ORIGINAL ARTICLE

MEDICAL COLLEGES ADMISSION TEST IN PUNJAB, PAKISTAN

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Background: Nearly 18,000 candidates securing 60% and above marks in Higher Secondary School Certificate (HSSC) examination contest for admission in Medical Colleges, in Punjab, Pakistan by sitting in the Medical College Admission Test (MCAT) each summer. This cross-sectional study was conducted to identify patterns related to demographic, economic and educational backgrounds, over a two-year-period, in this population, and how HSSC and MCAT marks predict future performance of the selected candidates. **Methods:** Marks obtained by candidates in HSSC, MCAT, and 1st Professional MBBS (Part-I) Examinations over two years 2008–2009, were analysed using parametric tests in SPSS. **Results:** Total 18,090 candidates in 2008 and 18,486 in 2009 sat in the MCAT. National HSSC candidates scored higher marks in HSSC and MCAT but lower marks than their foreign qualified HSSC counterparts (e.g., Advanced-Levels from Cambridge University, UK) in Part-I overall and in all its sub-components individually ($p<0.05$). Female students scored higher marks than males in HSSC ($p>0.05$), MCAT ($p>0.05$) and Part-I theory, practical, *viva voce*, continuous assessment and Objective-Structured Performance Evaluation (OSPE) components ($p<0.05$). In both years, students from the Dera Ghazi Khan District scored the highest marks in the HSSC Examinations ($p<0.05$) but least marks in MCAT in 2008 ($p<0.05$) and in Part-I in 2008 and 2009 ($p<0.05$). Students from 'tougher' Boards like Rawalpindi in 2008 and the Federal Board in 2009 who scored least marks in HSSC scored highest marks in MCAT, and in Part-I Examinations ($p<0.05$). Linear regression on Part-I by taking HSSC and MCAT marks as independent variables showed that the MCAT marks exerted the greatest positive influence consistently at 0.104 (2008) and 0.106 (2009). In 2009 HSSC marks were shown to exert a negative influence (-0.08) on Part-I. **Conclusion:** There is need to standardise HSSC education and examination across all Intermediate Boards. MCAT is a better predictor of Medical Students' future performance.

Keywords: Higher Secondary School Certificate, MCAT, demographic, socio-economic, assessment

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INTRODUCTION

With over 170 million people, Pakistan is the most populated country in the WHO Eastern Mediterranean Region.[1] Pakistan Medical and Dental Council was established as the sole registering and licensing authority of medical and dental health professionals in 1962.[2] The total number of registered medical practitioners in the country currently stands at 112,183.[3] Careers in the health professions are satisfying and financially rewarding.[4] Nevertheless, there are always far more applicants, than places available at all stages of induction into undergraduate and postgraduate health profession education.[5]

Throughout the world, health profession institutions use different criteria for admission, varying from pre-medical examination scores only, to a combination of aptitude and achievement tests, interviews, clinical competency examinations, presentations, and even lottery.[6] With stakes high and competition fierce, the selection process needs to be credible, just, transparent, reliable, valid and acceptable to all stakeholders.[7]

The selection process adopted should:

- allow for uniform selection from various socio-economic and demographic strata of the population
- be able to predict the performance of those selected in the short and long-term
- be based on the needs of the society and national demands of the profession
- take into account the curriculum and the institutional mission
- preferably be able to select candidates with the right blend of emotional and intelligence quotient
- be relaxed enough so as not to be a psycho-traumatic event for the students in particular, and society at large

Prediction of health professionals' performance 30–40 years down the line is a daunting challenge. However, performance of students can be predicted through the selection process. The performance during their health profession education, can be used later to predict the future, long-term performance as health professionals.

In Punjab, the most populous and developed province of Pakistan[8], Medical College Admission Test (MCAT) is conducted each summer by the University of Health Sciences (UHS), Lahore. Approximately 18,000 candidates, both in 2008 and 2009, contested for public and private seats in the Province.

In both 2008 and 2009, the merit for admission was established by taking 70% of the marks scored by

the candidates in the pre-medical examinations, and adding to it, 30% of the marks obtained in the MCAT. Eligible candidates were allotted seats according to their merit-based preferences in nearly 30 medical colleges throughout Punjab.

This study aimed to identify patterns related to demographic, socio-economic and educational backgrounds over a two year period from 2008 to 2009, in the MCAT sitting population in Punjab, and also to see how Higher Secondary School Certificate (HSSC) examination and MCAT marks predict future performance in the short-term.

METHODOLOGY

In this cross-sectional study, HSSC and MCAT marks obtained by the entire population that sat in the MCAT in Punjab over a two year period, 2008 and 2009, were entered into SPSS-16. Marks obtained by selected candidates over these two years in the baccalaureate of medicine; baccalaureate of surgery (MBBS), First Professional Part-I Examinations (Part-I) overall and in all its subcomponents individually were also entered into SPSS. Parametric tests were applied to determine the correlation of these awards overall and in their subcomponents and how they vary for different socioeconomic and demographic strata. Value of Cronbach's $\alpha \leq 0.05$ was taken as statistically significant. Variation of Part-I marks by taking HSSC and MCAT marks as independent these awards demographically was analysed using ANOVA. For determining the impact of HSSC and MCAT performance in Part-I, linear regression was applied on variables.

RESULTS

Total 18,090 candidates in 2008 and 18,486 in 2009 sat in the MCAT. HSSC marks were significantly higher than the MCAT and Part-I marks in both years ($p<0.05$), while MCAT marks were found to be significantly higher than Part-I marks (Table-1).

Table-1: Results of paired *t*-test on overall marks

Paired Sample *t*-test	Exam	2008		2009	
		Mean	*p*	Mean	*p*
HSSC *vs* MCAT	HSSC	930.80	0.000	949.63	0.000
	MCAT	823.83		764.32	
HSSC *vs* Part-I	HSSC	930.80	0.000	949.63	0.000
	Part-I	712.85		702.50	
Part-I *vs* MCAT	Part-I	712.85	0.000	702.50	0.000
	MCAT	823.85		764.32	

National HSSC candidates scored higher marks in HSSC (largely due to the Inter-Board Committee of Chairmen equivalence criteria) and MCAT but lower marks than their foreign qualified HSSC counterparts (e.g., Advanced-levels) in Part-I overall and in all its sub-components individually ($p<0.05$) (Table-2).

Table-2: Influence of educational background on examination awards

Variables	Educational background	2008		2009	
		Mean	*p*	Mean	*p*
HSSC	National	932.99	0.000	952.31	0.000
	Foreign	890.93		881.87	
MCAT	National	828.84	0.000	769.74	0.000
	Foreign	732.67		626.75	
Part-I	National	711.32	0.000	701.94	0.000
	Foreign	740.88		716.85	
SAQs	National	70.16	0.000	68.23	0.000
	Foreign	74.33		71.41	
MCQs	National	87.34	0.000	86.36	0.000
	Foreign	93.59		94.15	
Continuous Assessment	National	39.25	0.000	36.78	0.000
	Foreign	42.12		42.98	
Viva Voce	National	70.44	0.004	69.12	0.000
	Foreign	73.43		74.14	
OSPE	National	88.54	0.001	86.97	0.000
	Foreign	92.09		90.14	

Female students scored higher marks than males in HSSC ($p>0.05$), MCAT ($p>0.05$) and Part-I theory, practical, *viva voce*, continuous assessment, and Objective Structured Performance Evaluation (OSPE) components ($p<0.05$) (Table-3).

Table-3: Gender differences in scores

Variables	Gender	2008		2009	
		Mean	*p*	Mean	*p*
HSSC	Female	931.89	0.301	951.98	0.058
	Male	928.97		944.77	
MCAT	Female	820.55	0.093	766.67	0.223
	Male	829.31		759.23	
Part-I	Female	718.16	0.000	707.32	0.000
	Male	704.00		692.71	
SAQs	Female	70.91	0.000	72.71	0.000
	Male	69.08		71.23	
MCQs	Female	87.20	0.000	85.32	0.000
	Male	88.38		86.02	
Continuous Assessment	Female	40.00	0.000	37.05	0.000
	Male	38.09		35.21	
Viva Voce	Female	71.33	0.000	68.15	0.000
	Male	69.33		65.28	
OSPE	Female	89.75	0.000	88.34	0.000
	Male	86.96		85.23	

In both years, Part-I scores were found to differ significantly demographically. Post Hoc (Tukey) test revealed that students in DG Khan District scored highest marks in HSSC examination ($p<0.05$) but least in MCAT in 2008 ($p<0.05$) and in Part-I in 2008 and 2009 ($p<0.05$). Students from 'tougher' boards like Rawalpindi in 2008 and the Federal Board in 2009 who scored least marks in HSSC, scored highest marks in Part-I Examinations ($p<0.05$).

Linear Regression on Part-I by taking HSSC and MCAT marks as independent variables showed that the MCAT marks exerted the greatest positive influence consistently at 0.104 (2008) and 0.106 (2009). In 2009 HSSC marks were shown to exert a negative influence (-0.08) on Part-I.

DISCUSSION

Students consistently scored low in MCAT, compared to their HSSC and Part-I scores. This perhaps is because MCAT is an entirely objective examination based on

220 Multiple Choice Questions (MCQs) (70 of Biology, 60 of Chemistry, 60 of Physics and 30 of English). In HSSC, and Part-I Examinations, the presence of Long Essay Questions (LEQs) in the former, Structured Answer Questions (SAQs) in the latter with practical and *viva voce* examinations in both, add to some subjectivity, which perhaps goes to the advantage of the students.[9]

Students in most public and private Higher Secondary Schools follow the National HSSC curricula and also sit in the National HSSC examination. Students may take admission in a select few schools that offer foreign higher secondary school qualifications, like the University of Cambridge Advanced Level and the American 12th Grade. Assessment results in the foreign HSSC qualifications are based on a percentile system compared to a percentage system of National HSSC examination results. The equivalence granted to foreign HSSC results by IBCC does not exceed 90% of the maximum national HSSC awards. It was, therefore, no surprise that the students holding foreign HSSC qualifications when equated at national HSSC marks were found to score significantly lower marks than their national counterparts. Even though pre-medical academic performance is the most widely considered criterion for admissions in the medical schools, various studies have shown that on its own, it is neither valid nor reliable.[10] Pre-medical students concentrate furiously on science and live for grades.[11]

Part-I examination is taken at the end of the first year of medical school in the subjects of Anatomy, Biochemistry and Physiology. The examination is based on standardised assessment process, conducted by the UHS throughout Punjab. Health profession education is concept-intensive and the assessment is based on question-asking rather than question-answering abilities, pragmatic rather than ideational talents, and problem-evaluating rather than problem-solving skills.[4] Students that are inculcated with these skills and abilities in pre-medical studies based on foreign HSSC curricula and assessment get an earlier grasp in this concept and psychomotor skill intensive, health professional education than the national HSSC students, whose curriculum and assessment has for long been argued to have been based on rote-learning and subjectivity in assessment. It comes as no surprise, therefore, that the foreign qualified HSSC students score higher marks in the Part-I examination overall and in all its subcomponents individually including SAQs, MCQs, continuous assessment, *viva voce*, practical examinations and OSPE.

Male to female population ratio of Punjab is 1.056.[8] In 2008 and 2009, females occupied 68.9% and 67.08% of the total available medical college seats. The results of the study showed that the female students scored higher marks than their male counterparts in pre-medical examination, MCAT, and Part-I examinations overall and in all its subcomponents. That females score higher marks than males in pre-medical and undergraduate health profession education had also been reported in other studies worldwide.[12,13] It can be argued that in a developing country like Pakistan, the socioeconomic burdens faced by men at a relatively early age side-track their energies in areas other than education. Moreover, the protective and supportive environment provided to females in a predominantly Muslim population helps them in focusing their energies towards educational activities. This could be, one of the reasons for female predominance in the educational sector, and their higher grades. The fact that, post-education/qualification attrition is very high amongst the female health professional graduates and also their reluctance to work in rural areas and choice of laboratory and research related jobs, rather than the more exhaustive clinical specialties, is leading to a paucity of skilled health professionals in most areas.

While all schools providing for the national HSSC education follow the same government approved curricula, HSSC education in Punjab is divided for purposes of administration under eight Intermediate Boards. The Boards are responsible for quality management of HSSC education within their domain and assessment of their students. Students may be socio-economically and demographically categorised according to the Intermediate Boards under which they come. For example, DG Khan District is socio-economically under-developed and yet its students' scored statistically, significantly higher marks in HSSC examinations than the students of other Boards of well-developed areas in the Punjab.

In MCAT, however, a standardised examination conducted by UHS for all eligible students of Punjab across all Boards, the students of DG Khan scored lower marks than the students from 'tougher Boards' like Rawalpindi in 2008 and Federal Board in 2009. The students of these latter two Boards had scored the least marks in HSSC examinations but scored statistically, significantly higher marks in MCAT, and also in Part-I.

It is conceivable that students from well-developed districts were able to adjust better and relatively quickly to the medical education environment, and a curriculum and assessment that is based on good communication skills and rapid adjustment to psychomotor skills and affective domain.[14] High scorers of under-developed areas performing poorly in MCAT is more difficult to explain, and perhaps, the issue relates to standardisation of assessment across all 8 Boards.

The results show that the performance of students in MCAT as well as in HSSC examination can be used to predict their short-term future performance. The fact that high performers in MCAT, perform well in

undergraduate health professional education and high performers in HSSC examinations do not is very interesting, especially when seen in the light of the results of the socioeconomic and demographic aspects of the study.

The North-American MCAT[15] is amongst the most well-known. It contains four sections: physical sciences, verbal reasoning, a writing sample and biological sciences. Similar tests in Australia and UK (GAMSAT, UMAT and UKCAT)[16,17] are said to measure potential and aptitude. Predictive values of 0.104 (2008) and 0.106 (2009) of Punjab's MCAT are lower than those reported for North-American MCAT at 0.39, perhaps because the North-American MCAT also focuses on areas other than biological sciences.

It is planned to examine predictive performance beyond year one as students reach higher levels.

CONCLUSION

In developing countries, where so much is at stake, great importance needs to be given for selecting the 'right people for the right job'. One of the methods for selection is to develop a merit-list based on the results of pre-medical examinations and an Entrance Test. It would be a good idea to develop a more holistic and adequately predictive selection process. There is a dire need for standardization of education and assessment across all HSSC Boards in Punjab.

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