SELECTION OF MEDICAL STUDENTS : THE RELATIONSHIP BETWEEN PRE-ADMISSION ACADEMIC ACHIEVEMENTS & STUDENTS' PROFILES TO PERFORMANCE IN MEDICAL SCHOOL

By

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TABLE OF CONTENTS

		Page
Acknowledgement		ii
List of Tables		v
List of Figures		vii
Abstrak		viii
Abstract		x
Chapter		
I	INTRODUCTION	1
	1.1. Issues in the selection of medical students	1
	1.2. Selection criteria	7
	1.2.1. Knowledge and cognitive ability	7
	1.2.2. Personal characteristics and attitudes	8
	1.2.3. Psychomotor skills	10
	1.3. Selection procedure	10
	1.4. Statement of the problem	13
	1.5. Significance of the study	15
	1.6. General objective	17
	1.7. Specific objectives	17
	1.8. Null hypothesis of the study	18
II	METHODOLOGY	19
	2.1. Study design	19
	2.2. Study location	19
	2.3. Study population	19
	2.3.1. Inclusion criteria	20
	2.3.2. Exclusion criteria	20
	2.4. Study instruments	20
	2.4.1. Questionairres	20
	2.5. Variables	23
	2.6. Data collection	24
	2.7. Data analysis	24
	2.7.1. Descriptive statistics	27

2.7.2. Statistical tests....27

III RESULTS....28
3.1. Descriptive analysis....28
a) Profile....28
b) Factors influencing choice of medical course....32
c) Perception of the medical course before and after joining the programme....34
d) Prior knowledge about the course....35
e) SPM grades....35
3.2. Analytical....38
a) Predictors of pre-clinical performance....38
i. Academic....38
ii. Profile factors....41
iii. Factors influencing choice of medical course....43
iv. Expectation and prior knowledge about the course....45
b) Predictors of early clinical performance....46
i. Academic....46
ii. Profile factors....56
iii. Factors influencing choice of medical course....66
iv. Expectation about the course....81
c) Regression analysis....84
i. Predictive power in pre-clinical performance....84
ii. Predictive power in early clinical performance....85
Medicine-Surgery posting....85
Obstetrics & Gynaecology posting....86
Paediatrics posting....87
Psychiatry posting....88
ENT posting....89
Dermatology posting....90
Ophthalmology posting....91

IV DISCUSSION....95
Limitations of the study....109

V CONCLUSION & RECOMMENDATIONS....111

VI BIBLIOGRAPHY....114

APPENDICES....120

LIST OF TABLES

Table 3.1.	Characteristics of respondents
Table 3.2.	Percentage of respondents who agreed with the statements below : before and after they became medical students
Table 3.3.	Grades of SPM subjects according to gender of respondents
Table 3.4.	SPM subject grades by pre-admission programme
Table 3.5.	Association between matriculations/STPM programme and Year 2 examination results
Table 3.6.	Association between SPM subject grades and Year 2 examination results
Table 3.7.	Association between respondents' profile and Year 2 examination results
Table 3.8.	Association between factors influencing choice of medical course and Year examination results
Table 3.9.	Association between prior knowledge about the course, perception of medical course and Year 2 examination results
Table 3.10.	Association between matriculations/STPM programme and early clinical performance
Table 3.11.	Early clinical performance by grades in Bahasa Malaysia
Table 3.12.	Early clinical performance by grades in English
Table 3.13.	Early clinical performance by grades in Biology
Table 3.14.	Early clinical performance by grades in Chemistry
Table 3.15.	Early clinical performance by grades in Physics
Table 3.16.	Early clinical performance by gender
Table 3.17.	Early clinical performance by ethnicity
Table 3.18.	Early clinical performance by marital status
Table 3.19.	Early clinical performance by type of secondary schools
Table 3.20.	Early clinical performance by source of fee payment
Table 3.21.	Early clinical performance by household income
Table 3.22.	Early clinical performance by `interest in helping people' as a motivating factor
Table 3.23.	Early clinical performance by `high status profession' as a motivating factor
Table 3.24.	Early clinical performance by `doctor's high salary' as a motivating factor
Table 3.25.	Early clinical performance by `wide range of job opportunities' as a motivating factor
Table 3.26.	Early clinical performance by `good results at school' as a motivating factor

Table 3.27. Early clinical performance by `feeling destined to be a doctor' as a motivating factor
Table 3.28. Early clinical performance by `having a family member who is a doctor' as a motivating factor
Table 3.29. Early clinical performance by `personal illness' as a motivating factor
Table 3.30. Early clinical performance by `others' illness' as a motivating factor
Table 3.31. Early clinical performance by `lack of doctors in the country' as a motivating factor
Table 3.32. Early clinical performance by `parental wish' as a motivating factor
Table 3.33. Early clinical performance by students' actual picture about medical school
Table 3.34. Multiple logistic regression analysis to the good performance of Year 2
Table 3.35. Multiple logistic regression analysis to the good performance of Medicine-Surgery posting
Table 3.36. Multiple logistic regression analysis to the good performance of Obstetrics & Gynaecology posting
Table 3.37. Multiple logistic regression analysis to the good performance of Paediatrics posting
Table 3.38. Multiple logistic regression analysis to the good performance of Psychiatry posting
Table 3.39. Multiple logistic regression analysis to the good performance of ENT posting
Table 3.40. Multiple logistic regression analysis to the good performance of Dermatology posting
Table 3.41. Multiple logistic regression analysis to the good performance of Ophthalmology posting
Table 3.42. Summary of multiple logistic regression analysis of the pre-entry variables versus the performance in medical school

LIST OF FIGURES

Figure 2.1. Doctor of Medicine Programme (MD) of Universiti Putra Malaysia
Figure 3.1. Percentage of respondents according to age
Figure 3.2. Percentage of respondents according to age at which they decided to study medicine
Figure 3.3. Motivational factors for choosing medicine as a career by gender
Figure 3.4. Percentage of SPM subjects grades

ABSTRAK

Pemilihan Pelajar Perubatan: Hubungkait di antara pencapaian pra-kemasukan dan profil pelajar dengan prestasi sepanjang mengikuti kursus perubatan

TUJUAN: Satu kajian retrospektif untuk mendapatkan hubungkait antara pencapaian akademik pra-kemasukan, profil pelajar dan prestasi mereka semasa mengikuti kursus perubatan di Fakulti Perubatan dan Sains Kesihatan, Universiti Putra Malaysia telah dijalankan dari Mei 2005 hingga Oktober 2005. Kajian ini melibatkan 5 subjek Sijil Pelajaran Malaysia (SPM) iaitu Bahasa Malaysia, Bahasa Inggeris, Biologi, Kimia dan Fizik serta program matrikulasi/ Sijil Tinggi Pelajaran Malaysia (STPM). Profil pelajar merangkumi juga variabel demografi dan faktor-faktor motivasi. METODOLOGI: Semua pelajar yang telah mengikuti kursus di tahun-tahun pra-klinikal dan menjalani semua `posting' di Tahun 3 dan 4 terlibat di dalam kajian ini (n=147). Variabel bersandar adalah keputusan peperiksaan Tahun 2, `posting' Perubatan-Pembedahan, Pediatrik, Obstetrik & Ginekologi, Psikiatri, Otorinolaringologi, Dermatologi dan Oftalmologi. Keputusan peperiksaan Tahun 2 mewakili pencapaian tahun pra-klinikal sementara keputusan lain mewakili pencapaian tahun klinikal. Keputusan gred A, B+ dan B adalah dianggap baik manakala gred C+, C dan F adalah sederhana/lemah. Ujian statistik yang digunakan bagi menentukan hubungkait adalah Ujian Chi-square dan Fisher's Exact. Analisa regresi logistik turut digunakan bagi menentukan hubungkait antara variabel penting dan variable

bersandar. KEPUTUSAN: Hasil kajian menunjukkan variabel-variabel yang mempunyai hubungkait dengan prestasi di dalam kursus perubatan adalah 4 subjek SPM (iaitu Bahasa Inggeris, Biologi, Kimia dan Fizik), program STPM, jantina lelaki, berbangsa Cina dan pelajar yang berasal dari sekolah harian. Penilaian akhir menunjukkan pelajar STPM mempunyai kemungkinan 12.2 kali ganda untuk menunjukkan prestasi baik semasa di Tahun 2, 16.1 kali ganda bagi posting Perubatan dan Pembedahan serta 3.6 kali ganda bagi posting Oftalmologi. Pelajar yang mahir dalam Biologi pula berkemungkinan 2.6 kali ganda untuk mendapat markah tinggi bagi Tahun 2, Fizik – kemungkinannya 5 kali ganda bagi posting Perubatan dan Pembedahan, Kimia – kemungkinannya 2.4 kali ganda bagi posting Psikiatri, 4.8 kali ganda bagi Otorinolaringologi dan 2.7 kali ganda bagi Oftalmologi. Pelajar dari sekolah harian pula mempunyai kemungkinan 3.5 kali ganda mendapat markah tinggi bagi Psikiatri. Memilih kursus perubatan disebabkan desakan ibubapa dan tertarik dengan peluang kerjaya yang lebih luas tidak membantu dalam mencapai keputusan baik bagi Tahun 2 dan posting Otorinolaringologi. KESIMPULAN: Kajian ini mencadangkan bahawa terdapat hubungkait antara pencapaian akademik pra-kemasukan, profil pelajar dan prestasi mereka dalam kursus perubatan.

ABSTRACT

Selection of Medical Students : The Relationship Between Pre-admission Academic Achievement and Students' Profiles To Performance In Medical School

AIM: A retrospective study to determine the association between pre-admission academic achievement and students' profiles with their medical school performance was conducted in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia from May 2005 to October 2005. This study analysed 5 Sijil Pelajaran Malaysia (SPM) subjects (i.e. Bahasa Malaysia, English, Biology, Chemistry and Physics) and type of pre-admission programme [matriculation or Sijil Tinggi Pelajaran Malaysia (STPM)]. Students' profiles include their demographic variables and motivational factors. METHOD: All students who have gone through the pre-clinical years and all the clinical postings in Year 3 and Year 4 are included in this study (n=147). The outcome measures were the results of Year 2, postings of Medicine-Surgery, Paediatrics, Obstetrics & Gynaecology, Psychiatry, ENT, Dermatology, Ophthalmology. Year 2 examination results represent performance in the pre-clinical years while the rest of the outcomes represent performance in the early clinical years. The outcome of grades A, B+ and B are considered as good results while grades C+, C and F are average/poor results. Statistical tests used to determine the associations are Chi-square and Fisher's Exact test. Further analysis was carried out using logistic regression to

examine the relationship between important variables and all the outcomes. RESULTS: Univariate analysis found variables associated with good performance in medical school to include: four SPM subjects (i.e. English, Biology, Chemistry and Physics), STPM programme, male, Chinese and students from day schools. At final assessment, students who were from the STPM programme were 12.2 times more likely to perform well in Year 2, 16.1 times more likely in Medicine-Surgery and 3.6 times more likely in Ophthalmology. Students who were good in Biology were 2.6 times more likely to perform well in Year 2, while those good in Physics were 5 times more likely to perform well in Medicine-Surgery, students who did well in Chemistry were 2.4 times more likely to perform well in Psychiatry, 4.8 times more in ENT and 2.7 times more in Ophthalmology. Those from day school were 3.5 times more likely to do well in Psychiatry. Parental wish was inversely related to the performance in Ophthalmology while choice of wide range of job options in medicine was inversely related to outcomes in Year 2 and ENT. CONCLUSION: This study suggests that there is a relationship between pre-admission qualifications, students' profile and subsequent performance in the medical school.

I. INTRODUCTION

Selecting students for admission into a medical course is a great challenge. For years, studies have been conducted to address several issues in selection of medical students.

1.1. Issues in the selection of medical students

In formulating an admission policy, medical schools might face pressures from within the university, medical school and the public. Each of the stakeholders may have its own major concern regarding the medical school graduates. The pressures faced by the medical school can be minimized if stakeholders can agree on a common set of goals. It is a general belief that a medical school has a responsibility beyond that of ensuring students graduate with a degree at the end of the course (Bullimore, 1992). A medical school should also be responsible for providing good doctors to the society, who are not only knowledgeable but ethical and caring in practice (Bullimore, 1992). In producing such doctors, several factors to be considered are type of medical curriculum, quality of teaching, physical and financial resources of the medical school as well as the type of students being admitted into the course. These factors are very much related to the institutional goals. Therefore, it is crucial to know the institutional goals and societal expectations (Glick, 1994). Based on these goals and expectations of the institute and society, several selection criteria can be

considered. Knowing which selection criteria to be used, the most appropriate selection method can then be put in place. Some medical schools may be more directed towards research while others may wish to produce more family doctors (Glick, 1994). Most people view the medical course as work training in which medical students are expected to make medicine their career, to be a practicing doctor unlike other degree courses where such expectation does not always exist (Lowry, 1992) Therefore, the selection process during admission is about choosing who among the applicants will be good doctors. Patricia Hughes (2002) stressed that we should look for people with good qualities to become doctors and some of those qualities are conscientiousness, integrity, empathy and motivation. Some have asked for doctors who are good communicators, broad minded, flexible, self motivated, generous with time, cooperative, community oriented, accessible, intelligible, informative and holistic (Wood, 1996). As McGaghie (1990a) said, the decision to select medical students is as important as the decision to grant them a practicing license. It is often agreed that the aim of medical schools are not only to ensure successful completion of the medical course but also to produce good physicians. However, there is yet no strict definition of a good doctor, since there is no firm consensus on important shared core of knowledge, attitudes and skills that all doctors should have (Lowry, 1992). As such current research findings have confined mainly to the performance of students during the medical course.

With medicine as a highly competitive course, medical schools are often faced with too many applicants fighting for limited medical places. Ideally, there should be a selection policy which would comprise of i) a statement describing qualities (academic and non-academic) required for entry and ii) a list of valid, reliable tools to select these qualities

(Powis, 1994). In reality, this rarely happens because the qualities mentioned are vague or imprecise and the tools or selection methods involved are not practical. Selection methods and tools are either time consuming or too costly resulting in many medical schools relying on pre-entry academic scores as a selection criterion (Powis, 1994). It is not only an administratively simple procedure, it is also cheap. However, should this be the only criterion considered for selection, it might strengthen the assumption of the public that only the top scorers will make the best doctor (Powis, 1994). Therefore, without an efficient and effective selection policy, medical schools will continue to face a dilemma in selecting suitable candidates for their medical programmes.

In the United Kingdom, intellectual aptitude tests have been used in addition to A-level scores for purpose of selection into medical schools now that they are faced with many candidates who scored 3 `A's at A-level (McManus et al., 2005). Another solution suggested is to introduce A+ and A++ grades at A-level. On the other hand, it is also probable that a group of suitable candidates is excluded by the current admission method relying on good A-level scores, more so if such grades were introduced (McManus et al., 2005). Perhaps the question we should ask is not how high should we set the threshold mark, instead we should be interested in how low can the threshold mark be for entry to medical school (Powis, 1994). It would also make more sense to select form the existing pool more systematically on non-cognitive measures rather than choosing candidates with grades A+ and A++ (McManus et al., 2005).

Student selection has a great impact not only to the university, medical school and public. More importantly, the impact is on the prospective student him/herself. The student, if

selected will be subjected to a long period of training (Powis, 1994). Medical training is quite known for being very taxing and difficult. It not only requires competent intellectual make up but also to a great extent other non-cognitive abilities such as survival skills, time management and self-care. It is even worse if students chose to study medicine for the wrong reasons. Therefore, medical schools will have to identify the academic as well as personal attributes students should have to be able to complete the medical training. In addition, medical school should also be able to detect during the selection process, signs of students who may quit the course either due to academic failures or other reasons.

Medical training also involves a lot of financial and human resources that affect the medical school and the community. Therefore, it is important to keep the student attrition rate at its minimum to achieve the most effective training of future doctors (Powis, 1994).

It is commonly agreed that the selection procedure should be fair, just and equitable. Some has suggested that fairness can be achieved by random selection once the minimum academic standards are fulfilled (McGaghie, 1990a). However, this would encourage the admission committee to avoid making tough choices by rolling the dice. Other researchers pointed out that selection involves judgment where a decision is made based on weighted benefits and utilities (McGaghie, 1990a). In addressing equitability, there has been a move towards 'affirmative action' policies, whereby certain minority groups may receive preferential treatment (Powis, 1994). For example, many current policies recommend having an entrant pool of students that reflects the socio-cultural mix of society as a whole (Powis, 1994).

Three aspects of student selection policy were raised (Rogayah, 1996). Firstly, there is a need to have a match between institutional goals and applicant's aspirations. Secondly, the use of data gathered to assist in admission decisions based on its predictive power and thirdly, the acceptability of the selection policy and procedures. Having a good match between student's aspirations and the medical school's goals are important as there is evidence to suggest that the reason for attrition, quite often is due to student's disaffection of the course (Rogayah, 1996). Data gathered as selection criteria in admission decisions have also been shown to correlate with students' performance throughout the course (Powis 1994, Rogayah 1996). Finally, for a fair selection procedure, there must be clear guidelines and policies as well as measurable criteria that are made known to both applicants and interview panel members.

Another issue in selection of students is regarding the myth of the academic ability – achievement link (McGaghie, 1990a). Data from various studies have shown that there is only a very weak link between the pre-entry academic ability of aspirants (measured by MCAT scores and college leaving grades) and subsequent medical school performance (measured by medical school grades and the National Board of Medical Examiners examination). Some studies have concluded that while school-leaving examination results correlate with pre-clinical performance, the correlation declines sharply in the clinical years (Walton, 1987). Powis et al. (1988) quoted a study by Parlow and Rothman which showed that the intellectual capacity of entering medical students was associated with a decrease in flexibility, innovation and tolerance of ambiguity in the students who went through the 6-years medical course. This observation reflects a misfit between the students' attributes and the many clinical situations that are not clear cut and require a degree of innovation,

flexibility and tolerance of ambiguities amongst graduating doctors. Most students have shown that only 9-16% of the variation in achievement in medical school is explained by students' academic ability (McGaghie, 1990a). Therefore, more than 80% of the variation in medical school performance is due to other factors that are perhaps unknown or unmeasured.

A review of literature reveals inconsistent correlation between pre-admission academic criteria and success in medical school. In contrast to the findings stated above, a study in Nottingham found that there was a strong relationship between grade `A's in chemistry and biology to doing well in medical course (James & Chilvers, 2001). Similar findings was also shown in a study in King Faisal University that achievement in biology and chemistry during high school are correlated with good performance in medical school (El Mouzan et al., 1992). A study in the University of Wales showed good grades in A-level Biology, were found to be strongly correlated with good performance throughout the medical training (Green at al., 1993).

The inconsistent findings on whether pre-admission academic criteria are significant predictors of success in medical school are probably related to the wide variation in both pre-admission academic criteria and medical school curricula (James & Chilvers, 2001). Miller (1990) suggested that perhaps the most practical ruling would be to to have a quantitative element for screening and a qualitative configuration for selection purposes. This is to enable sufficient prospect of success in completing medical school and ensure that those with desirable qualities and considerable intelligence will not be excluded.

McGaghie (1990a) pointed out the difference between current medical education with its focus on biosciences and actual medical practice. Bioscience is about the intellectual component where the scientific factors are often separated from human affairs. In contrast, medical practice is like a social enterprise that requires a lot of contact with patients, fellow colleagues and other health professionals.

Generally, medical schools emphasise on the importance of certain personal qualities desirable in medical students. However, some of these schools may also rely on previous academic achievement as the sole criterion. This may be due to the complexity of measuring the personal qualities objectively (McGaghie, 1990a).

1.2. Selection criteria

1.2.1. Knowledge and cognitive ability

This concerns the reasoning and logical thinking, problem solving abilities, learning style and intellectual capacity. Traditional admission criteria such as Medical College Admissions Test (MCAT) and undergraduate grade point average (GPA) had been proven to predict students' performance well in the pre-clinical as well as clinical settings (Colliver et al., 1989). McManus showed that learning styles rather than A-level results are better predictors of university performance and Lowry (1992) stated that we should select students who utilize deep learning styles. She concluded that psychometric testing might be a better selection tool to determine this than A-level grades.

1.2.2. Personal characteristics and attitudes

An important selection criterion is to look for applicants with certain attitudes and skills deemed to be good qualities in the medical field. Desirable attitudes and skills include integrity, motivation, flexibility, adaptability, empathy, decision-making, tolerance and conscientiousness. Difficulty in trying to assess personality attributes can be overcome by using various personality tools available, however these tools are very costly to implement. Some of the personality inventories available are : California Psychological Inventory, 16 Personality factor questionnaire, Myers-Briggs Type Indicator, The Edwards Personal Preference Schedule and Minnesota Multiphasic Personality Interview (MMPI). In assessing personality attributes, we need to select the most appropriate method to assess specific characteristics. There is also the question of reliability and validity of the personality tools used and whether the utilisation of such methods will be cost-effective in the long term.

In a study of several non-academic variables in relation to performance at two very different medical schools, it was found that leadership/decisiveness, expected difficulty and motivation predicted higher scores in the Medical Licensure Exam Step 1 and higher basic science grades for each semester (Webb et al., 1997). A study in Belgium (Lievens et al., 2002) investigated personality traits of medical students and other students and found that medical students scored highest on extroversion and agreeableness which may be useful in their future professional career while, conscientiousness significantly predicts final scores in each pre-clinical year. This study concluded that personality assessment may be a useful tool in student counseling and guidance. Another study showed that adding personality

measures to the traditional academic scores as selection criteria increases the accuracy of predicting outcomes in medical school and beyond (Hojat et al., 1999). However, there are medical schools that have not used personality measures for selection of students. One possible reason is because of the perception that personality measures are not grounded in science (McGaghie, 1990a).

Apart from personality tests, interviews are used in addition to other selection measures. Bullimore (1992) showed that an unstructured interview has little value and stressed that to be effective, interviews should be structured and interviewers should be trained. This will eventually help universities to select medical students who will graduate as doctors with the skills and intellect that society needs and deserves. In the University of New South Wales, all potential candidates who were academically able were interviewed. A pair of interviewers interviews each candidate. The interviewers have to look for six characteristics in each candidate: compatibility with the problem-based course, perseverance, tolerance of ambiguity, supportiveness to others, motivation and self-confidence (Powis et al, 1988).

In testing the hypothesis that adult learners are more internally motivated rather than externally, Misch (2002) found that medical students' internal and external motivations are context-dependent, and are intricately linked with each other. In 1981, a study among first year medical students at the University of New South Wales found that their motivation to study medicine was primarily driven more by an intense personal interest rather by pure scientific or intellectual ambitions. Male students were found to be motivated by financial security and social rank more

frequently than women. On the other hand, female students were found to be more idealistic. However, intellectual curiosity rates are high for both. While several male students reported that family pressure influenced them to study medicine, none of the female students reported this (Ewan & Bennett, 1981).

In Universiti Sains Malaysia, Razali (1996) discovered two main reasons for students to choose the medical course: an interest in medicine and helping people. In a group of students who were influenced by their family to join medicine, 13% expressed the wish to change career as they were dissatisfied with their undergraduate experience as medical students.

1.2.3. Psychomotor skills

Very little data is available on the link between psychomotor skills and performance in medical school and perhaps it is premature to measure this at undergraduate selection process. However it is perhaps important to select those who are good with their hands to become general surgeons. For post graduate training, specialties such as Ophthalmology would also require students to have good hand-eye coordination, manual dexterity and precision.

1.3. Selection procedure

In the United Kingdom, the selection procedure in Warwick Medical School consists of four components: the application, the Medical Schools Admission Test (MSAT), a

supplementary application form and an interview. The interview which takes about 20 minutes is mainly to assess motivation, general suitability to medicine and communication abilities. (www2.warwick.ac.uk/). In Australian medical schools with graduate-entry programs, one of the selection procedure is a common entry test, the Graduate Australian Medical School Admissions Test (GAMSAT). The Australian Council for Educational Research (ACER) adopted the MSAT for undergraduate medical programmes as an aid for student selection into most Australian medical schools as well. MSAT assesses interpersonal understanding, critical reasoning and written communication. It does not test scientific knowledge and it is regarded as sufficient for entry into the medical school.

In the University of Newcastle, New South Wales there are two entry pathways. Academic entry requires applicants to possess similar academic qualifications for any Australian undergraduate medical school. Places are then offered in order of merit which usually means potential candidate through this pathway has to be in the top 1% of achievers. The second entry pathway is the composite entry. The applicant has to be in the top 10% of achievers. Once eligible for this pathway, the relative academic achievement is no longer of interest. Instead, places are offered based on applicant's performance in a written test and interview which are designed to assess personal qualities (Powis and Rolfe, 1998).

In the Aga Khan University, Pakistan there are two stages of admission procedure. The first stage consists of an admission test which all applicants living in Pakistan have to take regardless of their education. The test consists of chemistry, biology, physics, mathematics and English. Applicants are short listed for the second stage based on the scores of the test. The second stage is where each applicant is interviewed for 30 minutes by two faculty

members. The interview is to assess criteria such as independent thinking, interest in issues of health, maturity, social and cultural awareness and leadership potential (Rahbar et al., 2001).

In King Faisal University, Saudi Arabia a certain minimum percentage in secondary school is required followed by a Medical College Admission Test (MCAT). The admission committee then will also perform a personal interview of the candidates (El Mouzan, 1992).

In Malaysia, the present entry requirements into public medical school are a CGPA of at least 3.8-4.0 in science matriculation or at least B in three Sijil Tinggi Peperiksaan Malaysia (STPM) subjects (Chemistry, Physics, Biology or Mathematics). However, due to the increasing number of academically qualified applicants into medical school, an effort to streamline applicants to local public medical schools had been explored. A New Admission System was proposed in August 2004 to overcome the problem of the highly competitive medical seats in public medical school among the large pool of qualified applicants. The New Admission System proposed involved three stages: 1) Malaysian Medical School Admission Test (MMSAT), 2) an interview, 3) viewing of a video about the medical profession followed by a brief hospital tour. The trial run of this system was planned to be carried out in 2005 before its full implementation in 2006. However, the trial run was cancelled at the last minute. This was very unfortunate as such a test is highly recommended to further improve the quality of students entering medical training in Malaysia and subsequently assist in the production of quality future doctors for the country. MMSAT should seriously be considered as one of the essential tools in selecting prospective medical students in Malaysia.

1.4. Statement of the problem

There are many reasons why we should select medical students carefully. Firstly, because there have been doubts about the integrity of the medical profession especially with regards to the ethics of practice and care given by doctors. Secondly, there has been intense competition between applicants due to limited number of seats in medical schools. Thirdly, it is very costly to train a medical student with the current cost ranging from RM120,000 – RM 300,000. Certainly, medical training requires one of the largest commitments of resources. Thus, it is important to have a good fit between selection criteria and the capability as well as the intellect of the medical graduates (Caelleigh, 1990). Students who fail to complete medical training not only do injustice to themselves but also put financial impact on the colleges, education authorities, government and the public (Green at al, 1993).

In Malaysia, the issue of selection of medical students is more acute because there are more applicants than there are places. Therefore, it is very crucial to have selection procedure which is fair, transparent and is proven to be related to good outcomes. In 2004, 128 matriculation students with CGPA of 4.0 failed to be admitted into any of the medical faculties of the public universities. In a setting where places for medical study is offered based solely on academic merit, this has certainly posed a big problem (intervention by the Minister of Higher Education and the Malaysia Cabinet saw 29 of the students taken into 6 public medical schools while 99 others were admitted to 5 private medical schools -Utusan Malaysia, 2004). This issue of bright students who were unable to secure a place in public

medical schools has captured the interest of society and many individuals have stated their comments.

Prof. Datuk Dr. Hashim Yaacob the former Vice Chancellor, Universiti of Malaya said that the success of those 128 students getting seats in the medical schools are not an absolute right. He commented that obtaining a CGPA of 4.0. is not enough to justify admission to medical schools, as high CGPA is not the only important criteria to consider (Utusan Malaysia, 13th June 2004). Students who did well academically, eventually choose to study medicine as this is what their parents, family and society expect them to do. In many cases, this is probably due to the students' lack of information about what the medical course is really all about.

In Utusan Malaysia dated 20th March 2005, Deputy Minister of Higher Education announced that the government will add another 1428 places in the public universities within the next 5 years. Although places have been increased, the demand for medical course continues to increase every year. For 2005 alone, the government has added 100 more places compared to the 779 in year 2004. He reiterated that courses in medicine, pharmacy and dentistry are very competitive.Therefore the cabinet had decided that scores for admission to the above courses will be determined by both ranking of the cumulated grade point average (CGPA) and scores for co-curricular activities.

Powis (1994) stated that the goals of selection are i) to reduce the number of applicants to the number of available places ii) to identify unsuitable students for medical course iii) to identify good prospective medical students and iv) to identify good prospective doctors.

Presently in Malaysia, students are admitted into medical school based on their academic merit only. Selecting medical students based only on academic merit may fulfill the goal to reduce number of applicants but not the rest of the goals. Therefore, using a sole criterion of academic merit is certainly not justified. It is possible that meritocracy will result in unfavourable consequences. One side effect of meritocracy is that potential applicants have the perception that scoring high marks is itself the reason for doing medicine. They do not view medicine as a vocation but rather as a reward for obtaining excellent results at matriculation (Powis, 1994). Indeed, it was observed that those admitted with the highest matriculation scores were most likely to fail or withdraw from the course (Marley & Carman, 1999).

This study attempts to identify the right selection criteria that would produce the desirable end product in a medical school in Malaysia. Findings in this study should be an impetus to the start of many more research aimed at matching the right people with the right field of their interest and ability.

1.5. Significance of the study

An understanding of the relationship between admission criteria and performance in medical schools would address the following issues :

(a) Cost effectiveness

It costs a hefty sum of money to train someone in medicine and we need to train more and more doctors. In November 2005, the Parliamentary Secretary in the Prime Minister's Office informed Parliament that the Public Services Department (PSD) spent

RM198 million to sponsor 5997 students overseas. The amount covers course fee, allowances, health insurance and transportation. Most of the students (4154) are on scholarships while the rest are on loan scheme. The average cost for sending one student to a medical course overseas is between RM 150,000 to RM 1 million while locally, it costs about RM120,000 – RM300,000.

(b) Using better selection criteria

Currently when there are more applicants than there are available places of study, the academic standard for admission is raised. Presently, the entry requirements for UPM medical students are : a CGPA of 3.5 in science matriculation or obtaining at least B in 3 subjects in Chemistry, Physics, Biology or Mathematics. However, student selection is based entirely on their merit. The effectiveness of this method is in question since pre-admission academic qualities are not strongly correlated with performance in medical studies. Medical schools should then be interested to know what criteria are best used to select students to medical school. For the government, a reasonable selection criteria is one that is most likely to predict a favourable outcome at the end of the 5 years of medicine course. For the profession, the selection criteria should predict the capability to finish medical training as well as the intellect and character to be good physicians (Caelleigh, 1990).

(c) Allowing students to select a programme that suits them

The medical programme is often not flexible because it doesn't allow students to change their course once they have joined it (Faris, 1994). For students who faced difficulties in the clinical years, they have no choice but to continue and finish the

medical degree, otherwise they will have no marketable qualification if they quit the programme (Faris, 1994). Therefore, some students stay in the programme despite having poor interest in the field and faced a hard time in trying to complete the course. This is very unfortunate and very unfair for the students and for other candidates who fail to be admitted but who would have succeeded if given the chance.

(d) Fair and objective system

This study is an attempt to look at the characteristics of a student suitable for the medical profession and to use these characteristics as a selection criteria for the medical course. Clear and transparent criteria would make the system more fair and objective.

1.6. General objective of the study

To determine criteria which are valid and objective to be used in selection of medical students.

1.7. Specific objectives

i. To identify the relationship between pre-admission qualifications and subsequent performance (pre-clinical and early clinical) of medical students.

ii. To study the students' profile in relation to their performance in medical school.

1.8. Null hypotheses of the study

i. There is no relationship between pre-admission qualifications to pre-clinical performance.

ii. There is no association between pre-admission qualifications to early clinical performance.

iii. There is no relationship between students' profile and performance in medical school.

II. METHODOLOGY

2.1. Study design

This is a retrospective study. The independent variables already exist in the study population prior to admission to medical school. The dependent variables are their performances or examination results at the end of the postings in the medical course.

2.2. Study location

The research was conducted in the Faculty of Medicine & Health Sciences, Universiti Putra Malaysia. This faculty had its first intake of 51 students in July 1996. It currently has 500 students. Figure 2.1 shows the curriculum plan for the doctor of medicine programme in Universiti Putra Malaysia (Students' Handbook).

2.3. Study population

The study covers 147 medical students in Year 4 and Year 5 of the 2004/2005 cohort. These students are the 5^{th} and 6^{th} batches of students in the medical school.

2.3.1. Inclusion criteria

All medical students of Universiti Putra Malaysia who have gone through the pre-clinical years and all the clinical postings in Year 3 and Year 4.

2.3.2. Exclusion criteria

Students with incomplete academic records were excluded from the study. Out of the 150 respondents, 3 were foreign students. These students did not take Sijil Pelajaran Malaysia (SPM), Sijil Tinggi Pelajaran Malaysia (STPM) or matriculation. The academic records of these 3 respondents were incomplete and therefore they were excluded from this study which leaves the number of respondents studied are 147.

2.4. Study instruments

Questionnaires and students' records from the academic office were used in this study. Students' records were obtained from the academic office of both the pre-clinical and clinical section.

2.4.1. Questionnaires

A questionnaire of 19 items was constructed (Appendix B) based on various research findings on student selection (Lucier et al., 1995; Hughes, 2002; Frischenschlager et al., 2005).

a) Items 1 to 13 focus on background information that would help in constructing a profile of the students such as sex, age, ethnicity, marital status, type of school

attended, type of pre-admission qualification (whether they came from the matriculation program or STPM), whether they have mother, father or siblings who are doctors (Alfayez, 1990), source of financial support for the medical course, household income and age when they decided to study medicine.

b) Item 14 is a table containing 11 factors that are considered to influence the choice of medicine as a career (Warren, 1990; Wierenga et al., 2003). For each factor, respondents have to indicate how strongly the factor influences them; from no extent, little extent, some extent, considerable extent and great extent. The 11 factors are interest in helping people, status and salary in the medical profession, job opportunities, good results in school, feeling destined to be in this profession, having a family member who is a doctor, personal experience as a patient, seeing how medicine affects people during an illness in the family, not having enough doctors in the country and parental wish.

c) Item 15 requires respondents to express their views before and after they became medical students. Item 15 has 9 statements within 2 columns. One column represents their views before they became medical students and the second column are views after they have joined medical school. For each statement, respondents expressed their agreement using Likert scale of 1-5 in both columns. Scale of 1 indicates strongly disagree, 2 for disagree, 3 for neutral, 4 for agree and 5 for strongly agree. The 9 statements are : ability to do well in the examinations by studying alone, fear of blood, being aware of having to experience many sleepless nights to study for the exams, general impression of patients interaction, ability to

empathise with patients, acknowledgment of the salary of a houseman, perception of life as a medical student, opinion on difficulty in achieving good results in medical school as compared to matriculation or STPM and whether they view communication skills as important in medicine.

d) Item 16 intends to find out through a yes and no answer whether respondents have ever attended a program explaining about a career in medicine before they became a medical student. Item 17 asks respondents to describe briefly about the program if they answered yes to item 16.

e) Item 18 sums up the respondents' view of whether their expectation of the medical school was more or less the same, or, different from what they had expected (Warren, 1990; Weir, 2000). Item 19 asks respondents whether it would have been helpful for them to have more information on becoming a doctor before they applied to medical school.

The questionnaires were distributed to the students with the help of the batch representatives. Each questionnaire was accompanied by 2 pages of information regarding the study as well as instruction on how to fill up the questionnaire. On the first page, respondents were informed of the research title, background of the research, purpose of the research and assurance of the confidentiality of the information given. They were assured that all their individual information in the questionnaire and examination results will be summarized as collective results and

not as individual information. Respondents were requested to answer all the 19 items on the questionnaire.

2.5. Variables

There were 2 types of variables namely independent and dependent variables.

a) Independent variables were pre-admission academic achievements and students' profiles (El Mouzan, 1992; Green et al., 1993). Pre-admission academic achievements consisted of SPM subject grades. Also under the pre-admission heading was the type of programme before they entered medical school whether they are from matriculation or STPM programme. SPM subjects studied were : Bahasa Malaysia, English, Biology, Chemistry, Physics. Grades of SPM subjects were divided into 2 categories i.e. good and satisfactory. Categorization is as follows: good results were grades A1 and A2 whereas satisfactory results were grades C3, C4, C5, C6 and P7. The number of students with the lower grades is too small, therefore this categorization is used to enable statistical test to be conducted. Furthermore, the emphasis of this categorization is more on grades of A1 and A2 which indicate distinctive performance on the subjects.

b) Dependent variables were examination results of Year 2, and all clinical postings in Year 3 and 4 such as Medicine-Surgery, Paediatrics, Obstetric & Gynaecology, Psychiatry, Ear Nose and Throat (ENT), Dermatology and Ophthalmology. Year 2 results represent pre-clinical performance of the respondents. Clinical posting

results in Year 3 and 4 represent their performance in early clinical years. These results were divided into good and poor performance. The faculty classifies distinction marks as those of grades A and B+. However, in this statistical analysis, good performance include those who obtained A, B+ and B while poor performance are those with grades C+,C and F. Students who failed are grouped together with those with grades C+ and C, as separating the few failures into a different category will not allow reasonable statistical analysis.

2.6. Data collection

Survey forms were handed out to the student representatives for distribution to their classmates. Completed survey forms were collected between May and June 2005. Data collection of the academic results was carried out in July 2005. The academic office provided the students' records on their pre-clinical and clinical performance. Data were keyed in using the "Statistical Package for Social Sciences (SPSS) Version 11.0 software.

2.7. Data analysis

For analytical purposes, some data were re-grouped. Variable for ethnicity were divided into 3 instead of 4 as there were very few respondents who make up the ethnic group of 'others'. Seven respondents from ethnic group of 'others' were added to the ethnic of Indians (10 respondents) giving a total of 17 respondents. Therefore ethnic groups analysed