 (representing a decrease in average mark per subject from 85% to 75%) has greatly assisted in increasing the number of rural students who are eligible to apply for the medical course.

Two other Commonwealth initiatives which have assisted in fulfilling the RUSC Program objectives have been the Medical Rural Bonded Scholarships (MRBS) and the Rural Australia Medical Undergraduate Scholarship Scheme (RAMUS). These function as follows:

Medical Rural Bonded Scholarships: This scheme has been in existence since 2002 and provides a scholarship of more than \$20 000 per year to students who undertake to practise in a rural area for six years following completion of their basic and postgraduate medical training. The scholarship is not subject to a means test and penalties exist for breaking the contract with the Commonwealth Government. Within Australia 100 extra first year places are available each year associated with this scheme and each university has its own quota of places available. UWA currently has 8 scholarships to award each year. Some of these are awarded to rural students and others to metropolitan students on academic merit and a commitment to practise in a rural area.

Rural Australia Medical Undergraduate Scholarship Scheme: These scholarships provide rural students with financial assistance to meet the costs associated with moving away from their home to undertake their studies. The National Rural Health Alliance administers the RAMUS Scheme on behalf of the Commonwealth Government.

Under the RUSC funding a Rural Student Recruitment scheme was developed by UWA and a coordinator was appointed to facilitate the process. The scheme has been very successful and has been the driving force in achieving the 25% rural quota. The effect on the representation of schools in the medical school cohorts is, of course, a greater proportion of students from rural and remote locations. This situation has satisfied the stated objectives of the new selection process in diversifying the applicant pool geographically and with respect to socio-economic status, given that the rural schools tend to have a mixed SES composition whether they are from the government or non-government sectors.

Bonded Medical Places (BMP)

The final development that has had, and will continue to have, a significant effect on the cohorts of students selected for medical education, is the introduction of Bonded Medical Places. This scheme was introduced by the Commonwealth government in 2003 and was vehemently opposed by the Australian Medical Association. The Bonded Medical Places (BMP) Scheme provides funding to universities for additional medical school places with the intention to provide more doctors in areas of doctor shortage. Students who accept such a place undertake to work in an area of unmet need for the first six years of their medical career. The places they accept are unfunded for the individual, the incentive being the offer of a place that would not otherwise be offered to them. The BMPs are awarded to the lowest ranked 25% of students entering in any one year. That is, the students who accept a BMP are ranked, by definition, below those applicants who will be offered an unencumbered place.

Areas of unmet need, or workforce shortage, are located in outer metropolitan areas of the capital cities and in regional and rural Australia. Such shortages may be in General Practice or in areas of specialty, so there is an interaction between the location of the position and the nature of the area of medical workforce shortage. If a student accepts a Bonded Medical Place the arrangement is formalised in a written Deed of Agreement with the Commonwealth government.

Initially the total number of BMP places introduced in 2003 was 234 across Australia. Each university was allocated a certain number of such places, with the expectation that the places would be filled. As from 2006, for the 2007 intake, the quota of BMPs has increased to 25% of the total intake for each university for each year. Each university has to deal with the allocation of such places according to their own selection process. The most common method that has emerged is in the application process, in which a student applies for an 'ordinary' place and submits a separate preference for a BMP. In some cases a student may be offered a BMP in the first round of offers and this offer may change to an 'ordinary' place in the second round of offers.

As described above, the BMPs are awarded to the lowest ranked 25% of students entering in any one year. There are a number of unfortunate consequences of this scheme, in which students who have been awarded a BMP may be seen by their peers as 'inferior', thus setting up a hierarchy within the medical student cohort. For an individual student there is a tension between the acceptance of a BMP as a place in medical

school which would not otherwise have been offered, and the knowledge that they have legally agreed to work for a period of six years following their medical education in an area of doctor shortage. A further consequence, depending on student preferences, is that some students who accept a BMP may be ranked well below other students who were not offered a place at all because they did not specify a preference for a BMP. The 25% rural quota and the 25% BMP quota are independent schemes which may overlap. Hence some students will be part of the rural quota and will also have accepted a BMP.

Summary

The factors discussed in this chapter have interacted with the new medical selection process over the period from 1999. It is clear that these factors and their effects are only partially attributable to the introduction of the new process and that other trends and initiatives have also been in place. However, the result is that the composition of medical student cohorts have changed considerably over this time and it seems that the changes will be on-going and need to be monitored carefully.

In summary, the following points have emerged:

For school-leavers eligible to apply for the medical course in WA, that is those with a TER of at least 96, the following trends can be seen:

- Males show more interest in entering the courses of Commerce, Engineering and Computer Science, whereas females are more interested in entering Law and Medicine.
- The representation of the Independent schools sector at UWA has increased. However, the nature of Independent schools has also changed with a broader socio-economic composition within the sector.

In the medical course at UWA the following trends can be seen

- The female: male ratio of enrolments in medicine has changed from approximately 40: 60 to 54: 46 since the introduction of the new selection process. This trend has been stable over the period from 1999. The explanation for this trend appears to lie in the increased number of applications which has occurred with the lowering of the academic threshold from 99+ to 96, in which a higher proportion of females than males apply for courses such as Medicine.
- The representation of government school students has decreased with a corresponding increase from the independent sector. However, the representation of the so called elite schools has decreased over that

time with a higher proportion of lower SES Independent and Catholic schools represented.

Two major initiatives by the Commonwealth government have occurred in funding places for the future medical workforce, with respect to the provision of doctors in rural and remote areas and areas of unmet need, which may be related to location or to areas of medical specialty. These initiatives have had the following impact

- The gradual implementation of the 25% rural quota in medical student cohorts under the RUSC Program has changed the composition of the cohorts geographically and socio-economically. This was a stated aim of the new process. The two issues are interdependent in that the achievement of the rural quota has been possible because of the lowering of the academic threshold to 96.
- The introduction of the Bonded Medical Places scheme in which students are offered a medical school place in return for undertaking to work in an area of unmet need for the first six years after graduation has had several effects on the medical student cohorts. Students holding BMPs are ranked lower in the new selection process than students holding unencumbered places. From 2006 for 2007 entry the quota was 25% of the total intake.
- The two schemes, rural and BMP quotas are independent in principle, but overlap in practice.

Chapter 4

Selection procedures in Australian undergraduate medical schools

This chapter provides an overview of the procedures used in Australian undergraduate medical schools to select students; explains the three main components used in the UWA selection process, namely the Tertiary Entrance Rank, the Undergraduate Medicine and Health Sciences Admissions Test (UMAT) and the selection interview; and describes in detail the process used at UWA to select and rank the applicants. A final section deals briefly with selection in universities outside Australia.

Background

The University of Newcastle was the first Australian university with an undergraduate medical programme to introduce components other than an academic score into the selection of students. The University of Newcastle medical school pioneered the system which has become widespread in Australian medical schools of using a selection test and an interview in addition to academic scores. To avoid the sole use of academic results for entry, the University of Newcastle medical school decided to consider students in the top 10% of school results, with the addition of some tests of cognitive skills and an interview. The cognitive tests were locally developed and became the forerunner to the UMAT. The interview was intended to assess communication skills and motivation to study medicine. The tests and the interview were developed following extensive research by the dean of the medical school and a panel of faculty staff.

In the initial stages at the University of Newcastle, the interview was trialled with all entrants and data were collected without being used for selection. This enabled research to be done which included students who were selected by the academic results only method, but who would not have been selected by the new method. Over a number of years the cognitive tests and the interview were refined and combined into a process which involved the use of the cognitive tests to select for interview and the use of a threshold for the academic score, with final

selection being based on the interview score. From the beginning of this process the number of applicants was high and has remained so.

With the assistance of the Australian Council of Educational Research, the University of Newcastle developed the first version of the UMAT based on its own test of cognitive skills and used this new version for the first time in 1991. The scoring and generating of results was all undertaken by the University of Newcastle. In 1997 the University of Adelaide used it for the first time and also introduced an interview, modelled on the one used by the University of Newcastle. The University of Adelaide's selection process mirrored closely that used by Newcastle. The following year, 1998, the University of Melbourne and the University of Tasmania both started to use UMAT in their selection process, but for various reasons did not include an interview. The same year, 1998, UWA used UMAT for the first time and developed a different model of selection based on the same three components as the University of Newcastle and the University of Adelaide (academic score, UMAT and interview) but with the final selection being made by a total score which gave equal weight to each of the three components. UWA also developed its own interview format, distinct from that used by the other two universities.

Monash University had started to use an interview in the selection of its non-school-leaver entrants in the early 1990s. From 1995 the interview was used in combination with the academic score to select the whole cohort. Monash also developed a different style of interview from that used by the University of Newcastle. In 2000 Monash University began using UMAT and developed a final selection process based on the use of all three components (academic score, UMAT and interview) in which the interview is weighted more highly than the other two components, given an academic threshold. At about this time, the Australian Council of Educational Research took over the management of the scoring and reporting process as well as the item development for UMAT.

In 2002, the University of New South Wales introduced a three-component selection process based on a similar model to that used by UWA, but with a different style of interview. The interview styles used by the universities of Newcastle, Adelaide, Monash and New South Wales are all semi-structured, while UWA has developed a highly structured format. The University of Melbourne and the University of Tasmania have continued to use only the UMAT and an academic score in their selection. In the last two years the medical schools at the

Universities of Otago and Auckland in New Zealand and Bond University in Queensland have introduced the UMAT into their selection process. James Cook University also has an undergraduate Medicine programme. Whilst this university is a member of the UMAT Consortium, selection of medical students is undertaken by academic scores, a written submission and an interview. In 2006, the University of Adelaide modified their selection process to take more account of the TER, following criticism of their process as being too reliant on the outcomes of the interview. It must also be noted that claims made in the press against the University of Adelaide have not been upheld by the relevant authorities, including the office of the State Ombudsman. In 2007, the University of Western Sydney opened an undergraduate medical school and it uses the same three components as most of the other schools, namely TER, UMAT score and interview score.

It is worth noting that all the graduate medical schools use three components in the selection of students. These are the Graduate Australian Medical Student Admissions Test, an interview and an academic score, the Grade Point Average (GPA). There are currently eight graduate medical courses (including UWA) and a graduate dental course (Sydney) in Australia which use this three component system. The University of Wollongong started to participate in 2007.

The graduate entry system is quite different from the undergraduate entry system in that ACER is used as a clearinghouse and all applications go through this central office. Applicants are offered an interview at only one university, which restricts the number of interviews that any one institution undertakes. As with the undergraduate entry system, the various universities have their own individual approaches to the conduct of the interview and each uses their three components in different ways to make the final selection.

Part 1 - Selection processes

There are nine undergraduate medical schools in Australia and they fit into three main categories according to the way in which they select their students. Unlike the graduate schools, the process is carried out internally within each university with no reference to the other medical schools. Students apply through the relevant state tertiary admissions centre, and in many cases students make multiple applications to the undergraduate medical schools around Australia.

It should also be noted that each of these universities has introduced a new curriculum in the last few years. In each case this curriculum is student-centred and problem-based. As at UWA, the introduction of the new selection process and the new curriculum occurred in close proximity in all these institutions. However, it appears that the two events are not usually directly linked. With the exception of the University of Tasmania, Monash University and the University of Newcastle which all have 5-year programmes, the medical courses are of six years' duration.

The three categories of selection methods are: the successive threshold method, the weighted components method and the two component method. Each of these methods will be considered in turn. In each method an academic threshold score applies, although the threshold score varies across universities.

The successive threshold method: this method is the one originally devised by the University of Newcastle in the early 1990s, in which applicants have to achieve successive thresholds in the three components. This process was also adopted by the University of Adelaide from 1997 until the current round of selection, at which stage it changed to the weighted components method.

The first stage of the successive threshold method involves all the applicants sitting the UMAT and tertiary entrance examinations. Those who achieve the UMAT threshold score are invited for interview. The interview is a semi-structured process in which the same six criteria are assessed each year. In addition an overall score is awarded at the end of each interview. When the results of the tertiary entrance examinations become available, which traditionally occurs at the end of the year, any interviewees who have not achieved the threshold of a TER score of 90 are eliminated from the selection process. This leaves a pool of applicants who have passed the thresholds on both the UMAT and the TER and who have an interview score. The interview score is used to make the final selection of students, with the UMAT score being used as a tie-breaker for applicants with the same interview score.

In this process the UMAT score and the TER serve only as thresholds. The importance of the interview score becomes paramount, given that this is the means of ranking the remaining students. The implications are that all those students in the final student group will have a high interview score and the other two scores will vary across the group. This process has been successfully used at the University of Newcastle for many years. However, the University of Adelaide has not

been so fortunate. There the medical school has been accused of bias against a number of groups including students from independent schools. Claims have been made that steps are taken in the interview to exclude applicants whose family members are in the medical profession or who attended independent schools. These claims have been made in the media and have proved damaging to the medical school, to the extent that in 2006 the system of selection was modified to make greater use of the academic score, namely the TER. As a result, the University of Newcastle is the only medical school currently using the successive threshold method.

The weighted components method: This method was initiated by UWA in 1998 for 1999 entry. The three components (UMAT score, Interview score and TER) were used to develop a final ranked list by combining them statistically with equal weight. This process will be described in detail later in this chapter. In 2000, Monash University independently developed a system in which the three components are used to produce the final ranked list, but with the interview score being more heavily weighted than the other two components. In 2002, the University of New South Wales developed a selection model similar to that used by UWA, in which the three components are equally weighted. The weighted components method of selection involves the combination of the scores from the three components at the final stage of selection. Up to that point the process is similar to the successive threshold method. The first threshold to be attained is the UMAT score which is used to assist in inviting applicants for an interview. Applicants are interviewed on the assumption that they are likely to achieve the academic threshold score.

The academic threshold is applied as soon as it becomes available, to the group of students who have been interviewed. UWA uses a TER threshold of 96, Monash University uses 90 and the University of New South Wales uses 95. The University of Adelaide medical school used this method for 2007 entry, and applies a TER threshold of 90. The universities who adopt this method also apply a threshold to the interview score. Hence the final group of applicants who are ranked consists of those who have passed a threshold on each of the component scores.

The effect of combining the three components with equal weight and ranking the applicants based on this composite score is to allow one component to be compensated for by the other two. Hence within the final group of students selected by this method an applicant can afford to

have a 'low' score (within the range above the threshold) on one component, provided the other two scores are high. This leads to a mixed profile of students, with a full range of scores on each component. This effect will be discussed in more detail in relation to selection at UWA.

The new medical school at the University of Western Sydney also uses the three components to rank its applicants. A threshold is applied on the TER (93 for applicants from Greater Western Sydney and 95 for others) then final selection is made based on some combination of the UMAT score and the interview score.

The two component method: This method is used by the universities of Melbourne and Tasmania. In each case, only the UMAT score and the academic score are used to select the students. Both of these medical schools have pre-requisite subjects. Both medical schools decided not to undertake an interview for the undergraduate applicants because of the perceived lack of maturity of school-leavers, particularly males, and the high cost in time and resources involved in conducting interviews.

The University of Melbourne has a three-stream process which uses the UMAT score and the TER in different combinations. A TER threshold of 96 is applied to all applicants. The UMAT total score is composed of a combination of the three sections of UMAT which weights the first section double that of the other two sections. Approximately half the students are selected with a combined score which equally weights the UMAT score and the TER. One quarter have a very high TER and a UMAT score above a threshold and the final quarter have a very high UMAT score and a TER above 96. The University of Tasmania applies a TER threshold of 95 and selects on the basis of the UMAT score. They set thresholds on each of the sections of the UMAT and on the total score.

James Cook University does not use the UMAT at all, preferring instead to use the TER, a written submission and an interview. The focus of the course at James Cook is on rural and remote practice and indigenous health. The written submission and the interview deal with these aspects of the admissions process. As a consequence James Cook University is different from all the other undergraduate medical schools in Australia.

Summary

The common elements to most of the selection processes are the TER, the UMAT score and an interview score. Most of the medical schools, including UWA, also admit a small number of non school-leavers, but in each case the major proportion of the intake is from the school-leaver group. At UWA the proportion of non-school-leavers has been 20%, but this has changed with the introduction of a graduate course. Six of the nine undergraduate schools use all three elements, but the descriptions outlined above show that no two schools use them in exactly the same way. In each case where an interview is used (seven of the nine schools) the interview format and process is unique to that school. Bond University in Queensland, which is a private university, also uses a three-component system including the UMAT and an interview.

It seems reasonable to conclude that given the different ways in which the schools use the selection components, the nature of the student intakes will differ in some respects across the universities. Furthermore, applicants may have preferences for different institutions according to their type of selection process, and the nature of the interview will effect the outcomes of each different process. Table 4.1 summarises the selection processes for the nine undergraduate medical schools.

Following Table 4.1 is Part 2 of this chapter, which presents a description and discussion of the three main components used in the UWA selection process namely the Tertiary Entrance Rank (TER), the Undergraduate Medicine and Health Sciences Admissions Test (UMAT) and the selection interview; and a detailed description of the process used at UWA to select and rank the applicants.

Table 4.1: Summary of selection processes of Australian undergraduate medical schools

University	Length of course	Selection components	Prerequisites	Method of selection
Adelaide	6 years	TER ≥ 90 UMAT Oral Assessment		Combined score of TER, UMAT and interview.
James Cook	6 years	TER Written submission Interview	English Maths Chemistry	(Details unknown)
Newcastle	5 years	TER ≥ 90 UMAT Interview		Interview score with UMAT score as tiebreaker
Melbourne (This degree is no longer offered. All entry to become Graduate)	6 years	TER ≥ 96 Wted UMAT (S1 double)	English Chemistry Maths or Physics	3 streams combining UMAT and TER in different ways
Monash	5 years	ENTER ≥ 90 UMAT Interview	English Chemistry	Combined score of ENTER, UMAT and interview.
Tasmania	5 years	ENTER ≥ 95 UMAT	Chemistry Physical science Mathematics	UMAT total score, with thresholds on the Sections
UNSW	6 years	TER ≥ 95 UMAT ≥ 150 Interview		Combined score TER, UMAT, interview (equal weight)
UWA	6 years	TER ≥ 96 UMAT Interview	English	Combined score TER, UMAT, interview (equal weight)
UWS	5 years	TER ≥ 93 for Greater Western Sydney applicants TER ≥ 95 for others UMAT Interview		Combination of UMAT and interview scores

Part 2 - The three components

The Tertiary Entrance Rank

Since 1998, Western Australian school students' final scores have been represented as Tertiary Entrance Ranks (TER) in line with other states in Australia. TERs are used by the Tertiary Institutions Service Centre (TISC) to rank students and to make offers for particular university courses. TISC is the central institution which processes the applications of all students who wish to study at universities in Western Australia. Each state in Australia has an equivalent institution which performs the same role within that state. A TER has a number of advantages over the previous measure used, which was a Tertiary Entrance Score (TES). Firstly, it directly reports a student's position relative to other students. For example, a TER of 90.00 indicates that a student is equal to or better than 90% of the Year 12 school-leaver age population (this includes those who sat the Tertiary Entrance Exams as well as those who did not).

Furthermore, the TER allows the results of any WA student applying for university admission interstate to be directly compared in rank with students in other states, assuming homogeneous cohorts, as well as giving a common measure for interstate students applying for places in WA. All states (except Queensland) report student rankings on the same TER scale. In Victoria it is called the Equivalent National Tertiary Entrance Rank (ENTER); in New South Wales and the ACT it is called the Universities Admissions Index (UAI) and in South Australia, Tasmania and Western Australia, the Tertiary Entrance Rank (TER). This system of reporting scores for tertiary entrance was implemented in the same year as the new selection process for Medicine. The equivalent TERs for the cut-off scores for Medicine in the four years before the introduction of the new selection process were:

Year	1995	1996	1997	1998
TER	99.4	99.3	99.25	99.1

The threshold score that was set for the 1999 admissions for Medicine was a TER of 96.00. This represents an average combined score of approximately 75% for each of the 4 or 5 subjects used to calculate the Tertiary Entrance Score. The cut-off scores above demonstrate that school-leaver entrants to Medicine prior to 1999 were

in the top 1% of their Year 12 age group. Students with a TER of 96.00 have results which are equal to or better than 96% of their Year 12 age group, so they are in the top 4% of the population for their age group. This level corresponds approximately to the top 10% of those who sit the Tertiary Entrance Exams.

A number of issues related to the TER have already been discussed in a previous chapter. Most notably those issues raised questions of equity with respect to gender and type of school attended when the TER is the only criterion used for selection into high-stakes courses such as medicine.

The Undergraduate Medicine and Health Sciences Admissions Test (UMAT)

The UMAT consists of a battery of three subtests developed each year by the Australian Council for Educational Research (ACER) on behalf of a group of universities which form the UMAT Consortium. The tests are developed and used specifically to assist with the selection of students into medicine and health science degree programs at undergraduate level at these universities. The three sections of UMAT are called Logical Reasoning and Problem Solving; Understanding People (formerly known as Interaction Skills); and Non-Verbal Reasoning.

Initially, UMAT was developed for use in the selection of applicants to Medicine at the University of Newcastle beginning in 1991. In 1997 it was used also to assist in the selection of students for the University of Adelaide's medical program. From 1998 UMAT was redesignated the Undergraduate Medicine and Health Sciences Admission Test when its use was widened to include several health science faculties as well as the Faculties of Medicine at the universities of Melbourne, Tasmania and Western Australia. In 2000, Monash University began using UMAT, followed in 2002 by the universities of New South Wales and Queensland. In 2003, the University of Otago in Dunedin, New Zealand, used UMAT for the first time. A year later the University of Auckland in New Zealand, and Bond University and Griffith University in Australia followed suit.

UMAT as an Ability Test

Most psychological tests can be placed in one of two broad categories: mental ability tests and personality tests. This issue has been introduced previously, but will now be explored in more detail. Some of the following discussion is adapted from the construct and content validity study referred to earlier (Mercer and Chiavaroli, 2006). This discussion is included with the permission of ACER and the UMAT Consortium.

Mental ability tests originated with efforts to measure general mental ability. This broad class of tests includes intelligence, aptitude, and achievement tests (Weiten, 1992). Personality tests (or scales) measure various aspects of personality including motives, interests, values and attitudes. Ability tests aim to assess intellectual potential rather than previous learning or accumulated knowledge. Aptitude tests assess specific types of mental abilities (e.g. general reasoning, visuo-spatial ability), while achievement tests gauge a person's mastery of various subjects and measure previous learning (Weiten, 1992). According to these distinctions UMAT is a mental ability test designed to determine certain aptitudes for study in Medicine.

This difference between an achievement test and an aptitude test is important because it reflects how a selection test such as UMAT differs from the achievement tests most applicants would be familiar with in their secondary schooling. Anastasi and Urbina (1997) in their long-established textbook of psychological testing outline this difference more fully. They point out that one major difference between achievement and aptitude tests is essentially a difference in the degree of uniformity of previous relevant experience. Whereas achievement tests measure the effects of relatively standardised experiences such as that evident in studying school subjects, aptitude tests measure the effects of multiple, cumulative experiences found in everyday living. The learning assessed in aptitude tests is experienced in fairly uncontrolled and unknown conditions while the learning assessed in achievement tests is experienced under partially known and controlled conditions.

The second major difference (Anastasi and Urbina, 1997) relates to the respective uses of aptitude and achievement tests. The former serve to predict subsequent performance, while the latter measure the extent of previous specified learning. Aptitude tests are employed to estimate the quality of subsequent performance in a new situation or the extent to which an individual will benefit from a particular future programme.

However, the authors go on to argue that the difference between achievement tests and aptitude tests is hard to maintain at a practical level, as they frequently overlap in terms of content and purpose. Accordingly, the authors point out that 'the neutral term 'ability' is being substituted more and more to designate measures of cognitive behaviour'. This discussion will use the more prevalent term 'ability' to refer to UMAT, but the underlying distinction between achievement and aptitude testing remains relevant.

The following information is given to applicants who sit the UMAT:

General: UMAT is designed to assess general attributes and skills gained through prior experience and learning; specifically, the acquisition of skills in critical thinking and problem solving, interactions with others, and abstract non-verbal reasoning. These non-academic personal skills are considered important to the study and later practice of professions in the health sciences.

UMAT is an aptitude test. It is not curriculum based and presupposes no particular subjects of study at secondary level. It does not require any knowledge or skills in mathematics or sciences, or in any other area of the curriculum. It is designed to complement your academic results not to replicate them. It is not a personality or IQ test. (ACER, 2006)

Section 1 – Logical reasoning and Problem Solving: Materials in this Section are drawn from a wide variety of general sources and are based on a brief text or piece of information presented graphically.

Questions assess your ability to comprehend, draw logical conclusions, reach solutions by identifying relevant facts, evaluate information, pinpoint additional or missing information, and generate and test plausible hypotheses. (ACER, 2006).

A recent literature review of the general constructs underlying logical reasoning and problem solving, undertaken for the UMAT Consortium, (Mercer and Chiavaroli, 2006) can be summarised by the following major points:

- The two areas of logical reasoning and problem solving are closely related, with some form of reasoning being required in most problem solving. In addition, the relationship between reasoning ability and verbal ability is complex. Language 'load' must be carefully considered in the measurement of reasoning and problem solving.

- The two main types of reasoning are *deductive*, which is based on logic, and *inductive*, which is based on observable happenings. The three main types of problem solving are inducing structure, transformation and rearrangement of elements.
- Memory plays an important part in problem solving. In some cases, long term memory is required with an associated use of language skills, and in other cases short term memory will be required, in which language skills may or may not play a part.
- A view widely held in the literature is that problem solving skills are essential for today's graduates in all disciplines, not the least being in professional occupations.

Section 2 – Understanding People (formerly Interaction Skills): *Section 2 assesses the ability to understand and think about people. Questions are based on short dialogues, passages or scenarios. There are two types of question. One type will ask candidates to identify the best or most appropriate response for a given situation, while the other type will ask you to identify the option which best describes or explains a person's behaviour, thoughts or feelings.* (ACER, 2006)

UMAT Section 2 was originally intended to provide an assessment of candidates' 'empathy'. However, it has had the title 'Interaction Skills' for most of its lifetime and is currently named 'Understanding people'. This Section has been developed according to a construct of empathy which is appropriate for high-stakes testing. It is based on a broad definition of empathy which operationalises the construct as a general, cognitive ability to understand and reason about people. This concept construes empathy as fundamentally cognitive i.e. requiring reasoning and understanding rather than feeling and communication; as a variable between people, based on a combination of factors including knowledge, experience, cognitive ability, and disposition; and as 'non-fakeable' and therefore appropriate in high-stakes contexts.

The following features from the literature underpin the UMAT Section 2 construct (Mercer and Chiavaroli, 2006):

- A conceptualisation of the construct as a cognitive ability rather than as a personality trait
- A concomitant conceptualisation that high interpersonal ability is a matter of reasoning rather than a matter of knowledge of conventions or principles

- A context-specific approach rather than a ‘universal’ or prescriptive approach, emphasis on interpersonal situations rather than intrapersonal
- A performance-based instrument rather than self-report

Section 3 – Non-verbal Reasoning: *Questions in this Section may be of several kinds. All are based on patterns or sequences of shapes and are designed to assess your ability to reason in the abstract and solve problems in non-verbal contexts* (ACER, 2006).

Section 3 was intended from the outset to be a non-verbal component. Following a number of reviews of this Section and under the circumstances of broad usage of UMAT by most of the undergraduate medical schools, items are consistent with the general concept of non-verbal reasoning. This has been the direction of item development over the last few years.

The literature review for the UMAT Consortium referred to above makes the following general points about this area (Mercer and Chiavaroli, 2006):

- Non-verbal reasoning tests are generally characterised as those which require recognition of similarities, analogies and patterns in unfamiliar designs. Unlike verbal reasoning tests, the items do not need learned knowledge for solution and item types are typically series completion, codes and analogies.
- Many writers define non-verbal reasoning as related to ‘fluid general intelligence’, which involves the ability to reason with novel material without drawing on learned knowledge.
- Non-verbal tests are usually used as an indication of a student’s ability to understand and assimilate novel information independently of language skills.
- Rowe (Rowe 1986) claims that the literature contains considerable evidence that many types of non-verbal tasks have validity for the selection of technical, scientific and artistic courses. She also notes that most selection processes give great weight to verbal abilities. Verbal communication, verbal knowledge, reading ability and other language-based skills provide most of the data on which selection is based. She argues that performance on most tests of intelligence or aptitude is inextricably linked to language performance, thus giving an advantage to non-verbal tests in that they can lead to a reduction in the bias which may be caused by language and

social and cultural variables. She believes that a complete assessment of ability requires the use of both verbal and non-verbal tests. It is obvious that facility with words and quantitative concepts, knowledge of vocabulary and the ability to reason with words have their place in such tests and in their use for selection. However there is a strong argument for assessment of ability which is not entirely dependent on language.

- Non-verbal intelligence refers to those particular abilities which exist independently of language and that increase a person's capacity to function intelligently. Nonverbal abilities can be separated into higher order skills, such as problem solving, reasoning and abstract thinking, and lower order skills such as interpreting, organising and manipulating the concrete properties of stimuli (colour, size, shape etc).
- Three particular higher level non-verbal intellectual abilities are analogical reasoning, categorical classification and sequential reasoning. These abilities have been shown to be associated with academic success, professional competence and everyday living.

Use of UMAT scores by UWA

There are two stages in the use of UMAT scores in the final selection of medical students. The first is in the selection of applicants for interview and the second is in the final ranking of the applicants with all three component scores (TER, UMAT score and interview score). For school-leavers, in addition to the total UMAT score, their predicted academic score which becomes available in early November, is used in conjunction with the UMAT score to determine who will be offered an interview in December. Applicants' predicted academic scores are calculated from their school-based results. Schools send these results to the Curriculum Council in early November. The schools also provide these results to the Faculty of Medicine and Dentistry for applicants to its courses.

The use of thresholds on all three Section scores has not so far been included in the UWA selection process. This practice is undertaken by some faculties which use UMAT in their selection process. Similarly a threshold on the total score has not formally been used at UWA. The UMAT total score threshold at UWA is a de-facto threshold which is determined by the number of interviews which are available in a particular year. All user faculties use an aggregated score of the three sections. With the exception of the University of Melbourne which weights Section 1 double the other two sections, all faculties use the

same total score as UWA, in which the three sections are equally weighted.

Staff at the Australian Council for Educational Research who develop and administer the test believe that the three section scores should not be added because the total score has no real meaning as a construct and because of the loss of information inherent in producing an aggregated score. Correlations between the three section scores are usually low. From the point of view of the user faculties, a high total score indicates that a candidate has achieved highly in at least two of the three sections. This means that the profiles of the high scorers in relation to the aptitudes being tested will vary. Thus there is no specific defining characteristic(s) of an applicant with a high UMAT total score, bearing in mind the achievement of a TER threshold score, except that all these sections assess reasoning skills.

Other selection tests used for Medicine

The use of selection tests which include some sections of aptitude testing is becoming widespread in the US and the UK and other English-speaking countries. The other familiar example of such a test is the Graduate Australian Medical Schools Admissions Test (GAMSAT) which is used to select students for the UWA graduate programme and all other graduate medical programmes in Australia. The GAMSAT is also developed and administered by the Australian Council for Educational Research.

The GAMSAT consists of three sections:

- Reasoning in Humanities and Social Sciences
- Written Communication
- Reasoning in Biological and Physical Sciences

A version of the GAMSAT is used by some universities in the UK. The Australian Council for Educational Research prepares a separate test for these universities.

Following are brief descriptions of the other prominent tests currently available. The Medical College Admission Test (MCAT) has been in use for many years in the US. The Medical School Admission Test (MSAT) and the BioMedical Admission Test (BMAT) are used in the UK and the UK Clinical Aptitude Test (UKCAT) was developed for use in the UK for the first time for 2007. Most of the information

provided here is taken from websites. A list of the relevant websites is provided after the References.

Medical College Admissions Test

Developed for the Association for American Medical Colleges

The medical program in America is a graduate program and the Medical College Admissions Test (MCAT) is more like the Australian GAMSAT in nature. The Medical College Admissions Test is a standardized, multiple-choice examination designed to assess problem solving, critical thinking, and writing skills in addition to the examinee's knowledge of science concepts and principles prerequisite to the study of Medicine.

Scores are reported in each of the following areas: Verbal Reasoning, Physical Sciences, Writing Sample, and Biological Sciences. Medical college admission committees routinely consider Medical College Admissions Test scores as part of their admission decision process.

Medical School Admissions Test

Developed by Australian Council of Education Research

The Medical School Admissions Test (MSAT) is used in the selection of medical students at King's College London, Queen Mary's University of London and the University of Warwick.

MSAT consists of three discrete components and is designed to complement academic achievement as evidenced by A-Level or undergraduate degree grades and provides measures of general and personal skills and abilities not directly assessed in academic examinations. These components are in multiple-choice format. It also provides an assessment of written communication in the form of two essay tasks. Because the test does not draw on curriculum knowledge it is applicable to candidates across a range of ages and from a range of backgrounds, thus catering for students seeking admission to both undergraduate and graduate-entry programmes. Unlike GAMSAT, this test does not assess reasoning in basic sciences or the interpretation of complex verbal materials. It has a strong focus on general skills and personal attributes. It is designed to offer an alternative to GAMSAT for medical schools that do not wish to measure ability in the general sciences directly. The three sections of MSAT are Critical reasoning,

Interpersonal Understandings and Written Communication. The first two sections are similar in nature to Sections 1 and 2 of UMAT, while the third section involves two extended written tasks.

BioMedical Admissions Test

Developed by Cambridge Assessment

The BioMedical Admissions Test (BMAT) is a subject-specific admissions test taken by applicants to Medicine, Veterinary Medicine and related courses.

The BMAT is owned and administered by Cambridge Assessment (previously UCLES), which is responsible for producing and marking the test, and also facilitates an extensive worldwide centre network at which candidates can sit the BMAT. It assesses the following three sections:

- Section 1: Aptitude and Skills (multiple choice or short answer questions)
- Section 2: Scientific Knowledge and Applications (multiple choice or short answer questions)
- Section 3: Writing Task (1 from a choice of 3 short essay questions)

UK Clinical Aptitude Test

Developed by the UKCAT Consortium of Universities with Pearson VUE

From summer 2006, candidates applying to the Dental and Medical Schools of 24 UK universities, for entry in 2007, are required to take the UK Clinical Aptitude Test (UKCAT).

The UKCAT assesses a wide range of general skills and attributes rather than strictly academic achievement. Assessment is divided into four sections:

- Verbal Reasoning
- Quantitative Reasoning
- Abstract Reasoning
- Decision Analysis

The selection interview at UWA

The purpose of the selection interview is to assess personal qualities which are not measured by academic scores or aptitude tests, but which

are not personality traits. Examples of such qualities are communication skills and motivation to study medicine. These qualities are two of the criteria routinely assessed in the UWA selection interview. The other criteria vary from year to year and include such qualities as the ability to work with others, the ability to see things from the perspective of others and the ability to recognise and respond to diversity in society.

The interview which has been developed for the new selection process at UWA is a structured interview. The reasons for choosing a structured format were based on principles of good assessment, equity and fairness. It was agreed by the initial committee which developed the interview that given the large number of interviewers who would be involved, and their varied backgrounds, it would be prudent to ensure that all candidates were asked the same questions, in the same way, under the same conditions, were scored by the same protocols and therefore to whatever extent possible, were given the same opportunities to respond and to score. Experience in the first round of interviews in 1998, supported this view. This approach has been reinforced in subsequent years and the highly structured nature of the interview has become a feature of the UWA selection process.

The committee consisted of representatives from a wide range of backgrounds. The following groups were represented on the initial committee: the university's Equity Office, the Centre for Staff Development, the Institutional Research Unit, the Australian Medical Association, the Australian Dental Association, Faculty teaching staff in Medicine and Dentistry, health professionals from the hospital system, community members and members of the Faculty office. Over the years the composition of the membership has changed. A member of the community interviewing group has recently been on the working party and the UWA Equity office has always been represented.

Interviewers are recruited from within the university and the wider community. Following an initial campaign which targeted university staff, community organisations and health professional groups, most new interviewers are now recruited by word of mouth. There is a core group which has remained over the years. Some people come and go according to their workloads and to their family situations. For example, anyone with a close personal friend or family member applying that year does not qualify. One of the objectives has been to have access to a group of people with diverse backgrounds. One of the major limitations has been the proportion of males to females, with usually a lower than ideal representation of males in the cohort.

Two training sessions are provided initially and a retraining session is required each year. The following principles and practice were set up for the structure and process of the interview:

- Each interview panel would consist of two members, one a member of the Faculty and the other a community member.
- Each interview panel would consist of a male and a female interviewer.
- An observer is sometimes present to provide a check on, but not to participate in, the conduct of an interview.
- At the interview only first names would be used, both for the interviewers and the interviewee.
- Interviewers were asked to keep the interview as informal as possible within the constraints of a structured interview.
- Seven criteria would be assessed in the interviews. The criterion Communication has no questions related to it. This criterion is rated based on responses to the other criteria.
- At the beginning of an interview if the interviewer was aware of knowing the interviewee they should not proceed with the interview and another panel would be assigned to interview the candidate.
- During the interview both interviewers would write notes detailing the candidate's responses. No evaluative comments would be recorded.
- All questions in the interview schedule must be asked of each candidate and each question must be asked as written. Questions can be repeated but not paraphrased and only standard prompts (as provided to the interviewers) could be used.
- Interviews were scheduled one hour apart. The panel should allocate 35 – 40 minutes to talking to the applicant and the remaining 20 – 25 minutes would be for individual assessments, discussion and reaching consensus and completion of the relevant paper work.
- The same information must be given to each candidate both before and after the interview – this information is detailed in the interviewers' manual.
- Interviewees would be given the names of the criteria being assessed. These may vary from one year to the next.
- Interviewers would alternate in asking the set of questions for the seven criteria and in conducting the introductory and closing remarks.

- Interviewers conduct their own individual ratings then undertake consensus ratings which provide the final scores for a candidate.
- Interviewers sign their own individual ratings and the consensus ratings for each interview.
- Feedback would be routinely sought from both the interviewers and the candidates in the form of questionnaires, which include provision for open-ended comments from each group.
- A debriefing session with interviewers and the Interview Committee would provide an opportunity for a two-way exchange of information. This session to be held early in each year following the completion of the selection process.

Based on the experience and the feedback received each year by the Interview Committee and on the results of statistical analysis undertaken by the author, the process has been modified slightly each year. The basic process remains the same, however small adjustments have been made to streamline the organisation of the interview sessions or to modify the conduct of the interview.

In 2000 (for the 2001 intake) a threshold value was set for the interview score. This threshold value is reviewed each year in the light of the statistical qualities of the set of scores, resulting in approximately 10 – 15% of interviewees being eliminated from the ranking process by failing to meet this threshold. Scoring methods have been adapted over the years, but essentially each criterion has the same weight in the total score. Each year questions are asked on six criteria and the criterion of *Communication skills* is rated based on responses to the other six criteria.

The method of scoring has changed since 2004, at which time interviewers were asked to identify characteristics evident in applicants' responses rather than to assign numerical scores. This process is known as the Levels of Achievement method and numerical scores are assigned by faculty staff following the identification of specified characteristics by the interviewers. Such characteristics are listed for the interviewers and they are required to tick those that they can identify in a candidate's response. This system was locally constructed and has no other precedent.

The questions are revised each year by the Interview Committee. It is considered by the committee to be important not to use questions worded identically in adjacent years. In addition, in most years a new criterion is developed and new stimulus materials are used where a criterion is repeated from one year to the next. The interview process is

now quite streamlined and all aspects of the process are operationalised under strict guidelines. The process has been tested by appeal and found to be robust. This robustness appears to be related to the structure of the process and the level of written documentation on each interview. Much of the focus has been on issues such as equity and fairness for the interviewees. In order to provide an equitable situation, interviewees are provided with as much information as possible on the process of the interview and are given guidelines on maximising their performance on the day. This development has been in response to coaching clinics and a perception that students from independent schools are given more support from their institutions than students from the government sector. Applicants are also required to sign a confidentiality agreement on the interview content before commencing the interview and are warned of the pitfalls involved in releasing information to other applicants with whom they are in competition. Interviewers also undertake in writing to keep the content of the interview confidential.

Other medical schools use semi-structured interviews. UWA has developed and is committed to a structured interview. There are arguments for and against each interview style. The large number of interviewers involved each year, the varying skills and backgrounds of the interviewers and issues of equity and fairness are the major reasons for retaining the structured style adopted and developed by the initial Interview Committee. Each year a full report is produced on the conduct of the interviews and the statistical qualities of the set of scores. Outcomes from the report are used to inform the subsequent round of interviews.

Part 3 – Ranking applicants at UWA

At the conclusion of a round of interviews and when the TER scores become available in late December, the final pool of candidates consists of those who have passed the threshold on each of the three components. The UMAT cut-off score is a de-facto threshold which is determined by the number of interviews conducted; the interview threshold eliminates the lowest-scoring 10 – 15% of interviewees; and the TER threshold is 96. As a general rule, this pool of candidates consists of approximately 2 to 2.5 times the number of candidates to be selected.

The three components: UMAT total score, interview score and TER are quite different in their range and distribution. Consequently, it was deemed to be appropriate to standardise the scores to the same mean

and standard deviation for the group to ensure that each component makes the same contribution to the final combined score. The students were then ranked in descending order of this final score.

This compensatory system allows for a spread of scores in each component in the final group of students who actually enrol. The result of this should be an intake of students with a variety of characteristics. However, with a minimum TER of 96.00 required before an applicant can be ranked for selection, all students who are offered a place are expected to have the academic ability to pass the course. Nevertheless, average subject scores for these students are in the range 75% to 100%, so there is still a noticeable variation amongst the cohort.

Overview

Within Australian undergraduate medical schools the methods of student selection vary, with no two medical schools having an identical process. The common elements are the TER, the UMAT scores and scores from a selection interview. The selection interview is obviously important in this process, given that it is the determining element in the successive threshold method. Furthermore, one university which uses the weighted components method, gives greater weight to the interview score than to the other two components, given the relevant threshold scores. The unique nature of each institution's interview protocols and criteria is a reflection of the particular qualities which are held to be important by that medical school. The decision to conduct a structured or a semi-structured interview, the nature of the training involved for the interviewers and the rating scales developed for the criteria all reflect policies and values held by that particular faculty.

UWA's structured interview format has been criticised for being 'stilted' and overly formal. However, the style of interview and the criteria developed over the years demonstrate the commitment of the faculty to a process which is set up to be as reliable as possible for this type of selection interview. Issues of equity and fairness to the candidates have been foremost in the considerations which have gone into setting up such a process. Other faculties have their own rationale for their style of interview, which fit with the values they espouse. Reliability of the outcomes of the interview is of considerable interest to all faculties, given the focal role that the interview plays in the selection process of seven of the nine undergraduate medical schools. In each case, the interview is a 'local' instrument, whereas the UMAT is a national

test and the TER is defined nationally and assessed on a statewide basis. Measures taken to assess the reliability of the UWA interview process will be discussed in Chapter 7 of this study.

It is clear that aptitude testing, of the type undertaken in the UMAT, is now an international phenomenon with the proliferation of similar tests in the UK, the US, New Zealand and Canada. The common thread with these tests is the assessment of different forms of reasoning ability, in particular logical reasoning and problem solving of the type measured in UMAT Section 1. UWA uses a predicted academic score, in conjunction with the UMAT score, to select candidates for interview. At least one other university, the University of New South Wales, also uses a predicted academic score to assist in selection for interview.

TER thresholds range from 90 to 96. The threshold at UWA and the University of Melbourne is 96, representing the highest level of previous academic achievement (an average of at least 75% in secondary subject scores) across all the undergraduate medical schools. However, as has been demonstrated in a previous chapter, the use of TER alone also has negative aspects. At least some of these have been overcome by the introduction of criteria other than academic achievement in the selection of medical students.

Non-Australian Universities

A comprehensive description of the selection processes of Non-Australian universities into medical courses is beyond the scope of this study and has been dealt with by attempting to present some common themes, particularly in the literature review, and some brief case studies of universities in the countries which form the context of this study, namely the UK, the US, New Zealand and Canada. Appendix A contains a brief description of the selection processes used in the medical schools in the universities of Cambridge (UK), McMaster (Canada), Manchester (UK), Otago (NZ), Harvard (USA) and Auckland (NZ), and some general comments about them.

Chapter 5

Methodology: A Case Study

The main aim of this study was to evaluate the new processes which have developed in the last ten years in Australia for selecting school-leaver applicants into undergraduate medical courses. In considering the new selection processes and their outcomes in the Australian context, the particular process used at UWA is presented as a case study. This case study develops in detail the issues which precipitated change at UWA, the response of the university to these issues and the methods which were employed to implement change. By a mixed methods approach this study explores the views of the main groups of stakeholders to the changes and examines issues of reliability and validity in the processes developed to operationalise the changes. The particular outcomes observed at UWA following these changes have been investigated in the context of national and international trends in medical selection. The relevant methods employed in the study, both qualitative and quantitative, allow for both breadth and depth in the consideration of the issues pertinent at UWA.

The choice of a case study as the research methodology was justified by the literature, which identifies this method as ideal when a holistic, in-depth investigation is appropriate (Feagin, Orum and Sjoberg, 1991). Such studies are designed to bring out the details from the viewpoint of the participants by using multiple sources of data (Stake, 1995). Yin (1994) verifies the validity of the process of triangulation in which multiple sources of data are used to establish meaning. He identifies a number of sources of evidence for use in case studies and comments that no single source has a complete advantage over others. Rather a case study should use as many sources as are relevant to the study. Yin suggests that a case study is a legitimate research strategy, which empirically investigates a phenomenon within its real-life context. He also notes that case studies can be based on any mix of quantitative and qualitative evidence. These principles have been followed in undertaking this study.

The case study was carried out in three main stages with the following content: firstly, a consideration of the major changes in society, the medical profession, medical education and contextual factors which have led to the introduction of new selection processes in medical

schools internationally, in Australia and specifically in Western Australia; secondly, the actual processes which have been introduced and an investigation of the components of selection and their application at UWA; and thirdly, an analysis of the process and its outcomes at UWA and in Australia and the implications of such developments for the future. Table 5.1 shows the research design indicating the methods of data collection which were used to address the three stages of the study. This logical development explains the order in which the chapters in this thesis have been presented.

Material pertinent to the first of these stages, namely, background to changes in medical selection processes and the reasons for introducing a new process at UWA, was discussed in Chapter 1. A preliminary survey of methods used and the factors surrounding them in the USA, UK, Canada and New Zealand was made and the results of this survey have been reported in Chapter 2 as part of the literature review. The contextual factors surrounding the selection process at UWA were examined in considerable detail and were reported in Chapter 3. Interviews with staff from other universities showed that these factors were also relevant to their medical schools. However they were presented in relation to the Western Australian context, so that local statistics could be reported to reinforce and validate the reasons for presenting these particular factors.

In Chapter 4 the second stage of the study was reported. This involved the practices undertaken in the other eight Australian public undergraduate medical schools with respect to selection of school-leaver applicants, which were summarised according to the major categories used to rank the applicants using the three components of selection (TER, UMAT score and interview score). The three components were examined and described in some detail, the TER and UMAT being the two components which are common to all the processes in Australia and the interview being a local instrument which applies only to UWA. In the third stage, the results of the data collection were reported. This included a study of various forms of reliability which was undertaken in order to provide evidence of the credentials of the UWA interview as a selection instrument; an investigation of the predictive validity of the three components undertaken within the UWA context; and the opinions of stakeholders on the new process and its outcomes.

Table 5.1: Research Design

Purpose	Methods of data collection
STAGE 1	
To understand the background to changes in the selection process at UWA.	<ul style="list-style-type: none"> • Document review • UWA website • Interviews with senior UWA academics involved in implementing the changes
To develop an understanding of the changes in society and in the medical profession which have led to changes in methods of selecting medical students.	<ul style="list-style-type: none"> • Literature search • Interviews with university academics and staff in teaching hospitals in WA
To develop an understanding of new medical curricula and styles of learning which have been implemented in parallel with changes in selection processes.	<ul style="list-style-type: none"> • Interviews with UWA academic staff • Interviews with academics in other Australian medical schools
To investigate the contextual factors surrounding the selection of students at UWA.	<ul style="list-style-type: none"> • Reports from the Institutional Research Unit at UWA
STAGE 2	
To investigate the details of the processes used and their outcomes in other Australian undergraduate medical schools.	<ul style="list-style-type: none"> • Interviews with academic and administrative staff in other Australian medical schools. • Literature search • Review of specific university websites
To consider the components of selection used in Australia in detail.	<ul style="list-style-type: none"> • Document review and personal records • Personal experience
To document the changes to the selection process and the statistical outcomes of the new process at UWA.	<ul style="list-style-type: none"> • Personal experience and personal records • Faculty document review
STAGE 3	
To investigate the opinions of stakeholders in the UWA selection of medical students with respect to the new process and its outcomes.	<ul style="list-style-type: none"> • Interviews with secondary school staff • Interviews with UWA academics and administrative staff • Interviews with senior staff in the major WA teaching hospitals
To investigate the predictive validity of the components of selection with respect to the results of the first four cohorts of medical students under the new process.	<ul style="list-style-type: none"> • Predictive validity study
To investigate the inter-rater reliability and the internal consistency of the ratings generated in the selection interviews.	<ul style="list-style-type: none"> • Inter-rater reliability and internal consistency study of the UWA interview ratings data
To undertake an initial study of the attrition rate of students selected by the new process.	<ul style="list-style-type: none"> • Study of the attrition rate in the first cohort (entry in 1999).
To consider the implications for the future of changes in selection processes and curricula in the medical schools.	<ul style="list-style-type: none"> • Literature search • Interviews with academics at UWA and other universities

In order to undertake the evaluation of new selection processes, both qualitative and quantitative methods of data collection were used. The nature of the scores which represent the three components of selection and the ranking process at UWA, which uses statistical processes, made it appropriate to use quantitative methods, such as regression analysis and the calculation of reliability indices. Furthermore, the views of the various groups of stakeholders in the selection of medical students were an important part of the evaluation. Hence the use of personal interviews with representatives of the groups of stakeholders, which yielded qualitative data requiring appropriate methods of data analysis (see below).

The use of questionnaires for the groups of stakeholders was considered, but semi-structured interviews were favoured due to the complexity and broadness of the process and the contextual factors, thus allowing the opportunity for respondents to raise issues which had not previously been raised. The views of students were not sought due to their limited knowledge and understanding of the new selection process. Furthermore they were not in a position to compare the old and the new processes or old and new curricula, as each cohort experiences only one selection process and one form of the curriculum. Table 5.2 summarises information about the interviews with stakeholders. A process of purposive sampling was undertaken to identify those staff members most likely to have views on the process and outcomes of the new selection process, given their administrative role in the university or their teaching role in the faculty.

Details of the data collection methods follow under the two main categories of qualitative methods and quantitative methods. The results of the data collection are presented in Chapters 6 and 7. Chapter 8 summarises the outcomes of the study and considers implications for the future in the complex area of the selection of medical students.

Table 5.2: Summary of interviews with stakeholders

Category	Description of respondents
Academic staff at UWA	<ul style="list-style-type: none"> • Four senior university academics • Six Year-level coordinators in the medical course • Thirteen academics who teach in the medical course
Administrative staff at UWA	<ul style="list-style-type: none"> • Two faculty staff members • Five university staff members
Secondary school staff	<ul style="list-style-type: none"> • One principal • Four deputy principals • A Year 12 coordinator • A careers counsellor
Staff from other universities	<ul style="list-style-type: none"> • Eight senior academics • Two faculty administrative staff
Staff from WA teaching hospitals	<ul style="list-style-type: none"> • Three medical directors • Three directors of post-graduate medical education

Qualitative methods

Introduction

The qualitative methods used were a literature review; a document review within UWA; an internet search; interviews with academic and administrative staff at UWA; interviews with secondary school personnel in Perth; interviews with academic and administrative staff from other Australian medical schools; and interviews with senior staff from the major teaching hospitals in Perth. The details of the implementation of the qualitative methods follow. These data form part of the data collected as part of the review of the selection process at UWA as described previously in this thesis and were collected under the auspices of the faculty and with the relevant ethical protocols prescribed by the faculty and the university, under the direction of the Review Working Party.

Methods

I. Literature review

A University of Western Australia library catalogue search, a web search (via Google) and a search of five databases (Medline OVID citations, PubMed, Web of Science, PsycINFO, ERIC) was conducted to

gather the initial relevant literature with respect to the selection of medical students; the characteristics of good doctors; equity issues in selection; and the use of aptitude testing and interviews in the selection process. Searches were mainly confined to publications from the last ten years and to those published in English. The reference list of appropriate articles was also used to find other relevant articles. The journals *Medical Education*, *British Medical Journal* and *Academic Medicine* were found to be the most productive and these journals were checked electronically on a regular basis for further relevant articles.

II. Document review

Documents held within UWA, particularly those from the period 1997 – 2000, were reviewed for material relevant to the introduction of the new selection process in the (then) Faculty of Medicine and Dentistry. Minutes of meetings of the University Senate were located on the UWA website. Minutes of meetings of the Faculty Selection Committee and the Interview Committee were found in records in the faculty office, in hard copy. A number of reports written specifically as background material for these committees were included in this collection of documents. In 1997/8 the Institutional Research Unit at UWA was commissioned by the Faculty of Medicine and Dentistry to undertake various studies and to provide written reports to faculty committees and to the University Senate. These reports were included in the document review and information from these reports has been included in some of the background material. These reports were written by the author in her capacity as the Director of the Institutional Research Unit at that time.

III. Internet search

The selection processes of some universities overseas and the nature of some of the selection tests used in the UK, the USA and Canada were found by accessing the website of the particular institutions. Some issues were researched specifically on the internet to provide current information, by either the use of Google or by accessing specific university websites. Brief case studies of medical student selection processes were compiled from Cambridge University and the University of Manchester in the UK; Harvard Medical School in the USA; McMaster University in Canada; and the Universities of Auckland and Otago in New Zealand by accessing the relevant university websites. A list of these websites can be found following the Reference list.

IV. Interviews with UWA staff

A list was compiled of UWA staff in the following categories:

- Senior university academic administrative staff with some interest in or contact with the university's policies and processes related to the admission of students.
- University administrative staff involved in the admissions process or in contact with medical students through Student Services.
- Members of the university Equity Office.
- Faculty administrative staff involved in admissions.
- Senior faculty academic staff with an administrative role as well as teaching commitments.
- Teachers of first year medical students.
- Year-level coordinators of the academic programme for Years 1 to 6 of the medical course.

These staff were approached either by email or by telephone and asked to participate in the interview process. Appointments were made for an hour-long session. In most cases the interviews were conducted in the office of the staff member involved and in most cases interviews were conducted individually. Staff members were only interviewed in pairs at their own request and when their roles and interests with respect to the selection of medical students were very similar. Almost all staff members who were approached agreed to participate in the interviews. Those who declined usually did so due to lack of availability rather than lack of interest in the topic. The interviews were not audiotaped, with notes being taken during the interview. All staff members were assured of the confidentiality of their responses and that reporting would be as a member of a group. Focus groups were not possible due to the difficulty of finding a time common to the various participants. It was also felt that people would feel happier to express their opinions freely when interviewed individually and this proved to be the case.

Each session started with a brief overview of the selection process, then participants were asked to comment on any aspect of the process itself or the outcomes of the process. In particular, the following aspects were listed as prompts for discussion: the selection interview, the UMAT, the academic abilities of the students, equity issues in student selection, the communication skills of the students, the ability of the students to work together in groups and their interpersonal skills. The

issue of the new medical curriculum was also raised and interviewees were asked to comment, if they wished, on the effects of the new curriculum. Apart from the preamble described above, the interviews were relatively unstructured, with participants free to pursue issues of their own interest after the introduction. Some people had a specific issue which was relevant to them while others had a more general view of the issues and were able to comment more widely. Occasional prompts or follow-up questions were used, but most participants had perspectives and opinions which they expressed freely.

Following the completion of all interviews, the interview notes were divided into two main groups: staff members whose main interest was in teaching medical students and those who were involved in administrative or policy issues. The two groups of interviews were then analysed separately. Analysis was undertaken initially by identifying the main themes which emerged from the interviews. The main themes which emerged from discussions with the teachers were the curriculum; students' communication skills; students' academic ability; students' ability to work together; students with disabilities; the selection interview; the UMAT; equity issues and cultural issues. The main themes which emerged from discussion with administrators/policy makers were the objectives of selection; the process of selection; equity issues; the selection interview; and the nature of the medical profession.

When the main themes had been identified for each group, comprehensive notes were made on that theme from the interview notes and reporting was done under the headings identified above. In the case where a number of interviewees made similar points, some indication was given in the text that this view was held by several people. In the case where only one person made a particular point, it was reported in this way.

As part of the review of the selection process in the faculty, which was conducted by the author under the direction of a Review Working Party, the reports of these interviews were read by members of the working party and also by members of the Faculty Selection Committee. Most of the people in these two groups had been interviewed as stakeholders and they had an opportunity to comment on the reliability of the reports at this stage. Small adjustments were made to the reports based on their comments.

V. Interviews with secondary school personnel

One of the criteria listed for making changes to the new selection process was the pressure put on the schools under the previous system in which students intending to apply for medicine needed to achieve very high scores in their final year at school, both in the school-based assessments and in the TEE. In order to address this criterion and to examine the effects of the new selection process in relation to this pressure, six schools were selected and an interview was arranged with the principal or deputy principal, the careers advisor or the Year 12 coordinator.

Initially it was necessary to identify schools where the staff would be aware of the issues relevant to the selection of medical students both under the old and the new selection processes. The six schools selected were those with consistently high numbers of applicants and entrants to medicine under both the previous and the new selection processes. For most rural schools and many metropolitan secondary schools, the selection of one of their Year 12 students into the medical course is a rare event. The six schools selected were identified from a report prepared by the author whilst working at the Institutional Research Unit at UWA. Two of these schools were from the government sector, one from the Catholic Education sector and three from the independent sector. Three were co-educational schools, one was an all-boys school and two were all-girls schools. All six schools were situated in relatively high socio-economic metropolitan suburbs. The initial contact was made by telephone and the relevant person was identified for interview.

The preamble to the interview was a brief overview of the selection process and the identification of 'pressure on schools' as a pertinent issue. Interviewees were asked to comment on this issue and any other issue which they believed was relevant to the selection process and its outcomes, both in relation to individual students and to the schools. The interview was relatively unstructured, and notes were taken during the interview. The issues which emerged from the discussions were the pressure on schools of tertiary entrance requirements, private tutoring of secondary students, the UMAT, the selection interview, pre-requisite subjects and differences in the characteristics of the students selected under the new process compared with those selected by the old method. A thematic analysis of the data was undertaken in a similar way to the interviews with UWA staff and reporting was under the topics listed above.

VI. Interviews with academic and administrative staff from other universities

Academic and administrative staff from some of the other Australian universities with undergraduate medical schools were approached and asked to participate in interviews to describe their selection process and to comment on the perceived outcomes of the new selection process. Staff members from the universities of Monash, New South Wales, Melbourne, Adelaide and Newcastle were involved in face-to-face interviews. A member of the staff of Notre Dame University in Perth was also interviewed but this interview focused on selection interviews rather than on selection processes and their outcomes, as this medical school is solely graduate entry and the entry requirements are different from the undergraduate schools. Information about the other universities was found from their websites (see list of websites following the Reference list). During the interview staff members were asked questions about the nature of their interview (except Melbourne University), their method of ranking the applicants and staff perceptions of the students selected by the new process. Following the interviews with personnel from the Universities of New South Wales and Monash, the two institutions with selection processes most like those at UWA, the reports of the interviews were returned to them for verification. The reports on the individual Australian universities were given in considerably more detail in the review report than in this study, where only overviews are reported. The themes which emerged from the interviews were the new curriculum, academic levels of students, personal characteristics of the groups of students and the selection interview. The results are reported under these headings.

VII. Interviews with senior staff from the major teaching hospitals

The head of postgraduate medical education and the medical director at each of the major teaching hospitals in Western Australia, i.e. Royal Perth Hospital, Sir Charles Gairdner Hospital and Fremantle Hospital, were contacted and asked to participate in an interview to discuss the first cohort of graduates from the UWA medical school who had been selected for entry in 1999. A high proportion of this cohort had graduated in 2004 and at the time of interviewing they were close to completing their intern year at one of these three hospitals.

At two of the hospitals involved, the two staff members elected to be interviewed together and at the third they were interviewed separately.

The preamble to the interview was a brief description of the main steps in the selection process and a request for comments on any aspects of the selection process and its outcomes. In particular, the focus of the interviews was to be the characteristics of the latest group of graduates, with respect to qualities such as their communication skills, their ability to work in a team, their motivation to be doctors, their clinical reasoning skills and their academic capacity. It was also noted that the new curriculum was introduced soon after the new selection process and that the two are interdependent. Several of the hospital personnel had served as interviewers on the selection interview panels so they were familiar with the selection interview process.

The following themes emerged from the discussions: the new selection process, personal characteristics of the interns, generational factors, workplace factors and workforce issues. The results of the interviews were analysed and reported under these headings.

Quantitative methods

Three specific studies were undertaken as part of this study. In addition, reports and tables summarising student information were commissioned from the Institutional Research Unit.

The first specific study was the predictive validity study which investigated the relationship between scores on the three entry components and subsequent outcomes in the medical course. This study determined predictive validity in the course results data available at the time, of the three components which are used to select students under the new selection process.

The second quantitative study was the interview reliability study. This was set up to investigate various forms of reliability related to the structured interview used in the UWA medical selection process. Thirdly, a small study was also undertaken to evaluate the attrition rate in the first cohort selected by the new selection process. The methods employed in the quantitative data collection are now described in detail.

Commissioned reports and student information from the Institutional Research Unit at UWA

The Institutional Research Unit provided data on various aspects of student information. A number of these aspects have been discussed and

reported in the chapter on contextual factors. One such aspect was the preferences of secondary students applying for entry to universities in WA. During discussions with personnel from the Institutional Research Unit it was decided to restrict this to the three-year period for entry from 2003 to 2005. This data set was complete at the time of asking and was sufficiently recent to indicate current trends in student preference data. The same time period was used to report on the trends in the representation of the different schools sectors in WA tertiary student cohorts. The Institutional Research Unit also provided information leading to the construction of tables showing the representation of the three school sectors in medical student cohorts for the five years before and after the introduction of the new selection process, which also appears in Chapter 3. These tables were constructed by me based on information provided by the Institutional Research Unit.

Predictive Validity Study

As described in Chapter 1, in 1998 the Faculty of Medicine and Dentistry introduced admission to its medical course through a ranking mechanism that utilised in equal weight a combination of the Tertiary Entrance Rank (TER), the total UMAT score and the total score from a structured interview. In order to determine the effects of the various components of the ranking mechanism on course outcomes a predictive validity study was conducted using entry data and course results for the first four cohorts selected by this process. The four cohorts were combined and treated as one group in the analysis, with all the results available up to that point for the individual students in the four entry cohorts. The analyses reported here are a small part of the analyses undertaken for the review of the selection process commissioned by the faculty in 2005.

It will be recalled that the UMAT score represented the composite of scores from three separate domains which assessed Logical Reasoning & Problem Solving (UMAT1), Interaction Skills (now called Understanding People, UMAT2) and Non-verbal Reasoning (UMAT3). Even though the total UMAT score is used in the ranking process, the three component scores UMAT1, UMAT2 and UMAT3 were used in the regression analyses because of the different constructs underlying the three sections. The structured interview scored each of 6 questions together with a global score for communication skills.

The weighted average mark is a composite mark calculated from all the units completed by a student during the course (to whatever stage they had reached when the study was undertaken) which takes into account the result of each completed unit and its relative weight in the course. Secondary outcome variables included the average mark for the following units which were selected to assess the relative contribution to the weighted average mark of performance in units that delivered the curriculum in two different forms. The first form was delivered in didactic fashion in lectures and laboratory sessions and assessed predominantly factual knowledge. These were units such as:

- Normal Systems 100, 201 and 202 (comprising anatomy and physiology during 1st and 2nd year)
- Integrated Paraclinical Sciences 301, 302 and 401 (comprising pathology, pharmacology and microbiology during 3rd and 4th year).
- Foundations of Medical Chemistry
- Foundations of Cell Biology

The second form of units were those that delivered the curriculum through a combination of problem based learning tutorials, case based tutorials and clinical teaching and where assessment was either through a multidisciplinary observed structured clinical examination (OSCE) or a composite assessment of clinical performance. These were units such as:

- Clinical Skills 402, 502 and 602
- Science and Practice of Medicine 400, 500 and 600 (4th, 5th and 6th year),
- Medicine 430, 530 and 630 (4th, 5th and 6th year),
- Psychiatry 460 and 660 (4th and 6th year),
- Surgery 470 and 670 (4th and 6th year),
- Medicine Specialties 480 and 580 (4th and 5th year),
- General Practice 520 & Rural General Practice 620 (5th and 6th year).

The two broad groups of units described above will be referred to as knowledge-based and clinically-based respectively and the particular units listed are representative of units in these two categories. Foundations of Clinical Practice (FCP) 112, 212 and 312 (1st, 2nd and 3rd year) does not fit clearly into either of these categories and was considered to be knowledge-based for the purposes of this study.

Interview Reliability Study

It will be recalled that all students who had passed the relevant thresholds (TER and UMAT score) were required to undertake a structured interview. Each year approximately 500 applicants are interviewed in October or December for entry the following year. Of these approximately half of the interviewees are school-leavers who have applied for Medicine and are the subject of this study. Other interviewees have completed some tertiary study and are applying for Medicine and/or Dentistry. A further small group consists of school-leavers applying for Dentistry only. All applicants undertake the same interview under the same conditions and there are no significant differences between the performance of the different subgroups.

It will also be recalled that the interview consists of seven criteria. Six of the criteria are each assessed on a set of three questions with accompanying Levels of Achievement (rating scales), which are developed each year by the Interview Committee. The final criterion, *Communication*, is assessed as a global rating based on the responses to the other six criteria and with its own well defined rating scales. The criteria assessed in the 2005 round of interviews, for entry in 2006, were

- Commitment
- Ability to see from the perspective of others
- Emotional Intelligence
- Ability to work with others
- Diversity and health
- Social responsibility (*new criterion*)
- Communication

As described in Chapter 4, each interview panel consists of two people, a male and a female, a community interviewer and a member of the university staff. Interviewers initially undergo two training sessions to prepare them in both process and content aspects of the interview. Each year they are required to undergo a retraining session in the new interview protocols for that year.

When the formal part of the interview is complete the two interviewers rate the candidate individually on the seven criteria. They then discuss consensus ratings, which provide the final scores for the candidate. The whole process, from the time the candidate enters the room until the consensus ratings are complete, usually takes between 60 and 75 minutes. The interview reliability study was set up to test inter-

rater reliability, the reliability of each criterion and the internal consistency of the complete set of ratings data.

Methods

Three students (a male and two females) in their first year of study in Medicine at UWA were asked to undertake interviews, which were filmed at the Curtin University Media Unit in Perth, Western Australia. These filmed interviews were used in place of live interviews to allow simultaneous rating by a large group of interviewers. The students were selected to represent a range of different scores (high, average and low) on their own selection interview in 2004. The questions for the 2005 interview had been developed earlier in the year by the Interview Committee and were different from those used in the students' own selection interview. One new criterion, *Social responsibility*, had been introduced into the process for 2005. The three students signed a confidentiality agreement not to disclose any aspect of the new interview protocols. Each year all interviewers sign a confidentiality agreement which is relevant to the interview protocols for that year.

During the interviewer retraining sessions in September and November, the filmed interviews were shown to groups of interviewers and they were asked to rate them individually according to the new protocols and then to undertake consensus ratings in panels of two, which simulated conditions matching those in live interviews, namely a male and a female, a community and a university interviewer. As with the usual interviewing conditions, it was important that the interviewers did not have any previous knowledge of the interviewee. Data were collected on the three students on different days, with some interviewers being present on two separate days. The major part of the data collection for the Interview Reliability Study consisted of the individual and consensus ratings on the three students. A total of 72 interviewers took part in the study over the three days, with some interviewers rating more than one interview. The numbers of panels (two interviewers) which viewed and rated the three students were 17, 10 and 21 respectively, giving a total of 48 consensus scores and 96 individual scores across the three students.

In addition to the data specifically collected for the Interview Reliability Study as described above, the full data set from all students interviewed for places in 2005/06 was used in the calculation of an internal consistency index. This data consisted of the consensus scores

of the 509 interviewees for that year, which did not include the data from the three students who undertook the filmed interviews.

Statistical analysis

The data were analysed using the statistical package SPSS for Windows Version 14.0. Descriptive statistics were generated for the ratings, both individual and consensus, for each of the three filmed students.

The following reliability coefficients were calculated:

- Item – total correlations for each of the seven criteria, both in the individual and the consensus ratings, to check for the reliability of individual criteria.
- Intra-class correlations (ICC) using random effects for both student and rater. The model used was a two-way random effects model where both people effects and measures effects are random and the ICC used an absolute agreement definition. Indices were found for agreement between pairs and agreement between individuals.
- Cronbach's alpha was calculated to check on the internal consistency of the data generated by the 96 individual ratings and the 48 consensus ratings in the study. Cronbach's alpha was also calculated for the data generated by the 509 consensus scores of the actual interviewees in 2005/06.

Following the completion of the 509 interviews conducted in 2005/06, as described above, a Rasch analysis (Rasch, 1960, 1980), was undertaken on the full set of consensus scores for that year using the statistical package RUMM (Rasch Unidimensional Measurement Models) (Andrich, Sheridan and Luo, 2006). This data set consisted of the results of all applicants to the faculty for either Medicine or Dentistry for entry in 2006. The purpose of this analysis was to investigate the unidimensionality of the ratings data and to examine each criterion for fit to the model.

Initial study of the attrition rate

One of the reasons cited for the introduction of the new selection process was the high attrition rate amongst the medical students. This has been quoted as being in the vicinity of 16% over the duration of the

course. It is not known what methodology was used to derive this rate, however it is consistent with the rates reported by some other undergraduate medical schools with respect to their previous selection process and curriculum.

Figures provided by the Statistics Office in Planning Services at UWA show that over the period 1990 – 1995 (before the introduction of the new selection process), almost 85% of commencing students completed the medical course. This shows an attrition rate in this period of just over 15%. This calculation was not undertaken at an individual student level (see below) but was calculated on aggregated data of the number of students who started and completed the course in the relevant time period.

The only medical cohort which can be studied with any validity in this study is the 1999 cohort. It has become quite commonplace for a high percentage of students to take a year (or two years) out of their studies at some time during the course. So using the principle of successful completion of the course in minimum time does not apply to the same extent as it did previously when students were more likely to complete the course in six years. The 1999 cohort was due to finish their course at the end of 2004. However, approximately 25% of those who started in 1999 completed the course in 2005. In some cases this is because they failed a year and had to repeat, but in many cases it is because they chose to take a year off their studies to work or travel.

Some of the 1999 cohort was still enrolled at the time of the study and most of these will subsequently have finished in 2006. Some of these students have taken two years off during the course, others have repeated two years, while some have repeated one year and also taken one year off. The data were collected from the Student Records System at UWA, by considering individually each student who enrolled in 1999 and recording their progress throughout the course. These data were then aggregated for reporting.

Chapter 6

Results of qualitative analyses

In this chapter, the results of interviews with the groups described in Chapter 5 are presented. The results are presented in the order: secondary school personnel; UWA academic and administrative staff; senior staff from the teaching hospitals in WA; and staff from other Australian undergraduate medical schools. It will be recalled that it was considered outside the scope of this study to interview medical students.

Interviews with stakeholders

Secondary school personnel

The issues which emerged from the discussions with the six schools, summarised in the previous chapter, were the pressure on schools of tertiary entrance requirements, private tutoring of secondary students, preparation for the UMAT, the selection interview, pre-requisite subjects and differences in the characteristics of the students selected under the new process.

Pressure on schools of tertiary entrance requirements

There was general agreement among the school personnel that the pressure on the schools had been reduced in relation to academic scores for entry to Medicine. This is not to say that there is no pressure! The group of school students who now aspire to study Medicine is a larger group with a broader range of ability. They still need to study hard. However, they can work towards an average score above 75% rather than 85% and know that they will still be eligible to apply for the course. For students at the top level of academic ability the pressure is somewhat reduced, but for those closer to the new threshold score there is still considerable pressure, and a group of students who would previously have considered themselves out of contention, can now aspire to selection. This of course is one of the intentions of the new process. The consensus seemed to be that the pressure had now been spread across more students and over more components. This pressure was less intense than previously and the school and the whole Year 12 cohort was not subject to the intensity that used to be present under the old

system, when a small group of students needed to achieve high scores to be admitted to Medicine. In addition, the Dean of Curriculum at one school commented that there did not seem to be the same level of 'parental push' that had been associated with the old process.

For the students, however, whereas the pressure has been reduced in relation to academic achievement, it has been moved to other areas. Previously, intense pressure existed in the November examination period. That pressure is not so intense under the current system, but there is now pressure in July when the UMAT is conducted and to a lesser extent in December with the interview. It was pointed out that the release of UMAT results in late August is often stressful for students when they try to interpret their results. There is some uncertainty at this point as to whether 'this is enough to get in'. Another school representative saw this as a symptom of the fact that there is now less control for the student. Whereas previously they only had to work hard to get a high enough TER to obtain a place in Medicine, now they had other criteria to consider and they could not just apply the 'work hard' principle to these other criteria. At least one principal commented that, even under the old system, working hard did not necessarily guarantee a place and quoted the case of a worthy candidate who had missed out on a place in Medicine under the old system by 0.1 of a TES from a total score of 510. He saw this as a very 'cut-throat' system which was overly reliant on one criterion and he expressed reasonable satisfaction with the new system. Overall, the concept of broadening the criteria for entry to such a highly selective course was seen by all these schools as a positive initiative by the university.

Private tutoring of secondary students

The issue of private tutoring of secondary students in academic subjects was raised by most of the group. The private tutoring industry is still quite active and views were mixed as to the current use of private tutors to assist with entry to Medicine. One private school was concerned that there were equity issues associated with the cost of private tutors, particularly when they were being used for several subjects for a prolonged period of time in the final two years of school. He felt that this issue had been addressed to some extent with the commencement of the new selection process and that from this perspective the selection process was 'fairer'.

Another person commented that some of the money that had previously been spent on private tutors for academic subjects was now being re-directed into UMAT preparation and to a lesser extent, interview preparation. The general view was that parents who have the financial resources are prepared to spend money to give their child the greatest chance of success in attaining a place in this prestigious course, whether the money is spent on academic support or assistance in the other two components.

The UMAT

Several issues were raised in relation to UMAT. Amalgamated were UMAT training courses, the cost associated with these courses and the equity involved for students in terms of cost and access. The UMAT Practice Books released by ACER were seen as a positive step, particularly in view of the low cost of the books. One principal acknowledged the welcome adaptation to the process in which a combination of UMAT scores and a predicted TES is used to select for interview and commended the Faculty for the flexible way in which it has responded to suggestions for change put forward by the schools sector.

A frequently mentioned topic was UMAT training courses. For some of the private schools there may be pressure from parents to provide assistance in preparation for these tests. In addition, schools are frequently asked for advice on whether students should be enrolled in commercially available courses. These questions are difficult for the schools to answer and on the whole they try to remain neutral. Commercial training courses are seen as expensive and their effectiveness is not known. One school representative felt that some feedback from the university would be welcome on the success or otherwise of applicants who undertake such courses.

The selection interview

Schools were asked for feedback on the interview process. There was less comment on this topic than on the UMAT, because students have finished school by the time the school-leaver interviews are held in December. Information going back to the schools was usually received the following year, if at all, and was not usually detailed due to the elapsed time. However, the nature of the students finally selected by the

process was obviously a partial consequence of the interview and one school felt that 'confident, articulate people were advantaged' by this process. Another school representative expressed the view that the interview was the component which allowed people with attributes other than just academic ability to gain a place in Medicine. This was considered to be a positive outcome. Several schools had organised a session for their students to provide advice about interview technique.

Pre-requisite subjects

The question of prerequisites for Medicine was raised by several people. The only prerequisite listed is English. However, Chemistry is recommended and Physics must be taken in first year if it has not been taken at Year 12 level. This was seen as a possible deterrent to students with mainly humanities subjects, who may see these subjects as 'de facto' prerequisites. The principal who initially raised this issue thought that the Faculty should be encouraging students with humanities backgrounds to apply for Medicine. Another deputy principal commented that whereas Biology had not previously been a subject favoured by Medicine applicants, it was more likely to be studied by the new applicants. This was seen to be a positive change.

Differences in the characteristics of the students selected under the new process

The schools were very positive about the move away from a purely academic criterion for entry to Medicine. They were in favour of the principle of looking at more than one characteristic of a person for such an important profession. The representative of one school believed that the students who now gain a place are more socially capable and are more likely to be involved in a wider range of activities than just academic pursuits. The students selected under the new process are seen as academically capable, although not necessarily exceptional students, with a broader range of capabilities and interests than those selected by the previous process. This, of course, is an intended outcome, so this feedback is positive.

UWA academic staff

The main themes which emerged from discussions with staff who teach medical students were the curriculum; students' communication skills;

students' academic ability; students' ability to work together; the selection interview; the UMAT; students with disabilities; equity issues and cultural issues.

The curriculum

The curriculum was changed soon after the introduction of the new selection process. This occurred because a curriculum change was needed and was not directly related to the new selection procedures. However, it is obvious that the two entities, the selected student cohort and the curriculum, have an intrinsic relationship and it is difficult to separate out the effects of the two changes. The previous curriculum was content-based and a good deal of the assessment was based on recall/rote learning. The science courses studied in the first year were treated as separate disciplines and were content-driven. A motivating force in the introduction of the new curriculum was to change the assessment processes and to replace some of the factual content with process skills.

In 2000 the new curriculum was introduced in a staged fashion in an attempt to give existing students some access to the new style of teaching and learning and to cause the least disruption possible to the course. The result was that for several cohorts the curriculum consisted of a mixture of the old and the new and this mixture differed from one cohort to the next. Essentially the shift was from a teacher-centred, content-driven style to a more student-centred style with more emphasis on process. The early science courses were adapted to be integrated and applied to clinical settings, in a problem-based mode. This involves a different philosophical basis and different teaching and assessment methods. Students are encouraged to think holistically and to learn in more realistic life-like settings. The emphasis is on small-group teaching, process skills, reflection and feedback. However, as before, there is still a variety of teaching modes including lectures and laboratory sessions.

Most teachers of students in the early years of the course are in favour of this problem-solving approach and consider that the students like the way the Foundations of Clinical Practice provides a focus on medical applications in the science subjects. The approach to learning by this new method is viewed favourably, however one teacher commented that it is more difficult to get to know the students individually. Several teachers commented that there are still a few students who do not cope

well with this learning style. These appear to be a small group of high achievers who favour the more structured style of the old curriculum, which was characterised by an emphasis on declarative knowledge rather than procedural or contextual knowledge.

It can be seen from this brief description of the new curriculum that the interactive style of learning which is dependent on oral communication and group work is intrinsically linked with the selection of students who can operate effectively in this mode. The new curriculum follows national and international trends in setting the learning situation in context from the beginning of the course, with the emphasis placed on communication and professional skills.

One of the major changes associated with the new curriculum is the different forms of assessment. Previously most examinations were discipline specific and the focus was on passing written examinations. There are now many barrier exams, which must be passed in order to continue into the next semester. Remediation is built into the process and supplementary exams are available to enable students to proceed to the next stage. In general the students are perceived to be suitable to undertake the course. Problems in passing clinical exams are not usually considered to be connected to a lack of capacity to deal with declarative knowledge, which is assessed in traditional written examinations. Rather, the causes of such problems are likely to be in attitude, personal problems or the ability to analyse and synthesise information relevant to a clinical problem. Students who have the most problems appear to be those for whom clinical reasoning is difficult.

Students' communication skills

Student communication skills were acknowledged by most lecturers as being very important. There was an indication that there is a need to select in the first instance for students who have the requisite ability to communicate orally because of the interactive environment in which they learn. This requirement is separate from the need for good communication skills in members of the medical profession. Thus, even if medical students aim to become laboratory researchers, it is considered that they still need to be good communicators during their university education and internship.

The general level of communication skills among students was perceived to be high on entry to the course. There are still a few who lack this skill, but they are a small minority. Aspects of the curriculum

include attempts to teach these skills. Examples given of good communication skills in the teaching/learning situation were students' ability to ask pertinent questions and to present results of discussions/investigations, etc, to a wider group. Some students are quite outstanding at this skill. Students, on average, are considered to be better at finding information, their computer literacy is good and their communication skills are at a higher level than previously.

Students' academic ability

The general consensus was that there was no perceptible change in the academic ability of the students with the lowering of the TER threshold to 96. In general the students cope well with the course and no major problems were mentioned with the academic levels of students. Several lecturers commented that the previous academic threshold was too high and that the method of selecting students using an academic score only, resulted in students who were good at passing exams, particularly in mathematics and science. It was considered that many of those students, who had to score so highly to be admitted to the course, had not been able to participate in other activities and that this became a vicious circle in which the students operated in a narrow band of activity mainly focused on their academic pursuits. One lecturer questioned the need, still, to set the TER threshold as high as 96. The question was posed as to whether this threshold was low enough to achieve one of the stated aims of the new selection process, which was to diversify the group of students coming into the course. The comment was made by several lecturers that there is no intrinsic need to admit the very top TER students into the medical course. The medical course can be successfully accomplished by students with a range of academic ability. However, another teacher expressed concern at the fact that the threshold had been slightly lowered in some recent cohorts in order to fill the rural quota. It was also acknowledged that this lowering of the threshold is no longer necessary.

The general consensus was that the current cohorts do well academically and that there is no sign that the general level has declined. However, several lecturers commented that they considered that the current groups could do better academically than they do. An apparent explanation for this seems to lie in the propensity for these groups to have a wide set of interests and not to focus so completely on academic interests as did previous cohorts. One person commented that a few students are struggling towards the end of their course. This does

not appear to be related to academic ability. The cohorts are quite lifestyle oriented, they are not perceived to be as studious as previous groups, but this was not seen as a negative factor, rather a generational issue. Essentially the students had no major problems with skill levels. One lecturer commented that the high achieving, narrow-focus student with poor communication skills had been 'selected out' and this was a positive step for the profession. This statement reinforces the effectiveness of the selection process and indicates that the intended outcomes are being achieved.

Students' ability to work together

The current groups of students are considered to be less compliant than previous groups, they do not respond as well to authority, are more aware of their rights and are generally less driven. They are good at sharing information and are often willing to help each other out. Nonetheless there are still a few who have difficulty cooperating with others in a work situation. This minority is more obvious in the new curriculum than it had been previously. One lecturer said that the attitudes of a few students in the clinical setting were less than ideal and that some individuals still lacked the necessary sensitivities to function well this way. However, despite these few students, the general level of ability to work cooperatively in a team situation was considered good. It is likely that given the compensatory nature of the selection process, these particular students had lower scores on the interview than on the other two components.

The selection interview

At least half the academics interviewed in this group of stakeholders are also involved in the interview process. Most of these are interviewers, however some have been members of the Interview Committee or the Faculty Selection Committee.

Comments from the academics about the interview were generally very positive. The two main themes which arose were the identification of oral communication skills in the candidates and the usefulness of the interview in ascertaining applicants' motivation to study Medicine. If a student is there under some form of extrinsic pressure from family or their school, then the interview gives them the opportunity to express their doubts in privacy and to obtain a relatively low score on the

interview. There was doubt expressed about the accuracy of measuring any characteristics other than communication skills and motivation in such a short time, but the overall view was that the interview is justified if it serves these two major purposes.

The cost of conducting the interviews was acknowledged, but as one lecturer commented this cost is justified if only one or two candidates who do not want to study Medicine are eliminated in the process. There is no other mechanism in the selection process which allows an applicant to indicate that they do not really wish to undertake the course. Another teacher posed the question 'Can we use the interview even more effectively to identify applicants' motivation?' The view being expressed here is that there are still students entering the courses who are not intrinsically motivated to be there. There is still a small proportion of students who seem to be doing the course because of family pressure or because they have been through this stringent process and have been offered a place, and feel obliged to accept the place.

With respect to communication skills, it was acknowledged that there are still a few medical students who are lacking in this important area, but on the whole the groups selected are good communicators and the interview is seen as the mechanism by which such students are selected. Nervousness in the interview situation is acknowledged as an issue for some candidates. However the process does attempt to deal with this in a number of ways and ultimately cannot account for every candidate who is nervous. The interview was seen by several people as a way to stop people with unusual personality characteristics from entering the course. It was not clear what this meant, but it appeared to be related to some form of extreme personality traits that may interfere with their ability to make sound judgments. It should be noted that this is not a specific intention of the interview.

The interview process was variously described as 'equitable and fair', as 'working as well as an interview process can' and as 'not perfect, but more defensible than some of the others (interview processes)'. Another described the process as 'impressive and rigorous' and considered that the involvement of the community is a very positive aspect. The role of observers in the interviews was also raised as positive, as a check on both the individual interviewers and the process. The new method of assessing the results of the interview, known as the Levels of Achievement method (see previous section), was highly commended. Academics who have recently conducted interviews considered this to be a better system than the numerical scoring method, because it is

easier to find evidence for the decisions that are made in the consensus process.

One senior academic contended that the use of judgments by individuals, in the interview, necessarily introduced bias into a system which was formerly objective when based on academic achievement only as measured by the TER.

The UMAT

Not many of this group commented in depth on the UMAT. Those few who did comment raised the issue of training courses and were concerned at the proliferation of these courses. However, one academic commented that if the training courses give a candidate familiarity with aptitude tests then that is a justification for them. Another was in favour of the faculty conducting its own training courses, as that would create a more equitable situation.

A member of the faculty selection committee referred to the test as 'a national leveller' and considered that it was quite appropriate that the first stage in reducing the number of applicants was through a national test. However, another respondent who questioned the validity of UMAT, expressed the view that the fact that all the universities use the test does not automatically mean it is good.

Students with disabilities

Student disabilities was an area of interest for several of the academics. The disabilities referred to were both physical and mental. The increase in personal stress in society in general was noted and it is clear that this is more of an issue than it has been previously in student cohorts. One obvious manifestation at examination time is when some students need separate examinations and others require extra time to undertake examinations. This is expensive in staff time when it involves practical examinations. These requirements on the part of the students mostly seem to be related to their inability to deal with stressful situations. However, these are situations faced by all universities and faculties and the increase in institutional responses to such situations, in which the requests of the students are accommodated, is a relatively recent phenomenon.

Physical disabilities pose a different set of problems. It was acknowledged that students cannot be excluded from a course on the basis of a disability. However, the view expressed was that more onus should be on the student to deal individually with the situations in which their disability will be problematic. The physical and emotional/mental requirements of the profession are well known and it should possibly be made more obvious at the beginning of the course that this may put students with certain disabilities at a disadvantage. If students drop out of the course due to a disability which was apparent at the beginning of the course, then they may have taken a place which could have been filled by someone who would have completed the course and entered the medical profession.

Equity issues

Several lecturers were still of the view that the new selection process was not providing the social/SES mix that had been envisaged. The view expressed was that the private schools provide assistance to their students in all aspects of the selection process and that the equitable situation that is the ideal is not being realized. The ideal would be to broaden the SES to an extent that would bring greater depth to the profession. Some academics still feel that secondary schools in the more disadvantaged parts of the metropolitan area are not sufficiently well represented in the school-leaver intake. A question posed by one person was 'Do we need to consider affirmative action for lower SES groups?'

It was also asserted that careers teachers in lower SES schools do not encourage their students to apply for courses such as Medicine. They may need to be provided with further advice and support on this issue. Private schools on the other hand believe that their students should be entering courses such as Medicine and Law, when in some cases this belief is not justified by the abilities of the students in question.

Cultural issues

One point that was raised by a lecturer was that some cultural issues, such as those related to differences in customs and attitudes, are not necessarily well understood by some of those who teach medical students. This was seen as a generational issue in which younger people are more likely to be aware of such cultural issues and that on the whole the medical course is taught by people at least in their middle age.

Issues with respect to death and dying in all cultures was raised by one lecturer. Students are required to work with cadavers in their first year. This is initially difficult for some. Furthermore, early in the course students are required to have physical contact with clients in clinical settings, in particular with members of the opposite sex and with strangers. This is difficult for some students, particularly the female Islamic students. It was noted by another person that the proportion of Islamic students in the course appears to be increasing. Consequently this problem may become more obvious in the future. There may be no solution to this problem. However, it may be useful to inform students well in advance that these situations will occur and they need to think about how they will deal with them.

General issues

Several lecturers who have been involved in the early years of the courses over an extended period of time, commented on the characteristics of former groups of students. They were described as highly achievement-oriented with a 'what do we need to know?' approach to their learning. They were quite content-driven, particularly in the sciences, and committed to achieving high marks. It was also noted that the cohorts selected under the previous system had a higher proportion of males than the most recent cohorts. This was perceived by staff to have resulted in a high level of competition within previous groups. The current cohorts have a higher proportion of females some of whom are high achievers, but who are not regarded by staff to be as overtly competitive as the males in previous groups. These characteristics result in a different group dynamic which generally produces cohorts which are more cohesive and communicative. Former cohorts were also characterized by their inclination to read books, whereas the newer cohorts are computer literate and use the internet for information gathering and email to communicate with other students and teachers. This is likely to simply be a general societal change and not necessarily related to the nature of the groups of students.

The more diverse characteristics of the groups of students selected by the new process were seen by most as a very positive outcome. The current cohorts of students are perceived to have a wider set of interests with more extra-curricular activities than previous groups and are not just focused on achievement in the sciences. The new cohorts are perceived as more interesting to teach because they are more outgoing and questioning, they can discuss ideas, and generally appear to lead

more complex lives than the previous groups. The previous cohorts were described by one person as 'sponges, waiting to soak up facts'. The diversity of the groups is also perceived to be in their demographics. This was one of the stated aims of the new selection procedure and according to some respondents this has been successful. On the other hand, another lecturer saw the school-leaver entrants as still coming from a narrow social background. This issue has been discussed at some length in an earlier chapter, in which small changes are perceived in the mixture of school types in the new cohorts as compared with the previous cohorts.

The broader characteristics of the most recent cohorts are perceived to be a positive outcome because they reflect more closely the composition of the society in which we live. The course requires people with enough intelligence to undertake the work, but other characteristics need to be included in the selection of medical students. The Tertiary Entrance Examinations do not measure some of the characteristics which are needed in the course and in the profession.

One academic commented on the change in the growth of knowledge and the fact that we need to select for people who are 'mentally flexible' and who have skills in critical evaluation. The rationale behind this seemed to be that currently there is a requirement on students and professionals to filter and evaluate information rapidly and effectively, whereas previously there may have been time to reflect. Furthermore, there is currently a need during the course and as a member of the profession, to win the trust of both patients and colleagues, whereas this was a given condition in earlier days. No solutions were offered on the way in which to inculcate the necessary skills into students to respond to this situation. This appears to be another relatively new situation which has arisen with changes in society and is probably indicative of the changing nature of being a medical student and a doctor. Respondents were divided on the subject of students' clinical reasoning skills. Some considered it to be better, while others thought there was no difference in skill levels now compared with previous groups.

University and faculty administrative staff (both academic and general staff members)

The main themes which emerged in discussion with university and faculty administrative staff were the criteria and objectives of selection; the selection process; equity issues; the selection interview; and the nature of the medical profession.

The criteria and objectives of selection

One respondent pointed out that the Students' Charter states that 'Every student has the right to be considered for selection into courses or units on the basis of criteria that are valid, explicit, fair and reliable'. An underlying principle of this selection is that those selected should have the greatest probability of success in their course, where success is measured by completion of the course. This respondent considered that the function of the selection process in the Faculty was to select good students and not to provide the community with good practitioners at some later stage. Rather if this latter was an objective of the Faculty then it should be a function of the curriculum to turn good students into good doctors. Students have a legitimate right to treat their education in a public university as a 'consumption good' and to then choose to practise medicine if they wished.

In the same way, with respect to disabilities, potential students should only be rejected by the selection process if their disability is likely to prevent them from successfully completing the course. The underlying principle with all this discussion is that the mission of the university is to select students who can complete the course, which aims to prepare good doctors. It was acknowledged that the mission of the medical faculty may differ to some extent from this principle.

The selection process

The process is perceived to be rigorous and objective. The interview component has been challenged by several applicants and found to be robust. The level of documentation involved in the interview component was seen as commendable and this made the process defensible when it needed to be defended against a challenge, as it has been in recent years. One respondent commented on the increased workload entailed by the new process, not just within the faculty but in the wider university. However this was deemed to be justifiable given the apparently favourable outcomes of the new process.

It was noted that one of the major sources of criticism has been from within the medical profession. The system in which doctors earn enough to send their children to private schools becomes a self-perpetuating system in which their children earn the high scores which previously had guaranteed them entry into the medical course. The new system does not guarantee them a place. One mitigating factor is that there are now graduate alternatives for entry into the profession in WA. This

provides opportunities for school-leavers who are not successful initially, to enter the course at a later stage.

In commenting on the use of academic scores as the sole mechanism for selection, the convenience of such a system was noted, but academic achievement is only a small part of the requirements of the professions and indeed the TER threshold of 96 may still be too high. The compensatory nature of the ranking process was deemed to be excellent. Out of the different characteristics used in the selection process, it is still important for the full range of each to be represented in the cohorts, given the diversity of characteristics needed within the profession. The students in the recent cohorts were described as articulate and challenging to their teachers, and not just rote learners.

It was stated by one senior faculty representative that when decisions were being made about the introduction of the new selection process, models were considered both nationally and internationally. McMaster University in Canada and the University of Newcastle in Australia were two universities which had introduced innovative processes. One of the problems with evaluating the evidence is the difficulty in specifying and measuring suitable outcomes. The long-term nature of some outcomes makes them difficult to evaluate. 'Sometimes the best that can be said is that the outcomes have not deteriorated'.

Equity issues

The new selection process was seen as more egalitarian and one outcome is that it seems to have produced more diversity in the cohorts. One of the initial issues which had attracted criticism was the fact that students of Asian origin seemed to be less well-represented in the new cohorts. This issue appears to have diminished in intensity in Western Australia over time.

The high cost of the medical course to the individual is an issue which needs to be considered by the university and the faculty. The cost occurs both in the Higher Education Contribution Scheme fees and in the length of the course, making it inaccessible to some sections of the Western Australian community. In particular some refugee groups are not represented at all and this will be a problem in the future, as many such people prefer to see health professionals from their own cultural background. In addition some of the members of these groups come here with a sound academic background, and sometimes with good qualifications, and are unable to gain access to courses such as Medicine.

This is not just a question of language and culture, but it also has a technological aspect with respect to access to computers and the internet. The prestige associated with both the course and the profession presents another barrier for groups which are not part of mainstream Australian society. It was suggested that this may be an issue for consideration by the wider university community and not just the Faculty.

The apparent lack of a systematic bias in the components of selection was noted. There are small differences in subgroups which occur in any form of assessment. However, the UMAT and the interview are carefully monitored each year for evidence of various forms of bias. Any differences which occur seem to be balanced out by other parts of the selection process. The membership of the Interview Committee includes a member of the Equity Office. This inclusion is important so that potential barriers for some groups can be monitored. It was noted that equity is not just about race and gender and that the interests of all groups in society must be kept in view.

The selection interview

The interview process was regarded as excellent by several of the respondents. The need to be explicit about the requirements and the criteria of the interview was stated. Applicants have a right to prepare for both UMAT and the interview if they wish, so it should be clear what is being assessed in each of these. Issues with respect to the maturity of 17-year-old boys was raised. One aspect of this is girls' greater ability to discuss social issues and their own feelings. The same respondent believed that the consensus process introduces the variable of the personalities of the interviewers and their ability to interact with one another, which was seen as a negative variable.

The attention to detail which characterizes the interview process in all its stages was commented upon by a number of the respondents. It is difficult for an appeal against the process to be upheld because of the rigorous and well-established protocols associated with it. One senior academic who is not involved directly in the interview process, noted that the problems of judgment/subjectivity which are sometimes levelled at it are inherent in any assessment process. Most such processes are not challenged, whereas the interview has been challenged and has been found to be robust. A challenge in February 2005 to the outcomes of the interview for an individual student who had scored

highly on the other two components, but who was subsequently not offered a place, resulted in the challenge not being successful. The parents of the applicant took their case to the Vice Chancellor, who upheld the faculty's decision, based on the written evidence which was available from the interview.

The clarity and breadth of information available on the Faculty website and in other forms of documentation with respect to the interview are very good. Applicants are given clear information about the process. It was noted that the interview is rarely criticised by the students. The fact that it provides a means of exiting the selection process for applicants who do not wish to be selected was seen as a strength of the interview component. The other components of selection do not provide this facility.

The nature of the profession

The medical academic workforce is changing as well as the medical professional workforce, but not because of the selection process or the curriculum. There are many other influences affecting this. The gender issue in which the proportion of females coming into the course has increased, along with the future workforce implications accompanying it, is beyond the scope of faculties of Medicine to deal with. It needs to be addressed in a wider forum, at the professional level. It was noted by several people that males now take more account of lifestyle issues and that patterns of work for both males and females may change considerably over the next decade. The issue of the rural workforce is a difficult one. Females may be potentially less likely to go to rural areas than males.

The nature of the profession has changed recently. The prestige formerly associated with the medical profession has diminished. Patients are more likely to criticize and complain about aspects of their treatment than they were previously. In addition to this negative aspect of the work, the level of paperwork and bureaucracy has increased, as have the time constraints on seeing patients. Practitioners who become disillusioned with the profession in the future may do so for different reasons from those in the past. Thus, the attrition rate within the profession could be subject to a range of influences that have not previously been experienced and are impossible to control through the selection process and the medical curriculum. The level of altruism in the profession used to be very high, however there is much greater

awareness in the community now of problems in society and a lack of respect and recognition for members of the profession.

Senior staff from the teaching hospitals in WA

As with the members of UWA staff, several of the senior staff from the three major teaching hospitals have been involved in the selection interview as interviewers. The following themes emerged from these discussions: the new selection process, personal characteristics of the interns, characteristics of the generation of people known as Generation Y, the medical workplace and workforce factors.

The new selection process

Most senior staff expressed satisfaction with the existence of the new system. It was noted that academic levels were still high and two people commented that it is not necessary to be a genius to complete a university medical course. The real challenge in Medicine comes at a later stage when specialties are undertaken. A comment was made that if all those entering the course are academically focused then there will be a lack of general practitioners. The lack of fairness in the old system was noted, with the possibility for many potentially good doctors to just miss out on selection, when only an academic criterion was applied. The use of the three components of selection was seen as a good initiative, which is better than relying solely on academic achievement.

The majority of comments in this section were related to the interview. Features of the interview process such as the panel of two, the structured style and the grading system all received favourable comments. It was also noted that the existence of the interview gives some students a way to escape family pressure if they are not really motivated to be doctors. Applicants who were very nervous in the interview may well have similar problems in the workplace, so this was a useful purpose of the interview. The UWA interview was acclaimed as being a good attempt at undertaking an essentially problematic process.

The issue of communication skills was raised in the context of being able to speak to patients and this aspect of the interview was seen as positive. The comment was made that the qualities which make people good in the interview also make them good hospital doctors. The downside of this is that they are sometimes more 'difficult to manage'.

Personal characteristics of the interns

Many positive comments were made about the interns. It was noted that the initial impression was one of overconfidence, a comment made in a somewhat negative way. However, most people had found them good to work with and easy to relate to. One of the over-riding themes which became apparent was the commitment of this group of people to a work/life balance. They were described as having good communication skills in dealing with their colleagues, motivated as adult learners, showing responsibility for their own learning and working well in a team. The teamwork aspect was varied, with one hospital indicating that there was still some way to go with this skill and that a few interns had not fully assimilated the ability to work in a health care team in which each person had a unique contribution to make.

The issue of mental health problems among the interns was raised, the comment being made that there are usually one or two interns with problems each year at every hospital. The burden for the hospital becomes considerable if too many interns with a disability, mental or physical, were employed at one site. It is obvious that the medical faculty is aware of such issues although confidentiality needs to be maintained for the sake of the student/intern. An acknowledgement was made of the existence of such problems over the years but there was no expectation that this problem would be either better or worse with the new cohorts.

Characteristics of the generation of people known as Generation Y

The generation of people who were born in the 1980s are known as Generation Y. They are usually the children of the generation known as Baby Boomers and have grown up in relatively affluent conditions compared with their parents' early years. They are characterised by a strong sense of self-worth, a tendency to be self-indulgent and to speak their minds. On the positive side they have high expectations of themselves and believe that they can work faster and more effectively than others. They want jobs with some flexibility, which will accommodate their personal and family lives and often plan to work part-time in the future when their lifestyle requires this. The websites from which this description was developed appear in the list at the end of the References. These characteristics are typical of those which describe this generation and views consistent with these statements were expressed by the senior hospital staff.

Some of the differences in the recent cohorts of interns, including the first group from the new selection process, were attributed by most of the respondents to societal influences such as those described above. Recent cohorts have been progressively more outgoing and forthright, less compliant and with high expectations of their place in society. This was seen as a product of their parenting, the downside of this being that their work ethic is not as high as that of their parents. There is a clear difference between them and previous generations with respect to lifestyle and it is apparent that they are prepared to work hard to some extent, but they are not prepared to work for 100 hours per week as did previous generations of young doctors. The comment was made that 'the new generation is changing the way doctors work'. These characteristics were attributed more to the Generation Y phenomenon than to changes in selection processes or the curriculum.

The medical workplace

The hospital as a workplace is now multidisciplinary with an emphasis on the input of the health care team and on patient care. Most interns were able to accept this system but there were still a few who demonstrated a degree of arrogance. It was acknowledged that coming into a new workplace and learning its customs and practices is always stressful. The view was expressed that interns are generally well supported in the hospital system, but coping with workplace systems such as paperwork, line management and decision-making can take its toll in the early days. Fortunately most interns learn this quickly and overcome the early difficulties, which are more related to functional and procedural factors than to clinical factors. There was no indication that this group coped better or worse in this area than any other groups.

Workforce factors

Comments which were made with respect to the future workforce are outside the scope of this study, however they are relevant in the sense of their connection to the changing nature of the people who are studying Medicine. This may be partially related to the method of selection and to the different emphasis in the curriculum, but as discussed above it seems to be a societal change in which lifestyle assumes a significance not seen in previous generations.

Most respondents expressed concern at the possibility that some of the specialty areas in Medicine will suffer in the future. Various areas of surgery featured in this discussion as well as other highly disciplined areas which require considerable commitment from those who enter them. Given the shortage of doctors in Australia and the fact that younger doctors will have considerable choice in the field that they enter, some of the more difficult specialty areas may not be chosen by them. Some respondents were also concerned about the future of medical research with this generation of young doctors.

Gender issues were raised in relation to the changing ratio of males to females in the medical student intake. It was noted that this is a problem in some other professions as well, given that the pattern has been for females to work a lower proportion of time over their working lifetime than males.

Finally and significantly, a comment made by several people in this group, was that it will be a long time before the real results of all these changes will become apparent.

Staff from other Australian undergraduate medical programmes

Some of the results of discussions with both academic and administrative staff from the other Australian undergraduate medical programmes have been reported in Chapter 4 of this study, which gives a description of the different processes used in the other medical schools. The aspects of the discussions which are reported here are those related to the perceptions of the personnel interviewed about the outcomes of the selection processes.

It should be noted that each of these universities has also introduced a new curriculum in the last few years. In each case this curriculum is student-centred and problem-based. As for UWA, the introduction of the new selection process and the new curriculum occurred in close proximity. However, it appears that, as at UWA, the two events are not usually directly linked. Other major themes which became apparent were the academic levels of the students selected by the new processes and the personal characteristics of the groups of students. Most university representatives also commented on some aspect of their own medical school's interview.

The new curriculum

A common comment in interviewing personnel from these universities was that it is difficult to separate the effects of the new selection process and the new curriculum. In many ways they are interdependent. The new curricula in each case require students to have higher levels of interpersonal skills than was required under the old didactic, rote-learning style of curriculum. The new curricula are all student-centred and problem-based. They require students who are able to work on group projects and are able to communicate effectively with both their teachers and their peers.

Academic levels of the students

There is a strong view that the academic levels of medical students have not been diluted by the lowering of the academic thresholds. This is in some way connected to the higher than previous demand for the course at all the institutions. The median entry score in all universities who reported on such issues was in the vicinity of a TER of 99. This is also the case for UWA. Hence in each case approximately half those being admitted each year are in the top 1% of their year cohort. Even for those universities where the threshold score is a TER of 90, there are not usually many students with a TER near the threshold and in most cases those in this category have entered the course via a rural entry scheme. The general perception is that the new cohorts of students cope well with the academic requirements of the course.

The personal characteristics of the groups of students

In each case comments were made about the communication skills of the students. They are seen as more engaging, communicative and responsive and as more outgoing than previous groups. Other similar comments were: 'for the most part the groups of students work well together in groups', 'the students ask more questions' and 'they have good critical thinking skills'. The commonly cited downside to these positive comments was that as a large group they are more outspoken and talkative and less easy to manage in group situations such as large lecture groups.

The selection interview

A common view expressed was that the interview process is expensive in time and resources. However it is deemed to be valuable as a selection instrument. For the most part, the students are motivated to study Medicine and this is perceived to be as a direct result of the interview process. One university representative commented also on the predictive qualities of their interview scores and in particular the criterion of Motivation. The level of support of the interview process by those staff and community members involved as interviewers was frequently mentioned. One person referred to the new selection process and in particular the selection interview as a 'unifying' experience for the Faculty.

Two minor issues mentioned were the attrition rate of the students and the gender mix of the candidates. At least two universities claimed that their attrition rate had decreased quite significantly compared with the old selection process. Another commented that the attrition rate amongst first year students was much lower. With respect to the gender mix of applicants and students, the trend towards more females applying for and entering the medical course has persisted over the duration of the new selection process, and is common to all the undergraduate medical schools. The actual proportion of males to females varies across universities, but on average it appears to be approximately 55% females to 45% males.

Chapter 7

Results of quantitative analyses

In this chapter the results of three quantitative studies are reported. The first is the Interview Reliability Study which was undertaken to assess the reliability of the scores on the structured interview, both at the level of the individual scores given by the interviewers and at the level of the consensus score, which is used as the final score for the candidate. The second is the Predictive Validity Study which was carried out to evaluate the predictive validity of the components of selection, namely the TER, the score from the structured interview, and the scores from the three sections of the UMAT, with respect to a range of course outcomes. The third study is a relatively small investigation of the attrition rate amongst the first cohort to enter by the new selection process in 1999 who completed the course in 2004/05.

The Interview Reliability Study

It will be recalled that the Interview Reliability Study was carried out by filming three interviews with medical students, who were interviewed by a pair of interviewers under similar conditions to those that exist in a real interview. The students had been selected to represent a range of scores on their own selection interview the previous year. The filmed interviews were then rated by groups of individual interviewers and finally in panels of two. The ratings for the three filmed interviews of Students 1, 2 and 3 were recorded at both the individual and the consensus stage of the process. The three students were rated individually by 34, 20 and 42 interviewers respectively. Hence 17, 10 and 21 consensus ratings were recorded by the panels of two, using a process which mirrors that used in the actual interview situation.

To supplement the results of the study some results of the full cohort for the 2005/06 selection interviews are also reported. There were 509 interviews conducted in that cohort and the data reported are of the consensus (final) scores for the candidates. The three students in the Interview Reliability Study are not included in this cohort, but the interview criteria, questions and rating scales are the same.

Internal consistency

For the Interview Reliability Study, the internal consistency for the seven criteria in the study was measured by Cronbach's Alpha. Among the individual ratings a value of 0.87 ($n = 96$) was found. Among the consensus ratings in the study this value was 0.82 ($n = 48$). Among the full cohort consensus scores the value was 0.86 ($n = 509$). These values indicate high internal consistency among the criteria in each of the three data sets.

Intra-class correlations

The intra-class correlation coefficient (ICC) is a suitable statistic for quantifying the amount of measurement error in a numerical variable and is particularly useful for application in clustered data, that is in repeated measurements of the variable. In this current context it is a two-way random-effects model, using random effects for both the student and the rater. Within the clusters of data (individual students) the coefficient used is an absolute agreement definition. The value of the ICC for agreement between pairs was found to be 0.88 ($p < 0.001$) and for agreement between individuals was 0.72 ($p < 0.001$).

Rasch model analysis

The data set available from the Interview Reliability Study was insufficient in size for conducting an analysis using the Rasch model of modern test theory (Rasch, 1960, 1980). However, the data from the full cohort consensus scores were used to conduct a Rasch analysis, which provides information on whether the criteria fit together to provide measurements of a single dimension ie they are unidimensional. The software used to conduct this analysis was Rasch Unidimensional Measurement Models (RUMM), version 2020. The program also provides fit statistics, discrimination indices and graphical information for individual criteria and a person separation index (the Rasch equivalent of Cronbach's Alpha).

The results of this analysis showed that the power of the test of fit was high indicating that the criteria fit together well, which shows that they are measuring a single construct in which all the criteria are contributing to the overall measurement for each person. This interpretation is consistent with the high item-total correlations of

traditional test theory. The value of the person separation index was 0.85, consistent with the value of Cronbach's Alpha.

Discussion

The data collected in the Interview Reliability Study were sufficiently robust to provide good analysis outcomes in all aspects of the study. The level of agreement overall between average individual ratings and average consensus ratings was encouraging, in the sense that the two processes did not provide widely different values. This suggests that the interviewers were able to reach consensus relatively easily without a considerable change in their perceptions of the nature of the responses and their understandings of the criteria. However, a further positive outcome with respect to the consensus process is the somewhat lower standard deviations and mean absolute deviations from the median, which indicates that those few individual interviews with more extreme scores were moderated by the consensus process.

The high level of Cronbach's Alpha in each part of the study and in the full cohort (0.87, 0.82 and 0.86) is consistent with that found in previous years and indicates a high level of internal consistency of the data. The person separation index from the Rasch analysis (0.85) also supports this high level of reliability and indicates that the assessment is able to successfully measure differences in the ability of the subjects in the latent trait (construct) represented by the items (criteria) in the interview.

The most notable outcome from the Interview Reliability Study was the value of the Intra-class Correlation Coefficients. This indicated that 88% of the variation in the ratings was due to differences between the students rather than to differences within the students, when considering the level of agreement between pairs of interviewers, and that 72% of the variation between students (rather than within students) was accounted for when considering the level of agreement between individual interviewers. These levels point to a highly reliable process. It is generally accepted under most circumstances that values for these coefficients around 65% demonstrate an acceptable level of reliability in the measurement process.

Conclusions

The aim of the reliability study was to examine the reliability of the interview process and its outcomes. The degree of compatibility between the individual ratings and the consensus ratings suggests that the process is reliable in the way in which interviewers operationalise and apply their understandings of the Levels of Achievement.

Individual item characteristics in the form of item-total correlations and fit statistics from the Rasch analysis showed the individual criteria to be reliable in their contribution to the total score and in their contribution to the measurement of a single underlying construct.

The levels of Cronbach's Alpha and the ICC values showed the process to have high reliability when considering the overall levels of agreement between raters on the interview criteria.

Predictive Validity Study

The Predictive Validity Study reported in the original study has been progressively updated as more data became available. Full results of the updated study will be published elsewhere. Outcomes of the study over several years have been relatively consistent and are expressed in the following brief discussion.

For Standard entry (school-leaver) students in this study, it appears that TER and female gender were the major positive predictors in the first three years of the course. These two factors still had an important role to play in some units in Years 4 – 6 of the course, but TER has a less salient role in some of the clinically-based units in these latter Years. The Interview score (particularly *Communication Skills*) and UMAT1 (Logical reasoning and problem solving) both showed positive predictive power in a range of clinically-based units. Furthermore the interview score was a good predictor of overall outcomes in years 4–6.

As predicted from the findings reported in Chapter 2 of this thesis, previous academic achievement is an important predictor of success in a medical course (Hughes, 2002) and the outcome of the Predictive Validity Study reported here was confirmation of this in the undergraduate medical course at UWA. This was particularly so in the earlier years of the course, which are characterised by a greater number of knowledge-based units than clinically-based units. These findings are consistent with those reported by other researchers in this field (Tutton and Price, 2002) who reported that the association between previous

academic success decreases later in the course. McManus *et al* (2003), in reporting on a longitudinal study of graduates from a medical course in the UK, report on the long term effects of previous academic achievement. Tutton (1997) concluded that even though academic results show good predictive capacity for the academic sections of the course, the interview showed superior prediction in the more humanistic aspects of the course. All these findings are supported by the findings of the Predictive Validity Study, in which the interview score and the scores on UMAT1 (Logical reasoning and Problem solving) added assessments of characteristics not available under the old system.

Furthermore, it seems that the interview score and parts of the UMAT score, which added value to the academic score, had more effect in the clinical years of the course (Years 4-6) than in the earlier years. This raises the question that these effects may become more obvious over time and that the scope for further research in the postgraduate years is a clear pathway for more investigation as more cohorts graduate from the medical course.

Attrition rate in the first cohort

One of the reasons cited for the introduction of the new selection process was to try to mitigate the high attrition rate amongst medical students. This has been quoted as being in the vicinity of 16% over the duration of the course, as reported in Chapter 1 of this thesis. It is not known what methodology was used to derive this rate, however it is consistent with the rates reported by some other undergraduate medical schools with respect to their old selection process and previous forms of the medical curriculum.

Figures provided by the UWA Statistics Office in Planning Services show that over the period 1990 – 1995, almost 85% of commencing students completed the medical course. This shows an attrition rate in this period of between 15% and 16%.

Two main results came from studying the course completion patterns of the first 'new' cohort, which started the course in 1999. Firstly, many students do not progress through the course to complete in minimum time as was the case previously. Secondly, the attrition rate appears to be somewhat lower than the rate reported above in the early 1990's.

It is clear that the final completion rates for each cohort will not be available for at least 8 years, and probably longer, after commencement.

It also seems reasonable to conclude that approximately 94% of the cohort who started in 1999 will eventually complete the course. No specific inferences can be made from this, but it is clear that the attrition rate is substantially lower than previously and is likely to have been halved. This will need to be studied over an extended period of time, however the initial indications are promising.

Chapter 8

Summary and conclusions

The purpose of this chapter is to summarise the outcomes of this study; to evaluate the implementation of a new selection process for medical students at UWA; and to consider the implications of these changes for the future. Internationally, methods of selecting students into the elite, high-stakes courses of Medicine have undergone considerable change in the past decade and almost certainly will continue to evolve in the foreseeable future. The initial and major change away from the sole use of academic scores to using complementary information to select medical students was slow to be established (Edwards, 2001), but after this shift was accomplished in the early 1990s, change has been continuous (Hughes, 2002). The objective of this research has been to investigate, as a case study, the response to these circumstances by one Australian university, i.e. The University of Western Australia, with respect to its school-leaver applicants to the medical course.

This broad objective has been addressed by considering as specific aims an appraisal of the main goals of the new selection process; describing the three components which comprise the ranking mechanism of students in the new process; the implementation of the new selection process and some of the contextual issues surrounding it; an evaluation of the consequences of the changes in the short-term; and implications for the future. In this chapter these specific aims form the basis of the discussion about the new selection process at UWA and then the implications of this study are considered in the wider context in Australia and internationally.

The main goals of the UWA selection process

The move away from the sole use of academic scores in Australia, the UK, Canada and New Zealand was triggered by two major factors. One was the existence of high numbers of suitably academically qualified applicants who were deemed capable of passing a medical course, but not all of whom could be offered places. The other major factor was the developing understanding that qualities other than just academic achievement were important to the effective practice of Medicine and indeed to success in the medical course, which was itself changing. As a

consequence, and in tandem with other factors, the option of broadening the criteria for selection was mooted and medical schools started to take into account additional characteristics of the applicants, with a new set of goals underpinning the process.

The major goals of the new process at UWA were to increase diversity in the student cohorts; to promote equity in the selection of students with respect to different socio-economic, geographical and ethnic backgrounds; to attempt to identify students who are motivated to become doctors, which may be reflected in the lowering of the attrition rate in the course; to achieve greater congruity between the selection process, the goals of the medical school and the style of teaching; and finally to select students with the intellectual capacity to complete the course and the personal characteristics to assist them in becoming successful practitioners. These goals address the issues which underpinned the original motivations for change. The UWA response to these circumstances was similar to that espoused by other Australian medical schools and was a reflection of a complex set of circumstances involving changes in aspects of medical education, the medical profession and modern society.

It must be emphasized that there are few directly quantifiable outcomes which may indicate whether the process has been successful or not. Indeed most of the outcomes rely on the judgments of the stakeholders. In the long term, the measures which may answer the question are the attrition rate both in the course and the profession; the ability of the students to complete successfully the clinical years of the course; the performance of the graduates as interns; and the community's perceptions of the graduates as professionals. No definitive evidence is available yet on these outcome measures. In the meantime, other less direct evidence has been presented as part of the present study. The outcomes of the study of the attrition rate in the course as reported in Chapter 7 are only preliminary, but provide an encouraging start.

In summarising and discussing the main points which emerge from this study, the outcomes from the case study at UWA will be considered in four main themes: the contribution of each of the three components of selection (the Undergraduate Medicine and Health Sciences Admission Test, the selection interview and the TER) to the outcomes of selection; the effects of contextual factors; an assessment of the outcomes of the selection process in the light of changes in the medical curriculum and

the workplace; and finally setting the UWA process in the context of national and international trends in the selection of medical students.

The three selection components

It is considered important at UWA that the qualities used in the medical selection process are characteristics of the person which are not directly related to lifestyle or socio economic status, as these would mitigate against some of the stated equity goals. Hence in this process aspects such as references, written personal statements, evidence of community service, positions held in society etc, are not considered to be acceptable criteria. Each of these requires value judgments to be made by individuals, and the development of relatively more objective processes in their evaluation and use is deemed problematic at UWA. The three components used in Australia, and particularly in their application at UWA, attempt to fit accepted standards of assessment in an educational setting, such as validity and reliability (Tuckman, 1998) as well as fairness and equity.

The national test, the UMAT

The first component to be applied in the selection process is the national test, the UMAT. One of the major criticisms levelled at the UMAT, particularly in its early years, was that it was a 'secret' test and its validity as a selection instrument had not been established. To counter some of this criticism, the Australian Council for Educational Research has put a number of procedures in place since it took over the administration, scoring and analysis of the test in 2000. One of these procedures is to scrutinize the psychometric properties of the test each year. These psychometric properties are under constant analysis and development and currently operate at a high level in relation to established protocols for test development (ACER, 2006). A full report is published each year for the members of the consortium.

Validity is a complex and multi-faceted concept. There are those who believe that predictive validity is paramount and others who contend that the full spectrum of aspects of validity needs to be taken into account (Wolming, 1999). A construct validity study of the UMAT test was published recently (Mercer and Chiavaroli, 2006). Using a combination of statistical analysis of the test and its individual items, a literature review of the constructs, a content analysis and a comparison

with tests of a similar nature, this study established the legitimate basis of the test as a robust and credible instrument. The constructs underlying the three sections of UMAT, Logical reasoning and problem solving, Understanding people and Non-verbal reasoning, were articulated and connected to the literature review of characteristics of 'good' doctors and issues in the selection of medical students. The links between the cognitive qualities assessed in the UMAT and the characteristics required in the study and practice of Medicine were established.

The issue of predictive validity of all the sections of UMAT has not been conclusively established. However, the outcomes of the predictive validity study conducted at UWA as part of the review of its selection process, part of which is relevant to this study, show early signs of encouraging results (Mercer, 2006) in both the medical and dental courses. A study by the University of Adelaide (Turnbull and Robinson, 2005) showed some early indications of the quality of prediction of course outcomes. However, the measures reported by Turnbull and Robinson were the total UMAT score, the UMAT rank and percentage scores combined across all units and as such appear not to be sufficiently 'fine grained' to produce significant results, particularly in the light of the results of the UWA predictive validity study reported in Chapter 7, which differentiated between the types of individual units used as outcome measures. In this study UMAT1 (Logical reasoning and Problem solving) showed promising early results.

In order to address equity concerns regarding UMAT, in 2005 the Australian Council for Educational Research published the first Practice Question booklet, and two more versions were made available in 2006 and 2007. These booklets are an attempt, which has been well-received, to address equity issues and the problems associated with the proliferation of UMAT training courses, which, as noted in the interviews with stakeholders in this study, claim to prepare students to do well in the UMAT. It is difficult to address the effectiveness of such courses, particularly as those who conduct them do not have access to the range of item types used in the actual test and can only speculate as to their nature. Nevertheless, it is most likely that such courses provide students with experience in undertaking tests of this type, which differ from the achievement tests students are accustomed to in their secondary studies. The objective of publishing the Practice Question booklets was to provide this experience at a low cost and to make the test-taking situation more equitable for all students.

However, the issue of equity and UMAT training courses continues to be problematic. For example, the view espoused by some of the secondary school personnel interviewed in this study is that some parents are prepared to pay to give their child an advantage in any situation. The money that parents have previously spent on academic tutoring, is now spread to include preparation for the UMAT, and in some cases, the interview. There is no evidence that UMAT training courses are any more effective in preparing applicants than the Practice booklets published by the Australian Council for Educational Research.

The local instrument, the selection interview

The next stage in the selection process is the selection interview. This is a local instrument, as are most of the selection interviews used throughout Australia and internationally. The Multiple Mini Interview, developed by personnel at McMaster University in Canada, is now being used by some other medical schools in Australia, particularly the graduate medical schools, and appears to be the first such instrument which is used in a wider forum. As a general rule, the selection interview is the point at which the selection process for each university establishes its own emphasis. This is manifest in the nature of the process used, the training of the interviewers, the scoring mechanisms and the qualities assessed. These features of the interview are a reflection of the priorities and values of the faculty involved. Each faculty's selection interview has its own rationale, training methods, rating scales and protocols for the use of the interview score in the ranking of applicants.

At UWA, the medical faculty has established a long-standing committee which continually updates the process, the interview criteria and the training of the interviewers. Results of discussions with stakeholders, reported in Chapter 6, indicate widespread acceptance of this process and satisfaction with the outcomes. On the other hand several submissions from within the medical faculty (Mercer, 2006) indicate that the process still has its detractors. It should be noted, however, that medical students themselves are rarely critical of the selection interview, as reported by stakeholders in Chapter 6.

The major features attributed to the UWA interview by its stakeholders are its ability to address the two important areas of oral communication skills and motivation to study Medicine. In addressing these two areas, some of the goals of the new selection process are now considered. Identification of applicants' motivation to study Medicine is

an important goal of the new selection process and an important function of the selection interview. The interview seems not to be completely successful in eliminating applicants who do not have an intrinsic desire to study Medicine, as evidenced by the interviews with their lecturers in Chapter 6, but it performs the role of questioning this intent and of allowing applicants the opportunity to voluntarily withdraw from the process if they wish. This is the main point of control in the selection process for applicants who are under extrinsic pressure to apply for the medical course. They are directly questioned about their commitment to study Medicine and are able to answer truthfully without pressure from others. The implications are that one of the values of the selection interview is in its ability to differentiate, albeit not perfectly, amongst those who really want to study Medicine and those who have applied to satisfy the expectations of others.

Communication skills are considered to be among the personal characteristics which contribute to students succeeding in the new curriculum and to becoming successful practitioners at a later stage (Nicholson, 2005; Wagner *et al*, 2001). This aspect was discussed at length by all groups of stakeholders interviewed in this study and is supported by the literature as reported in Chapter 2. Once again, as discussed by stakeholders and reported in Chapter 6, the interview process does not perfectly eliminate poor communicators from the cohort, but it has been deemed to be successful in this respect by those who teach the students and those who supervise them as interns. Furthermore the criterion of *Communication Skills* in the selection interview was the individual criterion which had the greatest success in predicting outcomes in units such as General Practice, as reported in Chapter 7 in the results of the predictive validity study.

One of the positive features of the selection interview at UWA is the robustness of the process. To this point it has withstood challenges to its process and responded appropriately. The rigour and strict protocols of the process have contributed to this outcome. The Interview Reliability Study conducted as part of this study was informative and reassuring in this regard. The results of this study provided the Interview Committee with new insights into the interview process and have given rise to a number of recommendations for improving the process (Mercer, 2006). Continuous evaluation and adjustment has been a feature of the process, as described in Chapter 4, and has contributed to its perceived success.

The Interview Reliability Study demonstrated high levels of inter-rater reliability, congruence between the individual and consensus ratings, and internal consistency of the data. Based on these results, it seems that the use of the highly structured style of interview has been justified. Although this has meant a heavy workload for the Interview Committee, especially for the Chair of the committee and the faculty Manager of Admissions at UWA, the resultant process is robust, defensible and reliable.

Furthermore, and of particular significance, are the outcomes of the predictive validity study, reported in Chapter 7, with respect to the use of the interview scores in the final ranking of applicants. The Interview total score and the criterion *Communication Skills* is a significant positive predictor of outcomes in the clinical years of the Standard Medicine course. One aspect of the interview that has been criticized by its detractors is the use of such an instrument for school-leavers. Paradoxically, these are the group of students for whom the interview is most effective (Mercer, 2006). The group in which the predictive power of the Interview score was most evident was the Standard (school-leaver) cohort. These outcomes were not just isolated instances, but were consistent across a range of the clinically-based units.

The academic score, the TER

Sequentially, the final threshold to be applied in the selection process is the academic score. In the case of school-leavers this score is the TER which is a rank representing the results of the final year of secondary study. At UWA the required rank for entry to Medicine is 96, which represents an average score of approximately 75% in 4 or 5 subjects, which is easier to attain than when the process used only academic performance, when a rank of 99+ was needed and the average required was approximately 85%. Recent studies in this area consider secondary study not to be a 'level playing field' (Dobson and Skuja, *The Australian*, April 2005). Thus, for example, research suggests that in general, government schools are under-represented in tertiary study in general and in Medicine in particular. This issue of the high representation of the so-called 'elite' schools (both independent and government) was one of the driving forces in the introduction of the new selection process at UWA. Over-representation of students from independent schools in medical student cohorts is a phenomenon not confined to Western Australia (Story and Mercer, 2005), nor indeed to Australia (Searle,

2003). In particular, in Western Australia, students in the 96+ TER range increasingly come from independent schools (Institutional Research Unit report, 2005). The main mitigating factor here is the increase in the number of lower SES independent schools which are increasingly providing students for medical courses.

The implementation of the rural quota, as described in Chapter 3, is one contextual factor which is starting to show an effect on the representation of schools, with more rural schools being represented in recent cohorts, but change in the metropolitan school-leaver group has been slow. There are early signs of some changes, with a 5% reduction over the first five years of the new process of representation of the elite group of schools referred to above. This elite group is composed of government, Catholic and independent schools which have always had a high proportion of students selected into Medicine under the old and the new selection processes.

Once again, the predictive validity study provided significant evidence with respect to the importance of previous academic achievement for students entering the medical course. The TER was the major predictor of the course weighted average mark and of the knowledge-based units. This is a finding which is repeated in most similar studies. For example, Miller (2004) found this to be the case across UWA students, including medical students. Miller's other major finding in his recent study, which is consistent with the results of this research, is that gender is the other significant predictor of course outcomes, with females performing on average slightly better than males in university courses.

The compensatory nature of the ranking system at UWA, as described in Chapter 4, in which it is possible to have the full range of scores (above the thresholds) in each entry component (TER, UMAT total score and Interview total score) represented in each cohort, has made possible the conduct of an effective and productive study of predictive validity. However, attenuation effects are still applicable, given the relatively narrow range of TER and UMAT scores, and these have not been applied to the outcomes of the predictive validity study. The outcomes of this study have shown the main predictors of success in the medical course to be TER, gender, the Interview total score and UMAT1 (Logical reasoning and problem solving) in that order.

The effects of contextual factors

Two of the goals of the new selection process, summarised in Chapter 1, were increased diversity in the student cohorts and equity in the selection of students with respect to different socio-economic, geographical and ethnic backgrounds. The contextual factors discussed in Chapter 3 were concerned with issues of equity and diversity in medical student cohorts. These issues were the gender balance in the course, the representation of the different schools sectors in the cohorts, the implementation of the rural quota and the introduction of Bonded Medical Places by the Federal government. The effects of these factors at UWA are now summarised from the results of this study.

The issue of *gender balance* in the course has been a focus of concern in some quarters since the introduction of the new selection process. Stakeholders who teach or supervise the new cohorts of students have all commented on the change in the gender balance since the introduction of the new selection process and the implications of this change for the future medical workforce. The ratio of approximately 54% females to 46% males in the UWA medical course appears to have stabilised since the beginning of the new process. This compares with a ratio of approximately 40% to 60% under the old process. However, an investigation of trends in first preferences for students in WA in the 96+ TER range, as reported in Chapter 3, shows that this change appears to be related to a change in demand rather than to any systematic bias in the selection process and that it is a trend common to all professional courses except Engineering. Commerce and Computer Science courses are the other areas which attract a higher proportion of males than females.

Representation of the different schools sectors, with independent schools apparently being over-represented, was one of the original motivators for change at UWA. An investigation of the schools represented in the new cohorts, as reported in Chapter 3, shows that this situation has not changed in the way in which it had been hoped. However, different schools are now appearing on the list of those represented and even though many of these are independent schools, they come from the lower socio-economic independent schools rather than the elite group of schools which have traditionally been represented. Once again, trends at UWA in the 96+ TER range show the representation of independent schools to have increased overall.

The implementation of *the rural quota* in Medicine at UWA was described in Chapter 3. The required level of 25% of students with a rural background has been achieved in the last two years. This was facilitated by the lowering of the TER threshold to 96, compared with previous levels of 99+. One of the obvious effects of this is a change in geographical locations of students. Furthermore, a flow-on effect is the addition of new schools represented in the cohorts and a consequent change in the overall socio-economic levels represented by these schools.

The final contextual factor was the implementation of the *Bonded Medical Places scheme*, as described in Chapter 3. The introduction of this scheme, with a quota of 25%, has had two effects. One is a welcome increase in the number of places in medical schools in Australia. The other is that by definition, these places are awarded to students who are ranked lower than students with unbonded places. Not all students are willing to accept a bonded place, hence some of these places are awarded to students who rank quite low on the list. This means in the case of UWA that their average scores on the three components, as a group, will be lower than for the group of unbonded students, whilst still being above the required thresholds. The ultimate effects of this scheme are yet to become apparent, given that it is a relatively new scheme. The importance of TER, the Interview score and the UMAT1 (Logical reasoning and problem solving) score as predictors of success in the course, as evidenced in the Predictive Validity Study, probably indicates that the progress of students holding bonded places needs to be monitored.

Equity issues in the UWA selection process appear to have been rigorously addressed, particularly with respect to the selection interview, and comments by stakeholders indicate considerable satisfaction with this important area. This was an issue common to all the groups of stakeholders interviewed in this study. Diversity in the medical student cohorts is an aspect which is difficult to define and to measure. There is increasing diversity in the geographical location of students with the implementation of the rural quota. Socio-economic status of the cohorts is intangible, as there is no specific measure available. An indicator has been the representation of the schools sectors, and trends in the representation of independent schools at UWA and in the medical course, suggest that this goal is not being achieved. However, the balance between the elite schools and the lower socio-economic independent schools has changed in a favourable

direction, so some progress may have been made. The representation of outer metropolitan schools, particularly in the government sector, has not increased. However, this may be more an issue of lack of applicants from such schools, rather than applicants failing to gain a place. Hence the cause is not to be found in the selection process, rather it is in the aspirations of students from these schools with respect to applying for entry to the medical course. (Authors note: The faculty has introduced a new programme, known as the Outer Metropolitan Program, to address this issue.

The importance of previous academic achievement is not questioned. However, there are equity and diversity aspects of the student cohorts which suggest that this criterion needs to be scrutinised closely if the future workforce in this important profession is to adequately represent the society in which it functions. Secondary schooling in traditional academic studies tends to favour those from higher socio-economic backgrounds, hence this group is more highly represented in high stakes courses such as Medicine. Affirmative action, as for the rural students, may need to be undertaken for under-represented groups, such as those from lower SES backgrounds and certain cultural backgrounds. This issue has a history in the US (Andrich and Mercer, 1997) and the UK (Searle, 2003) and more work is needed in the future to address this important criterion.

The outcomes of the new selection process in the light of changes in the curriculum and the workplace

A stated goal of the new selection process was greater congruity between the selection of students and the style of teaching in the medical course. It was apparent from the comments of academics that the new curriculum was developed and implemented independently of the new selection process. However, the introduction of the two in such close proximity has been timely, with respect to the suitability of the new students to the new curriculum. The interactive style of learning, in which communication skills and the ability to work co-operatively are important aspects of the new curriculum, appears to have utilised effectively the characteristics of the new cohorts of students. This aspect was the subject of comment by all academics who teach the students. They also commented that not all current students have good communication skills, and the new learning style does not suit those few people who prefer a more structured learning environment, but as a general principle the majority of students operate effectively in the

curriculum, and the new style of curriculum requires students with the characteristics valued in the new selection process.

Comments from hospitals on the first intake of interns indicate a positive reaction to the new graduates. The Generation Y factor, characterised by a strong sense of self-worth, a tendency to self-indulgence and forthrightness of expression has been noted, as has the propensity of these cohorts to have a greater interest in their work/life balance than previous cohorts. Both the teachers of medical students and the supervisors of the medical graduates have commented that the academic ability of the cohorts has not been eroded by the lowering of the academic threshold. The students appear to have 'demonstrated the intellectual capacity to complete the course and the personal characteristics to assist them in becoming successful practitioners', which was a stated goal of the new process. However, it is early in the new process and the new curriculum, and such outcomes need to be monitored well into the future.

The gender balance in the course was an element of concern regarding workforce implications for the future. The concern expressed was that the high proportion of females was a negative factor with respect to an increased proportion of part-time doctors in the future. However, there are many aspects to this factor, most of which are outside the influence of the selection process or indeed the medical curriculum. Trends in society, with respect to work and the work/life balance, will probably change for both males and females in the next few decades. Such factors are outside the scope of this study and may need to be addressed over time by governments and professional associations. A recent study in the UK (Kilminster, Downes, Gough, Murdoch-Eaton and Roberts, 2007) which aimed to explore such issues and to understand the effects of the changing composition of the medical profession, concluded that there is a great deal of work to be done in this area and a more sophisticated approach will need to be taken than in the past. They are convinced that these issues have immediate relevance for workforce planning and for understanding the changing nature of medical education and health care delivery.

The UWA process in the context of national and international trends.

From Chapter 4, which deals with the new selection processes of Australian undergraduate medical schools, it can be seen that UWA is

typical in the national context. The widespread use of the same three components of selection used across Australia is the foremost similarity. The main differences amongst all the Australian selection processes is the nature of the selection interview and the way in which the three components are used for ranking the applicants. The statistical combining of the three components is common to UWA, Monash University and the University of New South Wales. The major advantage of a process such as that used by these three universities is the objectivity and defensibility with respect to a purely numerical ranking process, which utilises all three components of selection in the final ranked list. The process of statistical combination is in contrast to those processes which use the components as successive thresholds, as described in Chapter 4.

As described in Chapter 1, the UWA process had its origins in discussions with the schools sectors, whose representatives felt uncomfortable with a system which used the TER only as a threshold. This decision, to include the TER in the ranking process in addition to having a threshold value, has been vindicated with the emergence of the TER as a major predictor of course outcomes.

As reported in Chapter 6, the Australian universities report similar outcomes with respect to their satisfaction with the cohorts selected, citing the socially outgoing nature of the students as well as their highly satisfactory academic performance. A recent review of the selection process used at UWA for all students entering Medicine and Dentistry (Mercer, 2006), concluded that the process and its outcomes were highly satisfactory and only minor adjustments were recommended. It should be noted that all Australian graduate medical schools use the Graduate Australian Medical Schools Admissions Test, an interview and the Grade Point Average. In the same way as the undergraduate schools, they use these components in different ways for the final ranking of applicants.

In the international context, there has been a great deal written about the need to select for medical students using criteria other than academic performance (Albanese *et al*, 2003). Peskun, Detsky and Shandling (2007) in reporting on a recent research project at the University of Toronto concluded that cognitive as well as non-cognitive factors evaluated in the admissions process are important in predicting future success in Medicine. The use of personal characteristics in selection is widespread and is becoming more rigorous in its application (McManus, 2001; Morrison, 2003; Searle, 2003). The literature review

in Chapter 2 points to multi-faceted selection strategies in the UK, Canada, the US and New Zealand. The use of aptitude tests such as the Medical College Admissions Test, the Medical School Admissions Test, the BioMedical Admissions Test and the UK Clinical Aptitude Test overseas, as well as the Graduate Australian Medical Schools Admissions Test in the Australian graduate context, is now commonplace and is accepted as part of high-stakes selection processes. One perceived weakness of these instruments is the lack of predictive validity evidence (McManus *et al*, 2005), but their use is relatively new and the lead-time needed for researching their effectiveness in this way is relatively long. It is likely to be some years before sufficient good quality data can be collected to test their predictive validity. They generally appear to be strong from the perspective of content and construct validity (Bell, 2005). The UMAT has been investigated for content and construct validity (Mercer and Chiavaroli, 2006) and a similar study of the Graduate Australian Medical Schools Admissions Test has been undertaken. However, there is still a need for considerable research into the use of aptitude tests in the medical selection process and the debate on their use will no doubt continue for some time to come.

In the past, selection interviews have been used extensively in the UK and the US, but the previously unstructured and informal nature of these is gradually being replaced with a more structured style, in which criteria are specified, rating scales are implemented and trained interviewers work in pairs, which increases the reliability (Powis, 1998). In this sense the Australian context appears to be quite advanced. The example of the University of Newcastle's interview, which has been used over a lengthy period of time, has provided a good model for the development of interview formats in most of the other undergraduate medical schools.

Internationally there is a great deal of work being done in the development of selection instruments, which satisfy all the requirements of reliability and validity, and which are being developed and evaluated with transparency and evidence-based rigour. Such initiatives are ongoing and will continue to be researched and reported in the future. Instruments such as the Mojac and the PQA (Powis, 2006) and the Multiple Mini Interview from McMaster University (Eva *et al*, 2004) are being developed, trialed and comprehensively researched. The plea from Tutton and Price (2002) for medical faculties to trial their selection processes, and to publish the results objectively in the same way that

they would present scientific medical research, is finally receiving attention. It seems clear that the debate with respect to the use of selection instruments will continue into the future (Groves *et al*, 2007; McManus and Powis, 2007).

Conclusions

The use of personal qualities in the selection of medical students appears to have been embraced for the foreseeable future. This is justified in the context of the high demand for the courses, the high quality of the applicants and changes in society and the workplace, which require more of modern professionals than intellectual capacity alone. The question then becomes how to assess these qualities in a fair, valid, transparent and reliable way for application in selection processes. Cognitive aspects of the person, their ability to communicate and their motivation to enter the medical profession seem to be acceptable criteria, provided they can be operationalised in a way which provides an equitable and fair assessment.

Selection processes of medical students are at the forefront of discussions in most medical faculties and are prominent in the literature, both nationally and internationally (Gorman *et al*, 2005; Groves *et al*, 2007; Hays, 2005; Hulsman *et al*, 2007; McManus and Powis, 2007; Parry, 2006; Powis, 2006; Story and Mercer, 2005). It is likely that on-going refinement of these processes will ensue. Instruments such as the UMAT, which is used by a large number of institutions, albeit that they use the instrument in different ways, will continue to be scrutinised and criticised until evidence becomes available which allows for easier evaluation of their efficacy. As stated earlier, the true evaluation of selection processes may come at a much later stage when some of the graduates of the courses have been working in the community for some years. The length of medical courses and the time taken for medical graduates to establish their credentials as professionals means that apart from institutions such as the University of Newcastle, which was foremost in making changes, most Australian medical schools are not yet in a position to evaluate the long-term outcomes. Furthermore, the rapid rate of change in society and the profession means that any conclusions regarding cause and effect are tenuous. In the short term the evaluation of changed selection processes is only possible at the undergraduate level.

Pressure on universities to select a relatively small number of students from a large pool, yet not to lower their standards, means that the debate on the quality of selection processes will continue. The high stakes nature of medical selection makes it important for faculties to be transparent about their selection processes and the policies that they espouse in formulating them. Such practices need to be articulated and made public, along with any research results on the outcomes, so that potential applicants can be aware of the differences between medical schools and the differing emphases that they have in their preferred cohorts and in their curricula. The demand for places is unlikely to diminish in the near future, given the limitations placed on them by governments, hence medical schools can continue to be selective and to consider carefully the nature of their requirements. The experience that they have had in the last decade in operationalising and objectifying these requirements should result in improved processes in the future.

Appendix

Non-Australian universities – an overview of selection processes

It is not possible to present a detailed analysis of the selection processes of medical schools overseas. However some general comments can be made and several brief case studies presented.

In the UK and the US it has long been the case that admissions processes in all courses require more than the use of academic scores (Andrich and Mercer, 1997). In the UK an application to the Universities and Colleges Admissions Service (UCAS), the central clearinghouse for all tertiary applications, requires a personal statement and a reference from an academic referee. At a later stage in the process when an application has been passed to an individual university, an interview is usually required, particularly for selective courses such as Medicine, Veterinary Science and Dentistry. Such interviews have been relatively unstructured and are not scored against strict criteria as with Australian medical schools. Practices such as this are now changing and more rigour is being introduced into the interview and selection processes.

Four different selection tests are currently in use in the UK (see the section on aptitude tests in Chapter 4 for more details) including the Graduate Australian Medical Schools Admissions Test (GAMSAT). Some universities use the BioMedical Admissions Test (BMAT), others use the Medical Students Admissions Test (MSAT), and a new test called the UK Clinical Aptitude Test (UKCAT) will be widely used from 2007. Brief case studies of Cambridge University and the University of Manchester are presented later in this section. Details are taken from the websites of the universities, which are specified at the end of the References.

In the US all medical courses are graduate courses and as such cannot be directly compared with undergraduate entry in Australia. However, the Medical College Admission Test (see Chapter 4) is used as part of the selection process of all medical schools. As with the UK an interview is routinely part of the selection process into all universities and in particular for selective courses. A brief case study of the Harvard Medical School is presented. In addition, a brief case study of entry to the undergraduate medical course at McMaster University in Canada is included.

In New Zealand, the medical schools at the University of Auckland and the University of Otago have both recently started to use the UMAT. Entry to the medical course at both these universities comes at the end of a first year of tertiary study in a health sciences course. At that stage selection into medicine is undertaken and these selection processes will be briefly described in this appendix. The information is taken from the websites of the two universities.

Case Studies

Cambridge University

The undergraduate medical course requires the following selection components:

- BMAT (see Chapter 4 for details)
- Interview
- Sometimes several school essays.
- High level academic success at A-levels

Interviews are intended to identify in applicants the characteristics that most suit students to undergraduate study at Cambridge. Put generally, these are:

- A passion for your chosen subject
- An ability to think independently
- Enthusiasm for complex and challenging ideas

More specifically, we (sic) are looking to assess:

- The appropriateness of your chosen course for you
- Motivation, commitment and organisation
- Ability to think critically and analytically
- Intellectual flexibility. By this, we mean your ability to
 - Pick up new ideas quickly
 - Apply your existing knowledge to situations you have not encountered before
- Vocational or professional commitment, where appropriate (eg Medicine)

The University of Manchester

The following selection components are used:

UKCAT (see Chapter 4 for details)

Personal statement

- Reasons for choosing Medicine
- Work experience in a caring role
- Interests/hobbies

Reference

This is likely to be written by the head teacher, college principal or the head of year/form tutor. The reference should cover these essential areas:

- Commitment to Medicine
- Staying power/perseverance
- Communication skills
- Humanity/humility
- Intellectual potential
- Leadership qualities
- Team work

Interview

Short-listed candidates will be called for interview in the School of Medicine. No candidate will be offered a place at Manchester without an interview.

The interview itself is a formal though friendly process. Each interview lasts 15 minutes (no more, no less). The interview panel comprises three (occasionally two) interviewers and a chairperson. The majority of the interviewers are practising clinicians. The interview is not a test of a candidate's academic knowledge. The pre-interview screening process operated by the School of Medicine (based on academic grading, personal statement and reference) will already have ensured that all candidates called to interview appear to have sufficient academic potential. The purpose of the interview is to take a wider view of the applicant as described below.

What the interviewers are looking for:

Ability to communicate

Why does candidate wish to be a doctor?

Knowledge of the Manchester course

What are the student's outside interests?

Previous caring experience

Matters of a medical interest

Ethical and other issues

Harvard Medical School

Admission to Harvard Medical School is very selective. We seek students of integrity and maturity who have concern for others, leadership potential and an aptitude for working with people.

The Committee on Admissions evaluates applications based on several factors, including:

- Academic Records
- Applicant's essay
- Medical College Admission Test (MCAT) scores
- Extracurricular activities
- Summer Occupations
- Life experiences
- Experience in the health field, including research or community work
- Letters of evaluation

McMaster University

The selection process has three elements: academic requirements, an autobiographical submission and an interview. From 2007/08 a fourth element will be added, namely the MCAT verbal reasoning requirement when the test becomes computer-based.

There are two **absolute requirements** for eligibility to apply to the programme:

- Applicants must have completed a minimum of 3 full academic years of university undergraduate degree level work; (***Please note - any applicant that has completed a Bachelor's degree at the time of application is eligible to apply, even if the degree was granted in less than 3 years or 30 credits*).
- Applicants must have achieved an overall OMSAS converted average of 3.00 on the 4.00 point scale.

Applicants must provide an Autobiographical Submission which is a description about their preparedness for Medicine and suitability for the McMaster Undergraduate Medical Program.

Several hundred applicants will be invited for interviews in Hamilton in March or April. Invitations for interview are determined on the basis of applicants' academic performance, an assessment of their preparedness for a career in Medicine and suitability for the McMaster Undergraduate Medical Program. From this group a class of 148 is selected.

The Undergraduate Medical Program uses two formulae to rank applicants - the first provides a rank order list for invitation to interview, and the second provides a rank order list for offer of

admission. The overall weightings reflect our commitment to consider the cognitive and professional qualities of applicants equally.

Formula 1 - 58% Undergraduate Grade Point Average, 38% Autobiographical Submission Score, up to 4% graduate experience.

Formula 2 - 33% Undergraduate Grade Point Average, 67% Multiple Mini-Interview.

Note: Some details are included on the multiple mini-interview in the literature review in Chapter 2 of this thesis.

The University of Auckland

Entry to the undergraduate medical course entails study for a full academic year in either The Bachelor of Health Sciences or the Bachelor of Science (Biomedical Science), which have four common courses. Overall an applicant must achieve a B+ average in their eight courses to be eligible for selection to medicine.

Applicants are ranked for selection for interview based on a combined score of their grades in the four common courses (80%) and the UMAT score (20%). Approximately twice as many applicants are interviewed as places available; and interviewees are then ranked on a combined score from their interview, their academic grade and the UMAT score.

The University of Otago

Entry to the undergraduate medical course for school-leavers entails study for a full academic year in the Health Sciences First Year. Applicants for medicine must attain a mark of 70% or more in each of the seven units which comprise this year as well as achieving a UMAT threshold score.

Applicants are ranked for selection into the medical course based on a combined score of their GPA in the Health Sciences First Year (two thirds) and the UMAT score (one third).

Overview

Some of these selection processes are very detailed and complex and contain elements on which judgments need to be made on the part of those involved in the selection of students. Unstructured and subjective interviews are slowly being replaced with more objective processes (see literature review in Chapter 2). However, there are still elements like personal statements, references, essays and letters of recommendation which need to be read, evaluated and somehow incorporated into the selection process. These are the elements which are also open to input from professional 'coaches' in the admissions 'industry'. This is

particularly the case in the US which operates a decentralised system in which each university receives a full application from each applicant and very little collaboration exists between universities. The only common elements to applications are the use of the MCAT and the GPA.

The two New Zealand universities have processes which are similar to some of those in Australia, the main difference being that selection takes place at the end of a first year of tertiary study.

It is important to note that an applicant's academic record is of primary interest in all selection processes whether they are for undergraduate or graduate programmes.

References

- ACER (2006). Information booklet UMAT 2006: Undergraduate Medicine and Health sciences Admission Test. Camberwell, Victoria, Australian Council for Educational Research.
- Albanese, M. A., M. H. Snow, *et al.* (2003). 'Assessing personal qualities in medical school admissions.' *Acad Med* 78(3): 313-21.
- Anastasi, A. and Urbina, S. (1997) Psychological Testing. Upper Saddle River, NJ, Prentice Hall.
- Andrich, D., G. Rowley, *et al.* (1989). *Upper Secondary School Certification and Tertiary Entrance Research Project*, Report commissioned by Minister for Education in Western Australia, Dr Carmen Lawrence
- Andrich, D. and A. Mercer (1997). International Perspectives on Selection Methods of Entry into Higher Education. Canberra, National Board of Employment, Education and Training: 1-79.
- Arulampalam, W., R. Naylor, *et al.* (2004). 'Factors affecting the probability of first year medical student dropout in the UK: a logistic analysis for the intake cohorts of 1980-92.' *Med Educ* 38: 492-503.
- Basco, W. T., G. E. Gilbert, *et al.* (2002). 'Determining the Consequences for Rural Applicants When Additional Consideration is Discontinued in a Medical School Admission Process.' *Academic Medicine* 77(10)(October): s20-s22.
- Basco, W. T., G. E. Gilbert, *et al.* (2000). 'The Ability of a Medical School Admission Process to Predict Clinical Performance and Patient's Satisfaction.' *Acad Med* 75: 743-747.
- Bell, J. (2005). 'The case against BMAT: Not withering but withered.' *BMJ* 331.
- Bore, M., D. Munro, *et al.* (2005). 'Selection of medical students according to their moral orientation.' *Med Educ* 39: 266-275.
- Caan, W. (2003). 'Personality and performance during a medical degree. Selecting for extreme personality types is perilous.' *BMJ* 326(7396): 986.
- Carmel, S. (1998). 'Medical students' attitudes regarding the use of life-sustaining treatments for themselves and for elderly persons.' *Social Science & Medicine* 46(4-5): 467-474.
- Cate, O. T., K. Smal, *et al.* (2002). 'Educational Assessment Center Techniques for Entrance Selection in Medical School.' *Acad Med* 77(7)(July): 737.
- Chamberlain, S. E. and J. Searle (2005). 'Assessing suitability for a problem-based learning curriculum: evaluating a new student selection instrument.' *Med Educ* 39: 250-257.
- Chant, D and Lingard, R (1991). 'Socio-economic indices and the identification of disadvantaged school' Department of education, University of Queensland.
- Cooper, R. A. (2003). 'Medical schools and their applicants: An analysis.' *Health Affairs* 22(4): 71-84.
- Daniel, A. E., R. J. Burn, *et al.* (1999). 'Patients' complaints about medical practice.' *Med J Aust* 170(12): 598-602.
- Dean, S. J., A. L. Barratt, *et al.* (2003). 'Preparedness for hospital practice among graduates of a problem-based, graduate-entry medical program.' *Med J Aust* 178(4): 163-6.
- Donnon, T., E. O. Paolucci, *et al.* (2007). 'The Predictive Validity of the MCAT for Medical School Performance and Medical Board Licensing Examinations: A Meta-Analysis of the Published Research.' *Acad Med* 82(1): 100-106.

- Editorial (1998). 'Revalidation for doctors.' *BMJ* 317 (7166)(October): 1094.
- Edwards, J. C., C. L. Elam, *et al.* (2001). 'An admission model for medical schools.' *Acad Med* 76(12): 1207-12.
- Elam, C., T. D. Stratton, *et al.* (2001). 'Measuring the Emotional Intelligence of Medical School Matriculants.' *Acad Med* 76(5)(May): 507-508.
- Elam, C. L. and D. W. Rudy (2000). 'Medical school matriculants' perceptions of physician competencies and qualities.' *Acad Med* 75(5): 511-2.
- Elliott, S. J. and J. Epstein (2005). 'Selecting the future doctors: the role of graduate medical programmes.' *Internal Medicine Journal* 35: 174-177.
- Elstein, A., S. Sprafka, *et al.* (1979). 'Problem Solving: Applications of Research to Undergraduate Instruction and Evaluation.' *Programmed Learning and Educational Technology* 16(4): 296-302.
- Eva, K. W. (2004). 'What every teacher needs to know about clinical reasoning.' *Medical Education* 39(June): 98-106.
- Eva, K. W., H. I. Reiter, *et al.* (2004). 'The Relationship between Interviewers' Characteristics and Ratings Assigned during a Multiple Mini-Interview.' 602-609.
- Feagin, J., Orum, A., and Sjöberg, G (Eds). (1991). 'A case for case study'. Chapel Hill, NC: University of North Carolina Press
- Ferguson, E., D. James, *et al.* (2002). 'Factors associated with success in medical school: systematic review of the literature.' *BMJ* 324: 952-957.
- Ferguson, E., D. James, *et al.* (2003). 'Pilot study of the roles of personality, references, and personal statements in relation to performance over the five years of a medical degree.' *BMJ* 326 (February): 429-432.
- Fones, C. S., E. H. Kua, *et al.* (1998). 'What makes a good doctor?'—views of the medical profession and the public in setting priorities for medical education.' *Singapore Med J* 39(12): 537-42.
- Gorman, D., I. Martin, *et al.* (2005). 'Selecting the future doctors: the role of graduate medical programmes.' *Intern Med J* 2005 Aug; 35 (8) 501-2
- Groves, M., J. Gordon, *et al.* (2007). 'Entry test for graduate medical programs: is it time to re-think?' *MED J AUST* 186: 120-123.
- Groves, M., P. O'Rourke, *et al.* (2003). 'The association between student characteristics and the development of clinical reasoning in a graduate-entry, PBL medical programme.' *Medical Teacher* 25(6): 626-631.
- Groves, M., I. Scott, *et al.* (2002). 'Assessing clinical reasoning: a method to monitor its development in a PBL curriculum.' *Med Teach* 24(5): 507-15.
- Harris, S. and C. Owen (2007). 'Discerning quality: using the multiple mini-interview in student selection for the Australian National University Medical School.' *Med Educ* 41(3): 234-241.
- Hays, R. (2005). 'What are we selecting for?' *BMJ* 331.
- Hojat, M. (2003). 'Jefferson Educators Look to Improve Physician Empathy.' Retrieved April 2004, from <http://www.aamc.org/newsroom/bulletin/jmctju/030606.htm>.
- Howes, D. (2002). 'Selection of medical students. How can medical schools produce good doctors if political dogma restricts them?' *BMJ* 325(7362): 495.
- Hughes, P. (2002). 'Can we improve on how we select medical students?' *J R Soc Med* 95(1): 18-22.
- Hughes, R. (1993). *Culture of complaint: the fraying of America*. New York, Oxford University Press.

- Hupp, J. (2004). 'Admissions committees select our future dental professionals. Right?' *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology & Endodontics* 97(1): 1-2.
- Hulsman, R. L., J. van der Ende, *et al.* (2007). 'Effectiveness of selection in medical school admissions: evaluation of the outcomes among freshman.' *Med Educ* 41(4): 369-377.
- James, D. and C. Chilvers (2001). 'Academic and non-academic predictors of success on the Nottingham undergraduate medical course 1970-1995.' *Medical Education* 35: 1056-1064.
- Joyce, C. and R. Wolfe (2005). 'Geographic distribution of the Australian primary health workforce in 1996 and 2001.' *Aust N Z Public Health* 29(2)(April): 129-35.
- Jung, H. P., M. Wensing, *et al.* (1997). 'What makes a good general practitioner: do patients and doctors have different views?' *Br J Gen Pract* 47(425): 805-9.
- Kilminster, S., J. Downes, *et al.* (2007). 'Women in medicine - is there a problem? A literature review of the changing gender composition, structures and occupational cultures in medicine.' *Med Educ* 41(1): 39-49.
- Kalkarni, K. (2006). 'More medicine by numbers.' *BMJ* 332.
- Leahy, M., W. Cullen, *et al.* (2003). 'What makes a good doctor?' A cross sectional survey of public opinion.' *Ir Med J* 96(2): 38-41.
- Lievens, F. and P. Coetsier (2002). 'Situational tests in student selection: An examination of predictive validity, adverse impact, and construct validity.' *International Journal of Selection & Assessment* 10(4): 245-257.
- Lievens, F., P. Coetsier, *et al.* (2002). 'Medical students' personality characteristics and academic performance: a five-factor model perspective.' *Med Educ* 36: 1050-1056.
- Lippell, S. (2002). 'Creativity and medical education.' *Medical Education* 36(6): 519.
- Lumb, A. B. and A. Vail (2004). 'Comparison of academic, application form and social factors in predicting early performance on the medical course.' *Med Educ* 38: 1002-1005.
- Lumsden, M., M. Bore, *et al.* (2005). 'Assessment of personal qualities in relation to admission to medical school.' *Medical Education* 39: 259-265.
- McGaghie, W. C. (2002). 'Assessing readiness for medical education: Evolution of the Medical College Admission Test.' *Journal of the American Medical Association* 288(9)(September 2002): 1085 - 1090.
- McManus, I. C. (2001). Student Selection. *A practical guide for medical teachers*. Chapter 35: 379-391.
- McManus, I. C. and D. Powis (2007). 'Testing medical school selection tests.' *MED J AUST* 186(3): 118-119.
- McManus, I. C., D. Powis, *et al.* (2005). 'Intellectual aptitude tests and A levels for selecting UK School leaver entrants for medical school.' *BMJ* 331: 555-559.
- McManus, I. C., E. Smithers, *et al.* (2003). 'A levels and intelligence as predictors of medical careers in UK doctors: 20 year prospective study.' *BMJ* 327(19 July): 139-142.
- Mercer, A. (2006). *Review of the selection process of students into Medicine and Dentistry at The University of Western Australia*, Report to the Faculty, UWA.
- Mercer, A. and N. Chiavaroli (2006). *UMAT: A Validity Study. A review of the underlying constructs and an analysis of the content of the Undergraduate Medicine and Health Sciences Admission Test*. A report prepared for the UMAT Consortium.

- Miller, P (2004) Unpublished report on research, Graduate School of Management, UWA
- Morrison, J. (2003). 'Inputs and outputs in Medical education.' *Med Educ* 37: 395-396.
- Morrison, J. (2005). 'How to choose tomorrow's doctors.' *Medical Education* 39: 240-242.
- Munro, D., M. Bore, *et al.* (2005). 'Personality factors in professional ethical behaviour: Studies of empathy and narcissism.' *Australian Journal of Psychology*. 57(May): 49-60
- Nicholson, S. (2005). 'The benefits of aptitude testing for selecting medical students.' *BMJ* 331: 559-560.
- Norman, G. (2006). 'Commentary: Standardising the process versus improving the methods.' *BMJ* 332: 1008-1009.
- Parry, J., J. Mathers, *et al.* (2006). 'Admissions processes for five year medical courses at English schools: a review.' *BMJ* 332.
- Patrick, L. E., E. Altmaier, *et al.* (2001). 'A Structured Interview for Medical School Admission, Phase 1: Initial Procedures and Results.' *Academic Medicine* 76(1)(January): 66-71.
- Peskun, C., A. Detsky, *et al.* (2007). 'Effectiveness of medical school admissions criteria in predicting residency ranking four years later.' *Med Educ* 41(1).
- Powis, D. (1998). 'How to do it Select medical students.' *BMJ* 317 (7166)(October): 1149-1150.
- Powis, D. (2003). 'Selecting medical students.' *Medical Education* 37: 1365-2923.
- Powis, D. (2006). 'Evidence-based Admissions Procedures for Medical Students.' *BMJ* 332.
- Powis, D. A. (1994). 'Selecting Medical Students.' *Medical Education* 28: 443 - 469.
- Pritchard, L. (2003). 'Insituting a medical education revolution.' *Medical Education* 37: 678-679.
- Rasch, G. (1960/1980). *Probabilistic Models for Some Intelligence and Attainment Tests*. Chicago, MESA Press (original work published 1960)
- Reede, J. Y. (1999). 'Predictors of success in medicine.' *Clin Orthop*(362): 72-7.
- Reiter, H. I., K. W. Eva, *et al.* (2007). 'Multiple mini-interviews predict clerkship and licensing examination performance.' *Med Educ* 41(4): 378-384.
- Searle, J. (2003). 'Equal opportunity does not produce equity: (not) getting into medical school.' *Med Educ* 37: 290-291.
- Searle, J. (2003). 'Higher education admissions policies tested again.' *Medical Education* 37: 850-851.
- Searle, J. and J. McHarg (2003). 'Selection for medical school: just pick the right students and the rest is easy!' *Med Educ* 37: 458-463.
- Self, D., D. Baldwin, *et al.* (2000). 'Should Moral Reasoning Serve as a Criterion for Student and Resident Selection?' *Clin Orthop* 378(September): 115-123.
- Smith, F. (2003). 'Equity in Medical School Admissions.' *Med Educ* 37: 746.
- Smith, M. D. and C. Hayling (1998). 'Better admission criteria.' *Acad Med* 73(10): 1054-5.
- Stake, R. (1995). 'The art of case research' Newbury park, CA: Sage Publications
- Stanley, N. (Ed.) (1982). *Faculty of Medicine, The University of Western Australia, The First Quarter Century (1957-1982)*. Nedlands, Western Australia, Faculty of Medicine, The University of Western Australia.
- Story, M. and A. Mercer (2005). 'Selection of medical students: an Australian perspective.' *IMJ* 35: 647-649.

- Streyffeler, L., E. Altmaier, *et al.* (2005). 'Development of a Medical School Admissions Interview Phase 2: Predictive Validity of Cognitive and Non-cognitive Attributes.'
- Turnbull, D., P. Buckley, *et al.* (2003). 'Increasing the evidence base for selection for undergraduate medicine: four case studies investigating process and interim outcomes.' *Medical Education DOI* 37: 1115-1120.
- Turnbull, D. and J. Robinson (2005). 'Academic and personal qualities as predictors of performance over a six year medical degree: 6 year prospective study. Adelaide: 1-5.
- Tutton, P. (1997). 'The Selection Interview.' *Journal of Higher Education Policy and Management* 19: 27-33.
- Tutton, P. and M. Price (2002). 'Selection of medical students.' *BMJ* 324(7347): 1170-1.
- Tutton, P. J. M. (1993). 'Medical school entrants: semi-structured interview ratings, prior scholastic achievement and personality profiles.' *Medical Education* 27(February): 328-336.
- Tutton, P. J. M. (1994). 'The Development of a Semi-structured Interviewing System to be used as an Adjunct to Secondary School Performance for the Selection of Medical Students.' *Australian Journal of Education* 38: 219-232.
- Van Den Berg, P. and J. Feij (2003). 'Complex relationships among personality traits, job characteristics and work behaviours.' *International journal of selection and assessment* 11(4): 326.
- Vu, N. V., B. Dawson-Saunders, *et al.* (1987). 'Use of a medical reasoning aptitude test to help predict performance in medical school.' *Med Educ* 62(4): 325-35.
- Wagner, P. J., D. M. Jester, *et al.* (2001). 'Use of the Emotional Quotient Inventory in medical education.' *Acad Med* 76(5): 506-7.
- Ward, A. M., M. Kamien, *et al.* (2004). 'Medical career choice and practice location: early factors predicting course completion, career choice and practice location.' *Med Educ* 38(3): 239-48.
- Watson, W. (2006). 'Re: Evidence-based Admissions Procedures for Medical Students.' *BMJ* 332.
- Whitcomb, M. E. (2003). 'Achieving the Educational value of Diversity.' *Academic Medicine* 78(5)(May): 429-430.
- Whitcomb, M. E. and L. C. Bollinger (2003). 'The Need for Diversity in Higher Education.' *Academic Medicine* 78(5)(May): 431-436.
- White, C. (2005). 'Stress and pressure to blame for doctors' poor performance.' *BMJ* 331(October).
- Wilhelm, K. A. and H. Lapsley (2000). 'Disruptive doctors. Unprofessional interpersonal behaviour in doctors.' *Med J Aust* 173(7): 384-6.
- Wilkinson, D., G. Laven, *et al.* (2003). 'Impact of undergraduate and postgraduate rural training, and medical school entry criteria on rural practice among Australian general practioners: national study of 2414 doctors.' *Med Educ* 37(March): 809-814.
- Williams, K. B., D. R. Glasnapp, *et al.* (2003). 'Predictive validity of critical thinking skills for initial clinical dental hygiene performance.' *J Dent Educ* 67(11): 1180-92.
- Wolming, S. (1999). 'Validity issues in higher education selection: A Swedish example.' *Studies In Educational Evaluation* 25(4): 335-351.

- Woloschuk, W. and M. Tarrant (2004). 'Do students from rural backgrounds engage in rural family practice more than their urban raised peers?' *Medical Education* 38: 259-261.
- Woods, D. (1997). 'Problem Solving in the Context of Medicine.' *Journal of college science teaching* 26(3): 216-20.
- Yates, J. and D. James (2006). 'Predicting the 'strugglers': a case-control study of students at Nottingham University Medical School.' *BMJ* 332: 1009-1013.
- Yin, R. (1994). 'Case study research: Design and methods (2nd ed.)' Thousand oaks, CA: Sage Publishing

Websites

<http://www.meddent.uwa.edu.au/go/home>
<http://www.ukcat.ac.uk/home/>
<http://www.bmat.org.uk/>
<http://www.aamc.org/students/mcat/start.htm>
<http://www.ucas.ac.uk/tests/msat.html>
<http://www.acer.edu.au/>
<http://registrar.mcmaster.ca/external/index.htm>
<http://hms.harvard.edu/admissions/>
<http://www.manchester.ac.uk/>
<http://www.admissions.ox.ac.uk/>
<http://www.health.auckland.ac.nz/undergrad/medicine/entry.html>
<http://www.otago.ac.nz/study/entrance.html>
http://en.wikipedia.org/wiki/Generation_Y
http://www.usatoday.com/money/workplace/2005-11-06-gen-y_x.htm