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Can we predict students' academic achievement through motivation and preadmission scores? A cross-sectional study

Rozina Nazir[a], Muhammad Kaleem[b], Sidra Aamer[c], Nadia Zaib[d], Ahsan Malik[e], Fizza Sahar Anwar[f]

Abstract

Introduction: There are many different procedures which are being employed to induct students into dental colleges. These procedures were debated many times because of their low reliability and predictive validity.

Material and methods: A Cross-sectional study was conducted at Margalla College of Dentistry (MCD) Margalla Institute of Health Sciences (MIHS). Second, third and final year BDS students were selected by non-probability convenience sampling technique. Sample size comprises of 264 students. These students were asked to fill out a 'Strength of Motivation for Dental School' (SMDS) questionnaire. The results of pre-admission grades of these students and the professional examination results of first, second and third professionals in the college were gathered and the correlation between pre-admission grades and motivation level of students with academic achievement was calculated.

Results: Only 32.5% of students were strongly motivated but majority (66.3%) of the students had a moderate level of motivation. There was a weak correlation between students' academic performance and pre-admission achievement scores and motivation. This study fails to reject the null hypothesis (p-value > 0.05) and concluded that not enough evidence is available to suggest that there is a significant correlation between pre-admission grades and level of motivation of students with the academic achievement.

Conclusions: Choosing students for admission in dental colleges only on the basis of pre-admissions scores or motivation level may not be a feasible option. A blend of both cognitive ability and non-cognitive skills including various personality attributes should be used when selecting students for health professions education.

Keywords: Academic success; correlation; dental; motivation

Introduction

Health professions education has a commitment and a social agreement to prepare health professionals better, in order to cater with the issues of disease and disability affecting various individuals.[1] Though Pakistan Medical Commission have streamlined the admissions criteria in its regulations, there are still many different procedures which are being employed to induct students into dental colleges. These procedures were debated many times because of their low reliability and predictive validity.[2] For selection of students for admission in dental colleges, the admissions committee makes decisions based on grades secured in matric/O levels, Higher Secondary School Certificate (HSSC) Examination /A levels scores, plus Medical College Admission

[a] Corresponding Author: BDS, FCPS, MHPE; Professor and Head Dept of Orthodontics, Foundation University College of Dentistry , Foundation University Islamabad.
Email: dr_rozina@hotmail.com
[b] BDS, MCPS, CHPE; Professor and Head Dept of Periodontology, Rawal College of Dentistry, Rawal Institute of Health Science Islamabad.
[c] BDS, MSc, MHPE; Professor and Head Dept of Dental Material Sciences, Foundation University College of Dentistry, Foundation University Islamabad.
[d] BDS, MPhil; Professor and Head Dept of Oral Pathology, Foundation University College of Dentistry, Foundation University Islamabad.
[e] BDS, MMEd; Assistant Professor Head Dept of Dental Education and Research Foundation University College of Dentistry, Foundation University Islamabad.
[f] BDS, MHPE; Assistant Professor Dept of Dental Education and Research Foundation University College of Dentistry, Foundation University Islamabad.

Test (MDCAT) scores. In United states MCAT has undergone five revisions since 1965. The goal of latest revision was to accomplish a physician with diverse qualities. Several reports evaluated the validity and usefulness of latest version in achieving diversity and inclusivity.[3,4] Most of the colleges in Pakistan disregard reference letters, aptitude test, autobiographic assessments and interviews,[5] which is why the predictive validity rarely rises above 0.010. Test scores represent the major challenge. Nettle and Millet[6] noted that many schools have begun to de-emphasize test scores for example, some institutions have modified tests and while others have made them elective. A study by Koeing et al.[7] revealed that other variables including diligence, motivation and communication skills should also be investigated because MDCAT may not be a perfect predictor. In South Africa, a combination of the National Schools Certificate (NSC) and National Benchmark Test scores were used to select students in medical school. The schools also take into consideration noncognitive measures including personal attributes, socioeconomic status, race, and gender. Research showed that the NBT reliably predicted success in medical schools.[8] The UK Clinical Aptitude Test comprises of multiple-choice questions in 5 subsets: "Verbal Reasoning," "Decision Making," "Quantitative Reasoning," "Abstract Reasoning," and "Situational Judgement."[9] Our main purpose should be to choose individuals who will turn out to be competent, caring health care workers and who will most likely attend to the health care requirements of the community. Students should be selected first on their scores in MDCAT and GPA then their motivational strength can be judged so that it will serve future predictor of their professional grooming and performance. Certain 'canonical traits' like intellectual ability, motivation, learning style, communicative ability and personality should also be taken into consideration when selecting students for admission to medical and dental colleges.[10] Medical schools are therefore concerned about selecting the best candidates who can complete the rigorous medical education and develop into competent practitioners with the required skills and personalities.[11,12] In many cases, medical schools construct the admission processes to align with their social missions.[13,14]

High level of motivation is required for Energetic, independent and self-directed learning and self-determination.[15] At health professions education institutions, students are more strongly inspired by inherent values of helping people rather than the rewards. The admission procedure should favour students with sincere intrinsic interest in medicine and dentistry, selflessness and care directed intentions rather than those who aim to achieve professional achievements and monetary benefits only.

A 'Strength of Motivation for Medical School' (SMMS)[16] questionnaire has been suggested and established to be a trustworthy and applicable tool, for assessing the motivation scores of students inducted in medical school. As we wanted to study the motivation level of dental students, we slightly modified the questionnaire in order to achieve our objective. This study was conducted **t**o determine the predictive validity of pre-admission results of dental students, correlating pre-admission scores & level of motivation of students with their academic achievement and compiling recommendations on the basis of evidence generated for possible modifications in the admission procedure.

Material and Methods

A Cross-sectional study was conducted at Margalla College of Dentistry (MCD) Margalla Institute of Health Sciences (MIHS) Rawalpindi from Nov 2018 to April 2019. Ethical approval was sort from Ethics Review Committee of the institute (ERC no= RN/22/18). Sample size comprises of all the students of 2nd, 3rd and final year BDS which

comes to total of 264 students (18.3% male and 81.7% female). Sampling technique was non-probability convenience sampling regardless of gender, age or preadmission background. Informed consent was taken from all the students participating in the study.

These students were asked to fill out the 'Strength of Motivation for Dental School' (SMDS) questionnaire which was generated after slight modification to the original 'Strength of Motivation for Medical School' (SMMS) Questionnaire. The SMMS questionnaire has encouraging psychometric properties having a Cronbach's alpha reliability, which was calculated to be of 0.79.[16] This questionnaire consisted of a total of 16 items and the scoring was done using the five-point Likert scale ranging from 1 'strongly disagree' to 5 'strongly agree'. SMDS was almost similar to the original SMMS except for the following changes: in nine items the word dentistry replaces medicine, in four items the word dentist replaces doctor and in one item, dental training replaces medical training. Majority of the questions display that they are directly related with motivation whereas some of them are contrasting showing an inverse relation with motivation. To assess motivation of students in our context four more questions were added to the questionnaire. After adding these four questions, the questionnaire had a final count of 20 items. The questionnaire was validated by two content experts. The content validity index was calculated to be 0.85.

Scoring was done according to the authors' scoring guide. Each item gets a score of 1, 2, 3, 4 or 5 depending on the answer chosen by the participant. The items 2, 4, 8, 9, 11, 13 and 14 need to be reverse scored i.e. (Subtract the option chosen by the participant from 6, e.g., if the participant answers 2, the actual score after reverse scoring will be 6-2=4). The maximum total score possible is 100 and the minimum total score possible is 20. Strength of motivation of students getting education in a dental college will be greater if the score achieved on the questionnaire is higher.

The questionnaire was administered at the end of a lecture conducted at the start of the respective session. Before giving them the questionnaire, all the participants were explained the purpose of this research and were told how to fill in the questionnaire. They were informed that all the data will be kept confidential and strictly anonymous and they could withdraw their names anytime from the study. The participants were given enough time to fill in the questionnaire. Student affairs department was asked to provide data of the students who had consented to participate in the study i.e., pre-admission grades of these students and the result of their first, second and third professional examination.

Data collected was analysed using the statistical package for social sciences (SPSS) version 23. To compare preadmission scores and SMDS scores in different BDS classes Analysis of Variance (ANOVA) was used. In order to determine the predictive validity; the correlation between the pre-admission scores, SMDS questionnaire scores with their academic achievement was calculated by employing the Pearson coefficient of correlation. Logistic Regression was used to evaluate whether the preadmission and SMDS scores could predict the professional academic performance. Test was considered significant if p-value ≤ 0.05.

Results

From total of 264 students, 252 returned the filled questionnaire with the response rate was 95.4%. Out of 252 students 46 (18.3%) were male and 206 (81.7%) were female. For students filling out the SMDS questionnaire gender proportions were 1:4.46. The response rate of students filling out the SMDS questionnaire on the specific day was 100%, whereas those who did not fill out the questionnaire were absent on that particular day.

The scores of SMDS questionnaire show that

only 79 (31.3%) students demonstrated high motivation towards studying in a dental college (SMDS questionnaire score 72-100). Low levels of motivation were found in a small percentage of students i.e., 0.4% (SMDS questionnaire score 16-43) and majority 172 (68.3%) students had a moderate level of motivation. In Matric/O levels, 72.2% got A-1 Grade, 22.2% got A Grade and 5.6% got B Grade. In FSc /A levels, 19.8% got A1 grade, 57.5 % got A Grade, 22.6% got B grade. In MDCAT, 0.8% got A-1, 9.1% got A, 40.1% got B and 50% got C grade (Table I).

The correlation of SMDS scores with Matric/O level and FSc/ A level was very weak and with MDCAT score and professional academic performance it was very weak negative correlation.

Comparison of FSc/ A levels, Matric/O levels and SMDS score in second through final year was done by Analysis of variance and is shown in Table II. Moderate strength of motivation was detected from 2nd year (66.47±9.81) to final year (66.94±9.91) but was insignificant.

To determine the relationship of preadmission scores and the strength of motivation with academic success of students, Pearson coefficient of correlation was employed. The results are shown in Table III. Very weak to weak correlation was found between second, third and final year professional exam results and the MDCAT, Matric/ O levels and FSc/ A levels scores. Second, third and final year BDS results revealed no significant correlation with student motivation. shown in Table III.

In correlation analysis scores of FSc/ A levels, MCAT and 1st Prof along with aggregate Professional Academic Performance were found significantly associated with Professional Academic Performance grading. These parameters were then put in the multinomial logistic regression model. FSc/ A level and MCAT scores could not retain the initial level correlation, although (logically) scores of 1st Prof and aggregate scores were found related with Professional Academic Performance grading: better performance in 1st Prof exam was statistically correlated to better performance in achieving B or A grades OR (95% CI, p-value) 1.78 (1.18 – 2.66, 0.005). Whereas the aggregate marks in 1st 2nd and 3rd years Professional Academic Performance were found less likely to perform poorly 0.07 (0.02 - 0.21, <0.001). Although this shows better 1st Prof grades correlating with better professional academic results, a correlation between higher motivation and better professional academic performance could not be demonstrated, which is the main focus of this study as shown in Table IV.

Table I: Motivation scores of BDS Students in relation to Matric/ O levels, FSc /A levels and MDCAT scores

		Motivation Level Scores of Students		
		16-43 (Low)	44-71 (Moderate)	72-100 (High)
Grade in Matric/ O levels	A-1	3 (1.6%)	122(67%)	57(31.3 %)
	A	0(0.0%)	35(62.5%)	21(37.5 %)
	B	0(0.0%)	10(71.4%)	4(28.6%)
Grade in FSc/ A level	A-1	1(2.0%)	33(66%)	16(32%)
	A	0(0.0%)	97(66.9%)	48(33.1 %)
	B	2(3.5%)	37(64.9%)	18(31.6 %)
Grade in MDCAT	A-1	0(0.0%)	2(100%)	0(0.0%)
	A	0(0.0%)	15(65.2%)	8(34.8%)
	B	1(1%)	68(67.3%)	32(31.7 %)
	C	2(1.6%)	82(65.1%)	42(33.3 %)

A-1>80%, A=70-79.99%, B=60-69.99%, C=50-59.99%

Table II: Comparison of Matric/O levels, FSc/ A levels, MDCAT Score and SMDS Score by Analysis of Variance (n=252)

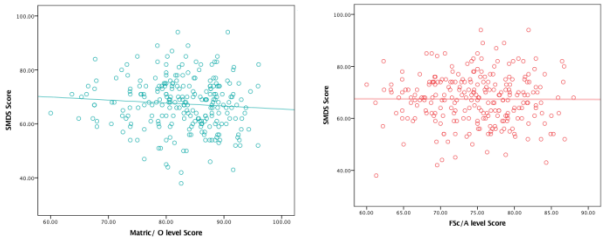
BDS Class	Matric/O levels score mean±SD	FSc/ A levels score mean±SD	MDCAT score mean±SD	SMDS score mean±SD
2nd Year (n=87)	84.20± 7.18%	76.21±5.59%	58.58±7.02%	66.47±9.81
3rd Year (n=77)	83.23±7.44%	75.23±5.82%	59.91±7.57%	69.01±8.72
Final Year (n=88)	81.16±5.83%	72.94±5.90%	57.89±6.30%	66.94±9.91
p-value	0.012	0.001	0.172	0.201

Table III: Pearson Coefficient of Correlation of Pre-Admission and Motivation scores with Academic achievement (n=252)

BDS Class scores	Matric/ O levels score		FSc/ A levels score		MDCAT score		SMDS score	
	Pearson Correlation	p-value	Pearson Correlation	p-value	Pearson Correlation	p-value	Pearson Correlation	p-value
1st Prof score	.147*	.019	.395**	.000	.363**	.000	.039	.534
2nd Prof score	-.122	.054	-.129*	.040	.035	.582	.046	.471
3rd Prof score	-.172**	.006	-.150**	.017	-.075	.235	-.054	.395

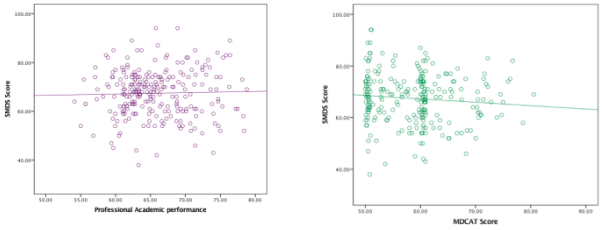
Table IV: Regression coefficient for FSc/A level, MDCAT and First Prof with Professional Academic Performance Grades

Professional Academic Performance Grades	Sig.	OR	95% Confidence Interval for Exp(B)	
			Lower Bound	Upper Bound
FSc/A level	0.409	.912	.733	1.135
MDCAT	0.132	1.110	.969	1.271
First Prof	0.005	1.781	1.189	2.666
Professional Academic Performance aggregate 1st, 2nd, 3rd Prof	0.000	0.073	.026	.201



Very weak negative correlation (r=-0.080)
Very weak negative correlation (r=-0.005)

Figure 1: SMDS Score correlation with Matric/ O levels and FSc/ A levels scores



Very weak negative correlation (r=-0.096)
Very weak correlation (r=0.029)

Figure 2: SMDS Score correlation with MDCAT and Professional exam score

Appendix
Questionnaire

Name: _____ Gender: M/F

Roll No. _____ Class: 2nd year/ 3rd year/ Final year

Strength of Motivation for Dental School (SMDS) Questionnaire

Please specify how much the following statements reflect your own state by selecting 1 to 5 (strongly disagree to strongly agree) with each statement given below.

1= Strongly disagree, 2= Disagree, 3=Neutral, 4=Agree, 5= Strongly Agree

		1	2	3	4	5
1.	I would always regret my decision if I hadn't availed myself of the opportunity to study dentistry.					
2.	I would quit studying dentistry if I were 95% certain that I could never become the specialist of my choice.					
3.	I would still choose dentistry even if that would mean studying in a foreign country in a language that I have not yet mastered.					
4.	As soon as I would discover that it would take me ten years to qualify as a dentist, I would stop studying.					
5.	Even if I could hardly maintain my social life, I would still continue dental training.					
6.	I wouldn't consider any other profession than becoming a dentist.					
7.	I would still choose dentistry even if that meant I would never be able to go on holidays with my friends anymore.					
8.	I would stop studying dentistry if I started scoring low marks and failing tests often.					

9.	If studying took me more than an average of 60 hours a week, I would seriously consider quitting.					
10.	I intend to become a dentist even though that would mean taking CME courses two evenings a week throughout my professional career.					
11.	It wouldn't really bother me too much if I could no longer study dentistry.					
12.	I would like to become a dentist, even if that would mean giving precedence to my work over my family.					
13.	I would quit studying as soon as it became apparent that there were no jobs or resident positions after graduation.					
14.	I would not have chosen dentistry if it would have caused me to accumulate substantial financial debts.					
15.	I would like to study dentistry, even if I have to spend a lot of time on topics that later turn out to be a waste of time.					
16.	I would be prepared to retake my final high school exams to get higher marks if this would be necessary to study dentistry.					
17.	I would still continue studying dentistry even if I find out there is gender-based selection at post graduate level.					
18.	If I get admission in a college that is located in a rural district, I would quit studying dentistry.					
19.	I intend to quit dentistry if I get scholarship abroad in any other field.					
20.	I would continue studying dentistry even if my parents forced me to choose some other profession.					

Discussion

Many studies have demonstrated that pre-admission grades are a good predicator of future success in medical or dental colleges.[17] However, some other studies have shown a modest correlation[18] while others demonstrate that it is not a good and reliable indicator for predicting future success in professional examination in medical or dental colleges.[19] In this study the correlation between pre-admission scores and academic performance of dental students in various professional examinations was found to lie between very weak to weak. While a study in Saudi Arabia by Al- Qahtani et al[20] showed that school certificate grades predicted academic success only in the early years of medical education.

Wingard and Williamson[21] explained in their literature review that the current scoring system was found to be deficient with inadequate selection techniques and intrinsic incapability of the grades to specify the conversion of potential aptitude into students' achievements. These are some of the likely explanations for this poor correlation. In their study they also summarized that preadmission grades and examination scores only tell us about a candidate's ability to remember remote evidences, and hence these students may be incapable of performing well in many important areas of health professions education.

A weak correlation between preadmission

grades and motivation score with academic achievements was demonstrated in this study. Kusurkar et al[22] explained in his literature review that a student's motivation for studying may be affected by many characteristics which can be related to specific student factors (age, gender, ethnicity, personality attributes, tutor and parent encouragement etc.), the learning environment, curriculum structure (conventional/ PBL-based), type of evaluation, rewards and an early contact with patients. A wide variety of non-cognitive skills, abilities and progressive attitudes and educational capability needs to be present in a health professional.

Multiple Mini-Interview (MMI) is one of the recently introduced methods. This method proved to be efficient in evaluating student abilities in many ways instead of using grades and test scores alone. A study by Lucieer SM et al revealed that those students who are admitted by voluntary qualitative selection procedure outperform those students based on lottery or outcome measure systems, which include dropout, professionalism and study progress.[23]

Some researchers speculate an increased level of motivation among students who are selected for medical programs.[22] A study by Wouters et al[24] stated that according to students, being selected for admission to medical school gave their motivation a boost. Kusurkar et al.[22] revealed in their study that this particular boost in motivation might be temporary in nature which is ultimately followed by a decrease of motivation during the first year of medical school.

In this study, the strength of motivation of dental students was assessed by using the SMDS questionnaire. There academic achievements and their motivation levels were compared, which revealed no correlation between the two. In study by Sobral DT[25] revealed that higher motivation and particularly higher intrinsic motivation is specifically related to enhanced academic performance in both medical and dental colleges during preclinical and clinical years. However, Luqman M[5] was unsuccessful in finding any correlation between academic success and motivation. In this study, majority of the students of this dental college had moderate strength of motivation in each academic year. The correlation in this study was found to be poor.

In order to maintain students' motivation levels particularly autonomous motivation, throughout the course of medical education the learning environment could be prepared in such a way that the students' desires for autonomy, competence and relatedness are all fulfilled. This can be accomplished by recommending autonomy-supportive educational methods. Problem based learning curricula; blended learning, early contact with and responsibility of patients, standards-based assessment and the chance to take up elective courses have all been recognized as being beneficial and helpful for maintaining students' motivation levels.[22]

There were a few limitations of the study, which should be noted when referring to the results of this study. The first is that this study is not a longitudinal study. More comprehensive cohort and prospective studies may be conducted on a single class with the same questionnaire being filled out every year by the same class as they progress from first year to final year of dental school. Results of this study cannot be generalized as the study population is confined to a single institute.

This will help in selection of those students who have a genuine interest in pursuing the profession and have the right cognitive abilities and suitable non-cognitive skills essential for achieving competency in the subject and proving to be beneficial to the community.

Conclusions

There was a weak correlation between students' academic performance and pre-admission achievement scores and motivation. Choosing students for admission in dental colleges only on the basis of pre-admissions scores or motivation level may not be a feasible option. A blend of both cognitive ability and non-cognitive skills

including various personality attributes should be used when selecting students for health professions education.

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