Medical Student Selection Process and Its Pre-Admission Scores Association with the New Students' Academic Performance in Universiti Sains Malaysia

4 authors, including:

Muhamad Saiful Bahri Yusoff
Universiti Sains Malaysia
368 PUBLICATIONS   **3,518** CITATIONS

SEE PROFILE

Aziz Baba
Universiti Sains Malaysia
40 PUBLICATIONS   **710** CITATIONS

SEE PROFILE

Ab Rahman Esa
Universiti Sultan Zainal Abidin
33 PUBLICATIONS   **660** CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Project   Promoting Resilience, Minimizing Burnout Among Students in Higher Education View project

Project   mentoring behaviour View project

HEALTH & ENVIRONMENT

Medical Student Selection Process and Its Pre-Admission Scores Association with the New Students' Academic Performance in Universiti Sains Malaysia

Muhamad Saiful Bahri Yusoff[1], **Ahmad Fuad Abdul Rahim**[1], **Abdul Aziz Baba**[2], **Ab Rahman Esa**[1]

ABSTRACT

Context: Upon graduation, graduates are expected to repay the society by providing the highest quality of medical care services. Thus, medical schools should pay more attention to the student selection procedures to ensure societal expectations are addressed appropriately.

Objectives: This article describes a medical student selection process that has been conducted by Universiti Sains Malaysia (USM) and its pre-admission scores association with the new students' academic performance.

Methods: A semi-independent student selection process was conducted by USM medical school. A total of 600 applicants were short-listed based on their performance in the past scholastic achievement and a psychometric test. They were called for interview and 196 candidates will be selected to enter medical course. This cohort of students were followed up and appraised with regard to their academic performance in medical studies against their past scholastic achievement, and psychometric and interview scores.

Findings: Approximately 486 turned up for interview and 196 candidates were selected to undergo the medical course. The distribution of successful candidates reflects the Malaysian population with regard of gender, race and socioeconomic strata. Students who obtained high interview scores demonstrated good academic performance ($p < 0.05$). High School Certificate (HSC) students obtained good marks across the examinations ($p < 0.01$). The CGPA and psychometric scores were not associated with academic performance ($p > 0.05$).

Conclusion: This study found that the medical student selection process that was adopted by USM is an acceptable and feasible. It has addressed issues of social inclusivity and socioeconomic strata. The interview score has shown a promising predictive capacity in selecting suitable candidates for the first year medical course. The psychometric assessment should be relooked as it showed a consistent unpredictive capacity throughout the first year examinations. The effectiveness and usefulness of the student selection is yet to be seen in the future.

KEY WORDS

student selection, medicine, undergraduate, medical students

INTRODUCTION

The study of medicine is highly regarded by society and often considered as difficult and highly competitive. Furthermore, enrollment places in medical course are limited by supply and demand situation. Most medical schools achieve this by requiring good scholastic achievement.

Unlike many other degree courses, the study of medicine is a lifelong learning process and does not end with attainment of an academic qualification. Society sees the medical course as a professional training period after which medical graduates are expected to make medicine their career. They are also expected to repay to society by providing the highest quality of medical care and services upon graduation[1]. Considering these facts, medical educators must pay more attention to the design of the selection of students to ensure issues such as social inclusivity, fairness, acceptability, predictive values, validity and reliability of the selection instruments are addressed appropriately[2].

In addition, student selection is important to medical training because the kind of students recruited at the beginning determine the kind of doctors produced at the end[3].

The aim of selection is not to pick candidates for specific jobs but rather to choose multipotential persons who will eventually find their interest and niche somewhere in medicine[4]. From that notion, methods of selection should be tailored to achieve the purpose; medical educators should be aware that each selection method has its strengths and weaknesses. Therefore, methods of selection should be assessed and selected based on its validity, reliability, feasibility and acceptability[2].

The policies of the selection process must be clearly defined and stated: how it is done, how information is collected, who are involved in decision making, how decisions are made including the weighting of various components[1]. Selection policies must also address special schemes to promote admission of applicants from under-represented groups such as minority groups, students from rural areas and poor families. These groups are usually disadvantaged in various socioeconomic aspects which may affect their performance in the selection[5]. As Downie & Charlton have highlighted, implementation of ad hoc selection policies cannot be properly evaluated or criticized and are vulnerable to considerable abuse or misconduct, and as a result create more problems and defeat the purpose of the selection[3].

The selection process must be transparent to ensure good practice and to avoid discrimination, unfairness or inconsistencies[2,5].
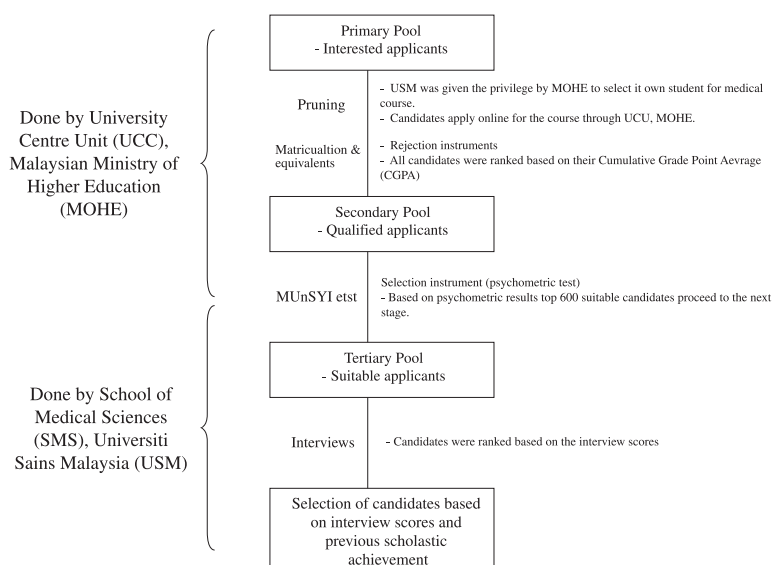
Figure 1. Flowchart of USM medical student selection process

Methods of selection generally can be grouped into two types which are cognitive and non-cognitive; cognitive methods usually look at the previous academic performance whereas non-cognitive methods look at intangible skills such as emotional intelligence and personality[2,5,6].

The selection process based on merit seems to be a simple one where applicants with the highest marks or merit (based on their previous academic performance) are selected to enter medical training. In reality, it is rather more complicated; high marks or merit does not necessarily make a good doctor in the future[5,7]. Previous scholastic achievement has been found to be better predictors of medical student success in medical schools[5,6,8]. Even so, Tutton & Price noted that the predictive capacity of previous scholastic achievement fades with progression through the course[5]. At the same time, there is a lack of published data on the value of alternative student selection processes in predicting medical students' future performance upon graduation[5]. Here lies the selection dilemma. Perhaps, a hybrid approach is a novel strategy to optimize the efficacy of selection as well as to achieve the selection purposes.

It is noteworthy that nowadays evidence-based medicine (EBM) is arguably accepted as the way to practice medicine, and therefore selection of medical students should be no different. Even so, the 'gold standard' of EBM, randomized control trials, is almost impossible to be implemented in the context of medical education particularly in student selection[2]. As a more reasonable approach, evidence-based student selection can be achieved through establishment of reasonable objective criteria of professional performance, validity in different fields and sorts of medical practice, dependability, demonstrable improvement, transparency in implementation and continuous research looking for the best evidence on its efficacy and usefulness[2,3,5,7].

This article describes a selection process that has been conducted by USM to select candidates for its undergraduate medical course. Issues of social inclusivity, fairness, predictive values, acceptability, validity and reliability of the selection process are discussed in this article. It is hoped that USM's experience in selecting medical undergraduates can contribute to the literature in selection in medicine particularly in the Malaysian context.

METHODS

Selection Process

Figure 1 shows the process of medical student selection in School of Medical Sciences (SMS), Universiti Sains Malaysia (USM).

With the recognition of USM as an APEX (Accelerated Program for Excellence) university by the government, the School of Medical Sciences decided to select its own students semi-independently from the central agency of the Ministry of Higher Education (MOHE). It is considered semi-independently because the selection at the primary and secondary pool is done by the central agency and USM selects its student from the tertiary pool onwards (figure 1). Other governmental medical schools obtain their quota of students directly from the Ministry of Higher Education

Starting with the June 2009 intake, 600 shortlisted applicants based on their performance in the Malaysian Certificate of Education (MCE), matriculation forecast results (or equivalents) and the psychometric test called Malaysian University Selection Yearly Inventory (MUnSYI) were required to attend an interview and respond to two questionnaires which were USM Emotional Quotient Inventory (USMEQ-i) and USM Personality Inventory (USMaP-i) assessing emotional quotient (EQ) and personality traits respectively[9,10]. The interview results were used for student selection, while the USMEQ-i and USMaP-i were used to analyze its reliability, validity and predictive values with the intention of adopting these instruments if the evidence provided is convincing. However, findings of the two inventories will not be covered in this article since it will be discussed in another article.

Objectives of the interview

* To assess the interest, general knowledge and expectations of applicants about medical education and medical career;
* To assess personal attributes of the applicants in relation to their suitability in studying medicine at USM;
* To assess the applicants' adequacy in communicative ability in Malay and English languages as basic requirements for a successful medical studies; and
* To observe any physical traits that might hinder the applicants from completing the medical studies or performing clinical functions.

Through this process, 196 students out of 486 that turned up for the interview were selected. This cohort of students were followed up and appraised with regard to i) their demographic profiles and ii) their performance in medical studies (examination results) against their past scholastic achievement, and MUnSYI and interview scores. MUnSYI scores were obtained from the MOHE.

Statistical analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 12. All data collection forms were given identification numbers. Data were entered, checked for data entry errors, explored and cleaned. The researcher used alpha ( ) at 0.05 and confidence interval of 95%. Descriptive statistics was applied for analysis of the demographic data. The students were grouped into pass and fail based on the examination results for statistical analysis purposes. Assumptions were made before running statistical tests. Independent-t test was applied to investigate the relationship between two variable means. The agreement level of two interviewers (inter-rater reliabili-

Table 1. Profile of interviewed and successful candidates

Variable		Interviewed candidates, (n = 486)	Successful candidates, (n = 196)
Gender, n (%)	Male	189 (38.9)	68 (34.7)
	Female	297 (61.1)	128 (65.3)
Qualification, n (%)	Matriculation	432 (88.9)	174 (88.8)
	High School Certificate (HSC)	30 (6.2)	13 (6.6)
	A-Level	24 (4.9)	9 (4.6)
Race, n (%)	Malay	243 (50)	105 (53.6)
	Chinese	174 (35.8)	61 (31.1)
	Indian	39 (8)	22 (11.2)
	Others	30 (5.8)	8 (3.6)
Origin, n (%)	Urban	205 (42.2)	99 (50.5)
	Rural	257 (52.9)	88 (44.9)
	Missing data	24 (4.9)	9 (4.6)
Parent income, n (%)	RM 1 - RM 500	34 (7)	8 (4.1)
	RM 501 - RM 1000	122 (25.1)	41 (20.9)
	RM 1001 - RM 2000	82 (16.9)	30 (15.3)
	RM 2001 - RM 3000	60 (12.3)	25 (12.8)
	RM 3001 - RM 4000	54 (11.1)	29 (14.8)
	RM 4001 - RM 5000	27 (5.6)	8 (4.1)
	RM 5001 - RM 7500	54 (11.1)	30 (15.3)
	RM 7501 - RM 10000	10 (2.1)	6 (3.1)
	More than RM 10000	10 (2.1)	6 (3.1)
	Missing data	33 (6.8)	13 (6.6)
Interview score, mean ± SD		31.49 ± 5.07	35.28 ± 2.05
CGPA result, mean ± SD (minimum, maximum)		3.97 ± 0.05 (3.88, 4.00)	3.97 ± 0.05 (3.88, 4.00)

Table 2. Performance of medical students (examination results) against with their previous scholastic achievement, MUnSYI and interview scores

Variable	Selanjar 1[a] (N = 196)		Selanjar 2[a] (N = 196)		Selanjar 3[a] (N = 196)		PRO 1[b] (N = 196)	
	Pass (n = 157)	Fail (n = 39)	Pass (n = 132)	Fail (n = 64)	Pass (n = 177)	Fail (n = 19)	Pass (n = 146)	Fail (n = 50)
Forecast result[1], mean	3.97	3.96	3.97	3.96	3.97	3.97	3.97	3.96
True result[1], mean	3.94	3.90	3.95	3.91	3.94	3.92	3.94	3.91
MUnSYI score, mean	75.56	76.16	75.58	75.86	75.58	76.64	75.41	76.47
Interview score, mean	35.35	35.02	35.61*	34.61*	35.22	35.86	35.46*	34.77*

The t-independent test was applied to compare mean different between two variables (pass and fail).

*p < 0.05   [1] CGPA Matriculation or equivalent result

[a] Continuous assessment   [b] Summative assessment

ty) was measured by Intra-class Correlation Coefficient (ICC); ICC value more than 0.5 is considered as an acceptable level of agreement[11].

RESULTS

Demographic data

600 suitable candidates were called for interview, 486 turned up for interview and 196 candidates were selected to undergo the medical course in USM (Table 1). Table 1 showed the distribution of interviewed and successful candidates.

Table 1 shows the distribution of candidates according to gender, entry qualification, race, their origin, their parent income, interview score, and their previous scholastic achievement (CGPA). In general, the distribution of successful candidates reflects the Malaysian population with regard of gender, race and socioeconomic strata.

Table 2 shows that mean interview scores of passed and failed students in Professional 1 examination were significantly different (t

(df) = -2.056 (194), mean difference (CI 95%) = -0.686 (-1.344, -0.280), p < 0.05). It indicated that candidates who obtained high interview scores have good academic performance during the final first year examination. Other variables were not significantly associated.

Table 2 also shows that the mean interview scores of passed and failed students in Selanjar 2 examination were significantly different (t (df) = -3.287 (194), mean difference (CI 95%) = -1.003 (-1.606, -0.401), p < 0.01). it suggested that candidates who obtained high interview scores performed well in the Selanjar 2 examination. Other variables were not significantly associated.

CGPA, interview and MUnSYI scores of passed and failed students during Selanjar 1 and 3 examinations were not significantly different. It suggested that CGPA, interview and MUnSYI scores were not associated with academic performance in the Selanjar 1 and 3 examinations.

Table 3 shows that HSC students obtained higher marks across the examinations compared to matriculation and A-Level students (p < 0.01). It demonstrated that candidates from HSC stream have better academic performance across the first year examinations compared to candidates from matriculation and A-level stream.

Table 3. Medical students' performance (examination results) in medical school according to their entry qualification

Variable	*Selanjar 1[b] (N = 196)		*Selanjar 2[c] (N = 196)		*Selanjar 3[d] (N = 196)		*PRO 1[a] (N = 196)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Entry qualification								
Matriculation (n = 174)	57.06	8.64	55.34	10.99	60.29	8.23	55.21	8.30
HSC (n = 13)	70.98	7.11	69.98	10.53	68.63	7.94	68.56	8.26
A-Level (n = 9)	58.39	35.02	59.98	14.94	61.96	13.83	57.34	13.70
F-statistics (df)	15.20		10.78		5.86		14.70	
p-value	< 0.001		< 0.001		0.003		< 0.001	

*One-way ANOVA

Post Hoc test (Tukey HSD method)

[a] PRO 1

-   HSC vs. Matriculation (mean difference (CI 95%) = 13.35 (7.52, 19.19), p < 0.001)
-   HSC vs. A-Level (mean difference (CI 95%) = 11.22 (2.42, 20.01), p < 0.01)
-   A-Level vs. Matriculation (mean difference (CI 95%) = 2.14 (-4.80, 9.07), p > 0.05)

[b] Selanjar 1

-   HSC vs. Matriculation (mean difference (CI 95%) = 13.92 (7.96, 19.89), p < 0.001)
-   HSC vs. A-Level (mean difference (CI 95%) = 12.60 (3.60, 21.60), p < 0.01)
-   A-Level vs. Matriculation (mean difference (CI 95%) = 1.33 (-5.76, 8.42), p > 0.05)

[c] Selanjar 2

-   HSC vs. Matriculation (mean difference (CI 95%) = 14.64 (7.06, 22.21), p < 0.001)
-   HSC vs. A-Level (mean difference (CI 95%) = 10.40 (-1.02, 21.82), p > 0.05)
-   A-Level vs. Matriculation (mean difference (CI 95%) = 4.24 (-4.77, 13.24), p > 0.05)

[d] Selanjar 3

-   HSC vs. Matriculation (mean difference (CI 95%) = 8.34 (2.55, 14.12), p < 0.01)
-   HSC vs. A-Level (mean difference (CI 95%) = 6.68 (-2.05, 15.40), p > 0.05)
-   A-Level vs. Matriculation (mean difference (CI 95%) = 1.66 (-4.08, 7.41), p > 0.05)

Inter-rater reliability analysis

There are 48 pairs of interview panel; ICC analysis showed that only 19 pairs had significant level of agreement, The level of agreement ranged from 0.39 to 1.00; 3 pairs had a perfect level of agreement (ICC = 1.00), 3 pairs had almost perfect level of agreement (0.95 < ICC < 1.00), 10 pairs had fair to excellent level of agreement (0.5 < ICC < 0.95), and 3 pairs had low level of agreement (ICC < 0.5). The remaining 29 pairs had no significant level of agreement. The findings suggested that the levels of agreement between interviewers were varied and inconsistent.

DISCUSSION

Demographic profile suggested that distribution of the successful candidates was almost parallel with the Malaysian population distribution in term of gender and ethic group. Even more, the distribution also can be considered to represent those from rural areas and lower social strata. These facts were considered as evidence of social fairness and inclusivity that have been addressed by the selection process. It is worth to note that, since this is the first cohort hence, the 'by-chance phenomenon' cannot be ruled out. Perhaps, the future cohorts should be followed up to confirm these findings.

It is noteworthy that the student selection process that was adopted by the School of Medical Sciences, USM was designed based on the collaborative effort between MOHE and the university. The collaborative effort perhaps is considered as evidence of the acceptability and feasibility of the selection process. As has been echoed by researchers the collaborative efforts in selection process will promote sustainable and continuous improvement of the process for betterment in the future[2]. Furthermore, it will lead to transparency in implementation and continuous research looking for the best evidence on its effectiveness and usefulness as it was a concern in previous studies[2,3,5,7]. This study found that medical students who passed summative examination obtained higher interview scores compared to those who failed. It suggested that interview scores are able to pick up suitable candidates that can perform in the first year medical course. Perhaps, this is an evidence to support the predictive capacity of the interview

scores. One of the possible reasons for that is due to a clear structure of interview process as reported by previous study[12]. It is interesting to look at the relationship between interview scores and students' performance throughout the course.

The inter-rater reliability analysis showed that the level of agreement between interviewers was varied and inconsistent. It is felt necessary for a calibration between interviewers should be done through training workshop to improve the reliability and validity of the interview process[12]. In the future, it is useful to look at the relationship between inter-rater reliability scores and predictive capacity of the interview process in the next cohort after the calibration.

This present study found that previous CGPA result does not predict the performance of first year medical students in the examinations. This finding is opposite to previous study[6]. Perhaps, the different is due to the different education system in the Netherland compared to Malaysia. However, those who are from the HSC got significantly higher marks throughout examinations than those who are from matriculation and A-Level. It seems that entry qualification has rather a more predictive values compared to CGPA results. A possible reason why HSC students performed better was due to the different training system; they are trained to be more self-directed and independent learners compare to matriculation and A-Level students. It is worth to highlight that, high marks does not necessarily make a good doctor in the future[5,7]. Even though, previous scholastic achievement has been found to be better predictors of medical student success in medical schools[5-8], but, the predictive capacity of previous scholastic achievement fades with progression through the course[5]. It is interesting to look at the students' performance throughout the course and also after graduation.

As far as the analysis is concerned, psychometric assessment of MUnSYI seems not predictive enough due to its inability to discriminate between passed and failed students. Consistently throughout the examinations those who passed in the examination got lower scores of MUnSYI compared to those who failed. The MUnSYI psychometric assessment should be reconsidered for future use in the selection process. However, since this is still in the early phase of the course therefore, concrete conclusion has yet to be seen. McManus et al has mentioned that in general, psychometric tests predictive validity is undemonstrated[13]. However, if the characteristics assessed are relevant to a career in medicine it will be valid and reliable[2]. It is worth

to highlight that, Schmidt and Hunter reported that the 'Big Five' personality traits particularly conscientiousness is the best predictor of job performance and trainability[14] and Mayer *et al* mentioned that there were considerable evidences showing that emotional intelligence is a determinant of success in a variety of occupational settings[15]. Considering these facts, perhaps, personality traits and emotional intelligence should be considered as part of the future student selection in USM medical school.

There were several limitations that should be considered in the selection process for future improvement. The first limitation was the validity and reliability of MUnSYI is unknown, therefore the accuracy of results obtained was questionable. The second limitation was interviewer pairs were inconsistent therefore the inter-rater reliability results might be compromised. The third limitation was the number of candidates for each interviewer pair was inconsistent and hence it may affect the selection process effectiveness in selecting suitable students. The fourth limitation was calibration training workshop was not properly done to the interviewers and thus may lead to inconsistent level of agreement between interviewers. The last limitation was the final selection of students was based only on the interview scores and CGPA of the candidates where it may lead to higher false positive decision making. Therefore, these limitations should be taken into account for the future improvement of student selection. Perhaps a multi-method approach should be considered.

CONCLUSION

This study found that the medical student selection process that was adopted by USM is an acceptable, feasible, and has addressed issues of social inclusivity and socioeconomic strata. The interview score has shown a promising predictivity capacity in selecting suitable candidates for the first year medical course. The levels of agreement between interviewers were inconsistent and the psychometric assessment should be relooked as it showed a consistent unpredictivity capacity throughout the first year examinations. The effectiveness and usefulness of the student selection is yet to be seen in the future.

ACKNOWLEDGEMENT

REFERENCES

1) Milton L. Selection of future doctors. Retrieved on April 2010. Available from *http://mmc.gov.my/v1/docs/bulletin/Selection%20of%20future%20Doctors.pdf*

2) Dent JA, Harden RM. *A practical guide for medical teachers*. 3rd ed. UK: Churchill's Livingstone Elsevier, 2009.

3) Downie RS, Charlton B. *The making of doctor: medical education in theory and practice*. Oxford: Oxford University Press, 1992.

4) Richards P, Stockill S. *The new learning medicine*. 14th ed. London: BMJ Publishing, 1997.

5) Tutton P, Price M. Selection of medical student-affirmative action goes beyond the selection process. *BMJ* 2002; 324: 1170-1171.

6) Cohen-Schotanus J, Arno MMM, Rreinders JJ, Jessica A, Van Rossum HJM, Van Der Vleuten CPM. The predictive validity of grade point average scores in a partial lottery medical school admission system. *Med Educ* 2006; 40: 1012-1019.

7) Norman GR. Editorial-The morality of medical school admission. *Adv Health Sci Educ* 2004; 9: 79-82.

8) Kulatunga-Moruzi C, Norman GR. Validity of admissions measures in predicting performance outcomes: the contribution of cognitive and non-cognitive dimensions. *Teach Learn Med* 2002; 14: 34-42.

9) Yusoff MSB, Rahim AFA, Esa AR. *The USM emotional quotient inventory (USMEQ-i) manual*. KKMED Publications. Malaysia; 2010a. Available online from *http://www.medic.usm.my/dme/images/stories/staff/KKMED/2010/manual%20usmeq-i.pdf*

10) Yusoff MSB, Rahim AFA, Esa AR (2010b). *The USM personality inventory (USMaP-i) manual*. KKMED Publications. Malaysia; 2010b. Available online from *http://www.medic.usm.my/dme/images/stories/staff/KKMED/2010/manual%20usmap-i.pdf*

11) Altman DG. Practical statistics for medical research. London: Chapman and Hall, 1991.

12) Marchase MC, Muchinsky PM. The validity of the employment interview: a meta-analysis. *Int J Sel Assessment* 1993; 1: 18-26.

13) McManus IC, Powis DA, Wakeford R, Ferguson E, James D, Richards P. Intelectual aptitude test and a levels for selecting UK school leaver entrants for medical school. *BMJ* 2005; 331: 139-142.

14) Schmidt FL, Hunter JE. The validity and utility of selection methods in personnel psychology: practical and theoretical implication of 85 years of research findings. *Psychol Bull* 1998; 124: 262-274.

15) Mayer JD, Roberts RD, Barsade SG. Human abilities: emotional intelligence. *Annu Rev Psychol* 2008; 59: 507-536.