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Paying Tuition and Academic Performance of Students at the Zagreb University School of Medicine

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Aim. To assess whether the prospect of waiving tuition fees influences the academic performance of the students with the lowest admission test scores and consequent mandatory tuition.

Methods. We compared the 110 tuition-paying students with the students who did not have to pay tuition because they scored well on 1994-1997 admission tests to the Zagreb School of Medicine. We formed 3 control groups (high-, medium-, and low-ranked students on the admission test), each with the same number of students as the group of tuition-paying students. Students' performance was assessed after the first two academic years on the basis of their grades, number of tries to pass the same examination, the time needed to pass an examination after a course, and the number of repeated years.

Results. Of 110 tuition-paying students admitted to the School in the 1994-1997 period, 13 had their tuition permanently waived and were therefore excluded from the analysis. Tuition-paying students had an the average grade of 3.1 out of maximum 5, took each examination 1.7 times before passing it, needed more than five months to pass an examination, and repeated 1.5 years per student. Their performance parameters did not differ from those of the low-ranked group, but were significantly worse than of the medium-ranked and high-ranked groups. Students in the high-ranked group performed the best in all four parameters (the average grade was slightly above 4.0, they took each examination 1.2 times on average, needed less than 2 months to pass an examination, and repeated 0.3 years per student).

Conclusion. The prospect of waiving tuition fees had no influence on students' performance. The students' rank on the admission test strongly correlates with their later academic success.

Key words: achievement; education, medical, undergraduate; motivation; school admission criteria; schools, medical; students, medical

Students at many medical schools in western countries have to pay tuition (1). In Croatia, as in most transition countries, the universities and their schools are state-owned, and education is free-of-charge for students who pass the admission test.

The absence of cost-driven motivation has often been accused as the main cause of students' poor performance, reflected in the long average duration of studies, high number of lost academic years, and low average grades (2), but it has never been researched systematically and proved as such in Croatia. Students' poor attendance of lectures, failures to prepare for seminars, and inadequate interest in all aspects of the studies has been ascribed to the lack of incentive. At the Zagreb University School of Medicine, approximately 30% of the students repeat the first, and another 10% each subsequent academic year (School's unpublished data). At the same time, there is a small but regular number of students who score low on the admission test, but get admitted to School provided they pay the tuition fee. The Ministry of Science and Technology has set the fee amount to 6,900 Croatian Kunas per year (around two average Croatian monthly salaries) (3-6). These students may be exempted from paying tuition in subsequent years if they prove successful (7-10).

We investigated whether the financial incentive influences a student's performance by comparing two different groups of students – those who pay and those who do not pay tuition, but follow the same curriculum in the same school.

Subjects and Methods

Setting

We carried out our study at the Zagreb University School of Medicine, the oldest and largest medical school in Croatia.

Admittance Rules

Every year, 600 or more high school graduates apply for admittance to the Zagreb University School of Medicine, which enrolls 240 new students per year. Two hundred of them are high school students who graduated from Croatian schools, and the remaining 40 are foreign students or students with Croatian citizenship who finished their high school education in a foreign country. Most candidates finish high school with excellent grades.

The admission tests are held in July and September, but students cannot take both in the same year. The September test is primarily organized for foreign high school students with Croatian or foreign citizenship and for those who, for some acceptable reason, were unable to attend the July test (3-6,11,12).

Two hundred student slots are always filled up in the July term, whereas 40 slots reserved for foreign students with foreign or Croatian citizenship never get filled up on September admission test. There are always 25-35 slots left, which get filled up by domestic candidates who ranked just below the 200th position on admission test in July. According to the decision of the Ministry of Science and Technology, these students are admitted under the condition to pay tuition each year. Those who fail to register for the next or any subsequent academic year must pay half the tuition fees temporarily or permanently, depending on their academic success (7-10).

Admission Test

The candidates are ranked according to a scoring system, with a maximum of 1,000 points. A student can earn 340 points on the basis of his or her high school general average grade, school-leaving examination grade, and grades in Biology, Chemistry, and Physics. Grades range from 2 to 5 (1 is a failure). Another 630 points can be scored on the admission test that contains 120 multiple-choice questions covering Biology, Chemistry, and Physics. There are no negative points for wrong answers. Thirty points can be earned for special achievements in high school (e.g., success on state competitions in Biology, Chemistry, or Physics) (12).

In general, the best-ranked candidates score a total of around 930 points, the lowest-ranked around 700 points, and those who have to pay tuition usually score around 670 points in total (the School's unpublished data). The candidates who score less than 315 points on the admission test cannot be enrolled regardless of their total score (12).

General Outline of the Curiculum

The academic year starts on October 1, and ends on September 30. The winter break (February) divides the academic year into two semesters.

In total, there are some 40 courses during a 6-year undergraduate study at the Zagreb University School of Medicine. All courses have some form of examination at the end, and most have a final grade that enters the calculation of the average grade. Passing grades range from 2 (D) to 5 (A). A student who fails an examination has to repeat it until earning at least grade 2 (11).

There are two regular examination terms in winter (February 1-28), two in summer (June 15-July 15), and two in fall (September 1-30) (11). Some courses offer additional terms. To be promoted to the next year of studies, a student must pass the examinations from most courses of a given year. A student is allowed to take each course examination four times, i.e., a student may fail the examination three times without any consequences. The fourth time, the student takes the examination before a three-member committee, and the failure means attending the course again (and cannot attend the next year courses).

Study Groups

We compared the achievement of the tuition-paying students with that of the students who did not have to pay tuition because they scored well on the admission test (ranked above the 200th position on the July admission test). Since the tuition-paying students had scored the worst at the admission test, the most appropriate control group whom to compare them with were the students who were ranked just above the tuition-paying students on the July admission test, i.e., slightly above the 200th position. They formed the low-ranked group.

To control the significance of the performance on the admission test, we included two additional comparison groups: those who were positioned in the middle of the list (the medium-ranked students), and those who scored the best at the admission test (high-ranked students) (Table 1).

Inclusion Criteria

The School's curriculum for the 1994/95 academic year was considerably modified (13,14), making it impossible to include the students admitted before 1994 in our study. Therefore, we studied the cohorts of students admitted in 1994, 1995, 1996, and 1997 (Table 1).

The number of the students admitted as tuition-paying students determined the initial size of all four groups.

The study finished with the beginning of 2000, which means that studied cohorts were not followed up to the end of their studies. Consequently, we assessed student's performance only during the first two years of their studies.

Table 1. Description of the four study groups of students admitted in the 1st and 2nd year of the studies at the Zagreb University School of Medicine in 1994, 1995, 1996, and 1997^a

Year of admission	Groups (No. of students)											
	high- ranked	medium- ranked	low- ranked	tuition-paying								
				admitted	excluded ^b	remained -	waived tuition fee					
							temporarily ^c	permanently ^d				
1994	18	18	18	18	3	15	0	2				
1995	25	25	25	25	5	20	2	0				
1996	35	35	35	35	3	32	2	2				
1997	32	32	32	32	2	30	0	2				
Total	110	110	110	110	13	97	4	6				

^aThe number of students admitted as tuition-paying students determined the initial size of all four groups. The groups have been formed according to the students' ranking at the admission tests in 1994, 1995, 1996, and 1997.

^bThese students were excluded from the study because they were waived tuition fees for reasons not related to academic performance: a) immediately after admission on the basis of the status of a displaced person or refugee because of the war, according to the decision of Ministry of Science and Technology; and b) after failing the first year and then passing the admission test the next year, succeeding thus to enroll without paying tuition.

^cA student could be temporarily waived the tuition fees by the decision of the dean if, after the 1st year of study, she or he has achieved the average mark of at least 4.0; in our research these students have been followed during the first two years of studies.

^d According to the decision of Ministry of Science and Education or by decision of the School's dean, the students who were ranked among the best 10% of all the students from the "tuition-paying group" could be permanently exempted, providing that they did not repeat any further academic year; these students have been followed only during the 1st year of studies.

Exclusion Criteria

The tuition-paying students could be exempted from paying fees (Table 1):

(a) By the decision of the School's dean. These students were exempted temporarily if they achieved the average mark of at least 4.0 after the first year of studies (7-9). Their performance was evaluated again after the next year of study. They were not excluded from our research because they still had an obvious financial motive to study hard.

(b) By the decision of Ministry of Science and Technology or the School's dean. These students were permanently exempted if they were ranked among the best 10% students in their group after the first year, provided that they would not fail any further year (7-10). We took into account their first-year scores, but excluded them from the further analysis because permanent exemption would lessen their fee-driven incentive.

(c) By the decision of Ministry of Science and Technology. Tuition could be permanently waivered immediately after the admittance if a student had the status of a displaced person or refugee because of the war (4,5). Such students were excluded from our research.

d) By passing the admission test the next year and thus succeeding to enroll without paying tuition. These students, as they were permanently exempted from paying tuition, were also excluded from our research, because they did not have a financial incentive to perform better.

Outcome Measures

Students' performance was assessed with respect to the first two years of their studies. The four study groups were compared using the average values of four variables for each group: the average passing grade, number of tries to pass the examination, time required to pass an examination, and number of repeated study years.

All examinations which carry a grade were analyzed: Anatomy, Chemistry, Biology, Physics, and Introduction to Social Medicine as the first year courses, and Physiology and Immunology, Biochemistry, Histology and Embryology, Neuroscience, Clinical Anatomy, and Introduction to Medical Research (with Medical Informatics and Statistics) as the second year courses (13).

Average Grade. The average grades were calculated on the basis of passed examinations only (grades 2-5). The overall average grade for a study group was calculated from the average grades of each student.

Average Number of Tries to Pass an Examination. The average number of tries to pass an examination was determined per course for each student and then calculated for each study group.

Average Time Needed to Pass an Examination. One-semester courses (Chemistry, Physics, Neuroscience, Clinical Anatomy, and Introduction to Medical Research) end on January 30 or June 15, and two-semester courses on June 15. The average period a student needed to pass an examination was calculated from the interval that elapsed from the end of a course to passing the examination in given subject. The average period (in days) was then calculated for each study group. *Number of Repeated Years.* According to the School's rules (11), a student has failed a year if, on September 30, at the end of the academic year, she or he did not pass all the examinations required. The number of failed academic years was then expressed as the average number of failed years during the first two academic years per student in each of the four study groups.

Statistics

Wilcoxon's nonparametric unpaired test was used in the analysis of the differences in the four parameters measured in the four study groups (p<0.05).

Results

A total of 427 students were included in our study. Each of the four investigated cohorts from 1994, 1995, 1996, and 1997 comprised 110 students (Table 1), but 13 students from the tuition-paying group were excluded from the study because their tuition was waived for reasons not related to their academic performance (Table 1). This left 97 students in the tuition-paying group, whereas the other three groups of students – the low-, the medium-, and the high-ranked group – had 110 students each (Table 1).

After the first two years of studies, the tuition-paying students achieved an average grade of 3.1, took each examination 1.7 times before passing it, needed more than five months to pass the examinations after the courses ended, and repeated 1.5 years per student during the first two years (Table 2). Their performance did not statistically differ from the performance of the low-ranked group, but they performed significantly worse than the medium- and high-ranked groups (Table 2).

The medium-ranked student group performed significantly better than the low-ranked or tuition-paying groups in three parameters: on average, the medium-ranked students achieved higher grades, took the examination fewer times before passing it, and had repeated fewer academic years per student (Table 2).

The high-ranked students performed significantly better than the three other groups in all four investigated parameters. The high-ranked students achieved better average grade, failed the examination less frequently, needed less time to pass the examination after the course ended, and repeated the first two academic years less often than the other group (p<0.001) (Table 2).

Table 2. Studying performance (mean SD) of the students according to their ranking on the admission test for the Zagreb University

 School of Medicine in 1994, 1995, 1996, and 1997 during their first two years of study

	Students' ranking positions									
Performance parameters	high	\mathbf{p}^{a}	medium	pa	low	pa	tuition-paying			
Average mark ^b	4.0±0.6	< 0.001	3.3±0.5	0.012	3.1±0.5	0.665	3.1±0.6			
Average number of times of repeating the same examination ^c	1.2±0.2	<0.001	1.4±0.4	0.013	1.6±0.6	0.120	1.7±0.7			
Average time to pass examination ^d	57.5±39.6	< 0.001	107.9±71.4	0.092	128.4±89.4	0.069	157.1±105.2			
The loss of the academic year ^e	0.3±0.7	< 0.001	0.9±1.1	0.007	1.3 ± 1.1	0.389	1.5±1.2			

^aWilcoxon's nonparametric unpaired test.

^bAverage mark (range 2-5) of all the examinations passed during the 1st and 2nd year of studies.

Average number of times one examination was taken in order to pass it.

^dAverage time (days) a student studied for passing the examination after the lectures have finished.

Average number of lost years (the 1st or 2nd year) per student.

Discussion

Our analysis of students' performance during the first two years of medical studies showed that paying tuition fees, with the possibility of exemption if a student fulfilled the criteria of good performance, in general did not constitute an incentive for an effort to perform better. This corresponds to our previous preliminary research (2).

After each year of studies, the tuition-paying group of students had the obvious motive to perform well. They had the opportunity to be permanently exempted from paying fees if they were among the best 10% students (7-10), and to be temporary exempted from paying fees if they passed all examinations and achieved a 4.0 average mark (7-9). In spite of this incentive, the students did not perform better than the students with similar admission rank. Possible reasons for their poor performance may be twofold. The tuition of 6,900 Kunas (approximately a bit more than two average monthly salaries in Croatia) was so insignificant that it did not represent a financial burden to their families and thus failed to constitute the incentive for better performance. This explanation is hardly acceptable. Although the tuition fee was not determined on economic grounds (in reality, the expenses per academic year are several fold higher), it still represented a significant amount for an average family in Croatia after the war.

Another possible explanation for the poor performance of tuition-paying students may lie in their low ranking on the admission test, because the students scoring better at the admission test performed significantly better in their academic obligations, as was reported by other studies (15,16). Accordingly, the tuition-paying and the low-ranked students who were ranked at the bottom of the admission list performed equally poorly during their first two years of study.

The School's admission test may not have been discriminative enough, with only 120 questions to differentiate all the applicants, whose number is at least three-fold (600-700) greater than the *numerous clausus* of the School. Nevertheless, our study showed high concordance between the ranking at the admission test and subsequent academic performance. This is an important finding, since the relation between the previous academic ability (e.g., at school or college) and the performance at medical school is a highly controversial question (17). Some authors found (18) that the students who had better than average grades in school also performed better later on in their career, whereas other investigators got different results (19-22).

Our analysis also showed that extending the ranking list downwards would, in general, result in admission of the candidates who would be less successful in their academic obligations. A surprising finding was that each year around 15% of the best ranked candidates at the admission test, who subsequently performed the best in the school, still failed to fulfill the requirements to be promoted to the next academic year (Table 2). This certainly calls for School's administration attention and analysis of the possible underlying causes.

We believe that our present results clearly demonstrate that a quantitative and unbiased admission test may serve as a powerful tool to select the best candidates. Indeed, the admission test score and the first two years of studies are among the most powerful discriminants of human qualities and profile of future physicians (23,24). Our study also showed that, in state-owned schools and free education, tuition does not present an incentive for better studying, at least in students who did not satisfy the admission criteria. With the development of private universities and schools (25), it will be interesting to see if such attitude towards tuition would change.

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