

ORIGINAL RESEARCH PAPER

## **Critical Analysis of Performance of Medical Students**

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**ABSTRACT** **Background:** Admission to B. P. Koirala Institute of Health Sciences (BPKIHS), a health sciences university, depends upon a candidate's academic score in prior education and performance in entrance examination. This study analyzes the performance of the first three classes of MBBS (Bachelor's Degree in Medicine and Surgery) students at different levels, who graduated between 1999 and 2001.

**Objective:** To determine whether the premedical performance at different levels has any role in medical performance, and to determine the extent to which the factors predict achievement in the medical program.

**Methodology:** The scores of students at different levels in premedical and medical education, gender and the medium of schooling of 86 medical students were compiled and analyzed.

**Results:** Annual medical performance scores were found to be significantly correlated with each other, but the average MBBS score was not dependent on either high school or entrance examination scores. However, it correlated with intermediate level in science score. Thus, the selection procedure needs to be developed in such a way that the candidates selected by the entrance examination are most likely to perform well in medical school and beyond.

**Implications:** There is a strong need to standardize the entrance selection procedure of MBBS at BPKIHS.

**KEYWORDS** *Performance, score, MBBS, BPKIHS, Nepal.*

### **Introduction**

The nature of admission to medical school must reflect the need for human resources, both quantitatively, in terms of the numbers selected, and

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qualitatively, in terms of the characteristics of those selected (Bandaranayake & Stiernborg, 1996). Students' selection for medical study is one of the major responsibilities of a medical school. This paper examines the significance of premedical scores in relation to medical performance and addresses the research question of how well the selection assessment at B. P. Koirala Institute of Health Sciences (BPKIHS) predicts medical performance.

BPKIHS, established under the act of 18 January 1993 and subsequently amended on 28 October 1998 by the parliament, is an autonomous health sciences university with a mandate to work towards developing a socially responsible and competent health work force. The primary responsibility of BPKIHS is to continuously strive to meet the health needs of the eastern region of Nepal at primary, secondary and tertiary levels. It also conducts need-based health systems research with an aim to use such strategies for overall community development of this region. The University is aptly named after Bisheshwar Prasad Koirala, Nepal's visionary in social upliftment, firm believer of National Reconciliation and National Integration. BPKIHS is located in a town called Dharan in Eastern Nepal – the land of the Everest.

The educational programs at BPKIHS are need-based, community-oriented, partially problem-based, and incorporate the organ system approach (Bijlani, 1995). The integrated community-oriented program refers to the decentralization teaching/learning program whereby teachers and students from BPKIHS regularly go to the sixteen affiliated district hospitals every week throughout the year. Health camps are also conducted in the community from time-to-time involving the students. The system of education at BPKIHS is the national pattern of medical education in Nepal as followed by Tribhuvan University and Kathmandu University, and as approved by the Nepal Medical Council and recommended for adoption by the Medical Council of India and General Medical Council of Britain (Upadhyay, 1995). Structured Interactive Sessions (SIS) involving active participation, Laboratory Exercise (LABEX), emphasizing achievement of important professional skills and development of the scientific temper, and Unconventional Learning Experiences (UNCLE) such as problem-based learning exercises, seminars and tutorials, etc., are ingredients of a very innovative and well-planned MBBS (Bachelor's Degree in Medicine and Surgery) program.

The students have to compete in the entrance exam to study MBBS at BPKIHS. Only those students scoring above 50% marks in the intermediate level or ten plus two with biology can compete. The top listed candidates are, then, admitted to BPKIHS MBBS Program. BPKIHS has its own pattern of assessment procedure to test skill, knowledge and aptitude of students. The assessment is carried out through a judicious mixture of tools such as Modified Essay Question (MEQ), Short Answer Question (SAQ), and Multiple Choice Question (MCQ). The test instruments also include Objective Structured Clinical Examination (OSCE – which consists of long case, short case and viva voce), Problem-Based Question (PBQ) and Objective Structured Practical

Examination (OSPE). An internal assessment is conducted at the end of every unit/semester of study. The final examination is conducted annually; the internal assessment contributes 30% to the final assessment (Koirala, 1996). The performance of the students is evaluated on the basis of their percentage scores at various levels of their study.

The aim of the present study is to determine whether the performance at different levels in the past has any significant role in the performance during medical undergraduate courses and to determine the extent to which the factors used can predict later achievement. Educational background and gender have also been taken into consideration. This paper offers suggestions for improving the student selection procedure applicable to various medical schools in developing and under-developing countries, and provides grounds for international recognition of the system adopted in teaching medical students at BPKIHS.

## **Methods**

### *Subjects/Source of Data*

A total of 86 students of the first three classes, admitted to the University for the academic year 1994–1996, are included in the study. The annual marks including internal assessments, secured by them in four and one-half years have been collected from records.

### *Study Variables*

1. High school or school leaving certificate score (SLCS)
2. Ten plus two or intermediate level in science score (ISS)
3. Entrance examination score (EES)
4. First year MBBS score (MBBS IS)
5. Second year MBBS score (MBBS IIS)
6. Third year MBBS score (MBBS IIIS)
7. Fourth year MBBS score (MBBS IVS)
8. Fifth year MBBS score (MBBS VS)
9. Average MBBS score (MBBS AS)
10. Gender
11. Medium of schooling

Note: (a) SLCS, ISS and EES are in percentages; (b) MBBS IS, MBBS IIS, MBBS IIIS, MBBS IVS and MBBS VS are in percentages of respective years which include internal assessments (30%) and annual exam (70%); and (c) MBBS AS is the average of percentage scores of 5 years.

### *Statistical Analysis*

The primary outcome of interest is the final score as denoted by average MBBS score of each student, calculated by taking the average of percentage-marks of

first, second, third, fourth and fifth years. Variables were studied with MS Excel (6.0) and data analyzed with SPSS (Statistical Package for Social Sciences, 10.0). The primary analysis was performed calculating measures of central tendency and dispersion. The skewness and kurtosis of the distribution of variables were observed. The Kolmogorov-Smirnov test showed all the continuous variables reasonably near to a normal distribution in each of three classes ( $p < 0.05$ ). Analysis of variance (ANOVA) was therefore used to determine the significant difference between the means. Pearson's correlation coefficients were calculated to determine the association of the scores and significance of the correlation was tested using the  $t$ -test (Mahajan, 1989).

## Results

The analysis of academic scores of the MBBS students in different classes (1994, 1995, and 1996) includes 29, 29 and 28 students, respectively. There were a few students who passed after a number of attempts in supplementary examinations. The failure rates, by class, were 3.3% in 1994, 6.6% in 1995, and 3.3% in 1996.

The analysis of variance (ANOVA) shows that the average entrance examination marks of the students in the three different classes were significant ( $p < 0.0001$ ). The average entrance performance in the 1994 class was comparatively better than in the 1995 and 1996 classes. But the percentage scores in high school and intermediate level in science showed no significant difference. Although the overall MBBS performance in the three different classes was significant ( $p < 0.01$ ), no difference was observed in the scores of first year and fifth year of MBBS: while the scores of second year ( $p < 0.0001$ ), third year ( $p < 0.0001$ ) and fourth year ( $p < 0.0001$ ) revealed statistically significant differences (Table 1).

Gender and medium of schooling did not have any significant role in the performance of any level of MBBS; but the performance of high school ( $p < 0.0005$ ) and intermediate level in science ( $p < 0.04$ ) was significantly better among the students from English medium schools than the students from Nepali medium schools (Table 1).

The Pearson's correlation analysis reveals that the average percentage marks of the MBBS students were significantly positively correlated with percentage marks in each medical year. The percentage marks in high school were negatively correlated with performance at entrance; however the correlation was not significant. The overall performance at MBBS course did not have any association with high school and entrance examination scores; but it was significantly correlated with intermediate level in science score ( $r = 0.2417$ ,  $p < 0.03$ ; Table 2).

**Table 1.** Scores at different levels of the MBBS students at BPKIHS from 1994–1996

	Mean ± SD									
	SLCS <sup>a</sup>	ISS <sup>b</sup>	EES <sup>c</sup>	MBBS IS <sup>d</sup>	MBBS IIS <sup>e</sup>	MBBS IIIS <sup>f</sup>	MBBS IVS <sup>g</sup>	MBBS VS <sup>h</sup>	MBBS AS <sup>i</sup>	MBBS AS <sup>j</sup>
<i>Classes (n)</i>										
1994 (29)	74.2 ± 6.3	71.9 ± 7.8	71.3 ± 2.5	67.8 ± 5.2	71.0 ± 5.1	73.3 ± 5.9	69.5 ± 4.3	65.8 ± 3.0	69.5 ± 4.2	69.5 ± 4.2
1995 (29)	75.2 ± 5.1	69.9 ± 8.7	52.1 ± 4.0	67.3 ± 5.4	68.0 ± 4.0	65.3 ± 3.5	65.3 ± 3.5	62.3 ± 17.6	65.6 ± 5.6	65.6 ± 5.6
1996 (28)	76.4 ± 5.3	71.2 ± 8.4	54.4 ± 4.2	69.3 ± 5.1	73.2 ± 4.6	64.3 ± 3.0	65.7 ± 3.2	66.5 ± 3.2	67.8 ± 3.4	67.8 ± 3.4
F value	1.1	0.4	241.2*	1.1	9.2*	42.7*	11.1*	1.3	5.2*	5.2*
<i>Gender</i>										
Male (78)	75.0 ± 5.7	70.6 ± 8.2	59.6 ± 9.4	68.2 ± 5.4	70.7 ± 5.2	67.7 ± 5.8	66.8 ± 4.3	64.6 ± 11.1	67.6 ± 4.9	67.6 ± 4.9
Female (8)	77.2 ± 3.6	74.6 ± 8.9	55.9 ± 8.2	67.5 ± 3.2	70.8 ± 2.8	67.7 ± 5.0	67.1 ± 2.5	66.9 ± 1.9	68.0 ± 1.8	68.0 ± 1.8
F value	1.056	1.726	1.143	0.105	0.006	0.002	0.045	0.344	0.064	0.064
<i>Medium of Schooling</i>										
English (68)	76.6 ± 4.6	72.0 ± 8.4	58.9 ± 9.3	68.6 ± 5.2	71.1 ± 5.1	67.7 ± 5.8	67.0 ± 4.4	64.6 ± 11.8	67.8 ± 5.1	67.8 ± 5.1
Nepali (18)	70.0 ± 6.0	67.3 ± 6.5	60.9 ± 9.6	66.2 ± 5.0	69.4 ± 4.0	67.4 ± 5.2	66.3 ± 3.2	65.7 ± 2.9	67.0 ± 3.2	67.0 ± 3.2
F value	25.658*	4.657*	0.652	3.145	1.561	0.052	0.415	0.147	0.419	0.419

\**p* < 0.05. <sup>a</sup>SLCS: % scores of high school. <sup>b</sup>ISS: % scores of intermediate in science. <sup>c</sup>EES: % scores of entrance examination. <sup>d</sup>MBBS IS: % scores of 1st year MBBS. <sup>e</sup>MBBS IIS: % scores of 2nd year MBBS. <sup>f</sup>MBBS IIIS: % scores of 3rd year MBBS. <sup>g</sup>MBBS IVS: % scores of 4th year MBBS. <sup>h</sup>MBBS VS: % scores of 5th year MBBS. <sup>i</sup>MBBS AS: average of % scores of five years.

**Table 2.** Correlation matrix of scores of MBBS students

Scores	SLCS	ISS	EES	MBBS IS	MBBS IIS	MBBS IIIS	MBBS IVS	MBBS VS	MBBS AS
SLCS <sup>a</sup>									
ISS <sup>b</sup>	0.290*								
EES <sup>c</sup>	-0.079	0.076							
MBBS IS <sup>d</sup>	0.177	0.247*	-0.094						
MBBS IIS <sup>e</sup>	0.167	0.208	0.025	0.770*					
MBBS IIIS <sup>f</sup>	0.075	0.245*	0.647*	0.299*	0.442*				
MBBS IVS <sup>g</sup>	0.151	0.197	0.362*	0.632*	0.712*	0.755*			
MBBS VS <sup>h</sup>	0.059	0.114	-0.055	0.544*	0.404*	0.224*	0.512*		
MBBS AS <sup>i</sup>	0.145	0.242*	0.179	0.806*	0.789*	0.631*	0.872*	0.7931	

\* $p < 0.05$ . <sup>a</sup>SLCS: % scores of high school. <sup>b</sup>ISS: % scores of intermediate in science. <sup>c</sup>EES: % scores of entrance examination. <sup>d</sup>MBBS IS: % scores of 1st year MBBS. <sup>e</sup>MBBS IIS: % scores of 2nd year MBBS. <sup>f</sup>MBBS IIIS: % scores of 3rd year MBBS. <sup>g</sup>MBBS IVS: % scores of 4th year MBBS. <sup>h</sup>MBBS VS: % scores of 5th year MBBS. <sup>i</sup>MBBS AS: average of % scores of five years.

## **Discussion**

In this study, the performance of the first three classes of students at MBBS is highlighted, and comparisons are made between them. The admission selection criteria should predict the performance of students taking their performance during the premedical years as a sub-criterion since its predictive power depends on the variables that are incorporated into this assessment process. The admission assessment approach is thought to be important as students enrolling at BPKIHS are from different backgrounds and places. The standard of their high school study may not have been the same, but the analysis shows that there was not any direct relationship between the entrance examination performance and MBBS performance. There is a need for the standardization of entrance procedure for selecting students at BPKIHS. Selection procedures could also include the assessment of non-cognitive knowledge, such as likely to perform well in medical school and beyond (Al-Nasir & Robertson, 2001). Studies have shown that the results of a medical college's selection procedures that include interviews incorporating the students' personal characteristics and cognitive abilities improve the selection process (Aldrich, 1987; Hojat *et al.*, 1993).

One earlier study reported that high school grades have a close correlation with the end of 1st year performance of medical students (Huff *et al.*, 1999). The present study contradicts this finding, as the performance at high school and entrance examination was not significantly correlated with MBBS first year nor with the average score on the MBBS. This may demonstrate that the entrance procedure at BPKIHS was not able to screen the students on the basis of personal qualities, intellectual abilities and motivation. The dean of medical schools in all of the Gulf States agrees that all medical schools should adopt this system of admissions by introducing a science examination *and* a structured interview (Weiss *et al.*, 1988). The present study also shows the related performance of the students in five years of medical study, where the scores of students in different medical years were significantly correlated. This may be due to the effective clinical teaching characteristics, which include teachers' competence, interpersonal relationships, teaching practices, evaluation practices and availability of materials to students (Das *et al.*, 1996). While earlier researchers focused on such characteristics of good teachers as accessibility, enthusiasm, clarity, knowledge and role modeling, later studies have included elements of the process of learning, such as creating a learning environment, promoting effective teaching, and providing feedback (Snell *et al.*, 2000).

This study suggests that there was no significant difference in the scores at any academic levels between males and females, similar to results obtained in a study conducted at Arabian Gulf University (Al-Nasir & Robertson, 2001).

A study reported that variability in performance of medical students in the final year examination could be partially explained by their high school certificate examination scores and the aggregate General School Certificate score emerged as the main predictor variable, followed by performance in biology

(Shazali *et al.*, 1997). Another study also reported that the high school grade emerged as a statistically significant predictor of 1st year academic score (Al-Nasir & Robertson, 2001). But there were no such strong predictors of MBBS performance in the present study, therefore it is not mentioned in the results. Basically there are many other variables contributing to the medical performance outcome like personal skills, intellectual abilities, labor, etc. These variables were not available from the records – a limitation of secondary data collection.

The selection procedure at BPKIHS is based on entrance performance only, which itself is based on multiple-choice questions. This may not screen out the unqualified students for future professional medical practice. To make the admission procedure more reliable and consistent so that the incapable students are invariably screened, three factors are strongly recommended to be included in selection procedure: (a) the minimum average score in high school examination may be increased; (b) a written admission test that includes biology, chemistry, physics, math and English may be taken; and (c) trained faculty members may conduct structured interviews. Those who successfully complete the above procedures should be admitted to the MBBS program.

## **Conclusion**

The average scores in high school and intermediate levels are significantly higher among the students from English medium schools than from Nepali medium schools, but the medium of schooling does not affect the performance of medical students to a great extent. The medical performance of the students depends on their own skills, including motivation, labor, and good teaching environment. The intermediate level in science score is a significant predictor of MBBS performance, but high school and entrance examination scores are not.

The basic purpose of entrance examinations is to select good students; however this study does not directly support this. There is, therefore, a strong need to develop or standardize the entrance-selection procedure. Every medical institute should develop a system that suits its unique situation, including the type of students it wishes to admit so that the objective of the program is adhered to. By and large, BPKIHS must look into the community background of the candidates and the need of the community concerned where the graduates will be working. A regular updating of the selection procedure would automatically be required to be consistent with and reflect changing societal needs.

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