

What Do Grades in Clinical Subjects Depend on? Case study of the Zagreb University School of Medicine

Rajna Golubić, Karlo Golubić

Zagreb University School of Medicine, Zagreb, Croatia

Aim. To investigate the influence of clinical site, student's and preceptor's sex, and preceptor's academic rank on grading in eight clinical subjects at the Zagreb University School of Medicine between 1999 and 2002.

Methods. We analyzed oral exam grades from five fourth-year clinical courses (radiology, oncology, nuclear medicine, internal medicine, and psychiatry) and three fifth-year clinical courses (surgery; ear, nose and throat diseases (ENT); and pediatrics). Internal medicine course also had a written test, common for all students. We recorded the clinical site where the exams were taken, clinical subjects, grades, number of attempts at passing the exams, student and preceptor gender, and preceptor academic rank. Chi-square test was used for data analysis.

Results. Grades from all clinical subjects but internal medicine course significantly differed, depending on clinical site where the exam was taken. There was a significant difference in grades from the internal medicine written exam among teaching sites. Preceptors with higher academic ranks awarded better grades. Male and female students performed equally well. Female preceptors gave significantly lower grades, regardless of the student gender and created a higher failure rate.

Conclusion. Oral exams are a subjective method of evaluating students' knowledge of clinical subjects and depend on the site of teaching and examination. Written exams and structured clinical skills examinations should be implemented for objective student assessment.

Key words: Croatia; education, medical, undergraduate; educational measurement; knowledge; students, medical; preceptorship

Grades are used as a method of evaluation of medical students' knowledge. They are also used as proofs and indicators of students' success, which greatly affects future employment opportunities and chance for professional advancement (1). Therefore, they need to be objective markers of knowledge and comprehension of the studied subject. Fairness and equity in grading is a subject of continuing interest and concern (2). The main factor presumed to cause an unequal treatment of students at exams is the subjectivity of preceptors.

Of the many factors affecting academic achievement, one of the most consistently reported is gender (3-6). Several studies, although not very recent, focused on comparing the performance of male and female students (3-13), whereas only a few others addressed the effect of preceptor gender and the interaction between preceptor and student gender (14,15). Further factors that may influence student grades are gender-specific differences and diversity in teaching at various clinical sites. Many studies show that women tend to have better verbal abilities, whereas men tend to excel in visual-spatial and mathematical tests (16-20). Little research attention has been given

to teacher's rank in relation to student's achievements (21). Undoubtedly, variability exists in instructional experiences of medical students in different clinical settings (2,22-25).

The aim of our study was to investigate the influence of student's and preceptor's gender and preceptor's academic rank on grading. We also analyzed the influence of these factors at different clinical teaching sites.

Material and Methods

Data were collected for the academic years 1999/2000, 2000/2001, and 2001/2002. We analyzed eight clinical subjects: radiology, oncology, nuclear medicine, internal medicine and psychiatry (fourth-year subjects) and surgery, ear, nose and throat diseases (ENT), and pediatrics (fifth-year subjects). A large part of clinical teaching at the Zagreb University School of Medicine takes place at the clinical departments of the University Hospital Center ("Šalata", "Rebro", and "Petrova" premises), at the Sisters of Mercy, Merkur, and Dubrava University Hospitals, as well as at other health institutions, such as Jordanovac Hospital for Pulmonary Diseases, Holy Ghost General Hospital, Vrapče Psychiatric Hospital, and others. Classes and exams from each analyzed subject were held at different clinical sites (at least two) (Table 1). Students were alphabetically distributed into groups attending classes from internal medicine, radiology, surgery, and pediatrics,

Table 1. Number of examinations and failure rates (in brackets) according to subject and clinical teaching site*

Subject	Clinical site								Total exams	p*
	Rebro	Sisters of Mercy	Dubrava	Merkur	Holy Ghost	Jordanovac	Vrapče	Šalata		
Radiology	444 (23.9)	187 (0.5)		194 (19.1)					825 (17.5)	<0.001
Oncology	369 (12.2)	407 (4.4)							776 (8.1)	<0.001
Nuclear medicine	553 (5.8)	322 (24.5)							875 (12.7)	<0.001
Internal medicine	350 (3.4)	119 (2.5)	54 (3.7)	131 (7.6)	41 (4.9)				695 (4.2)	–
Psychiatry	473 (3.6)						255 (0)		728 (2.3)	–
Surgery	411 (1.9)		183 (0.5)	70 (1.4)	49 (0)	83 (0)			796 (1.3)	–
ENT†		398 (0)						482 (3.7)	880 (2)	–
Pediatrics	454 (6.8)							228 (0)	682 (4.5)	–
Total exams	3,054	1,433	237	395	90	83	255	710	6,257	–

*Chi-square test – inappropriate because the expected frequency was below 1 or < 5 in more than 20% of the cases.

†Ear, nose, and throat.

Table 2. Number of preceptors according to subject they taught, their gender, and rank

Subject	Preceptor gender		Preceptor rank			Total number of preceptors
	male	female	assistant professor	associate professor	full professor	
Radiology	4	4	1	3	4	8
Oncology	3	1	1	2	1	4
Nuclear medicine	2	2	2	1	1	4
Internal medicine	34	6	6	24	10	40
Surgery	14	1	2	8	5	15
ENT*	10	1	0	6	5	11
Pediatrics	7	4	4	4	3	11

*Ear, nose, and throat.

at different clinical sites, whereas they were distributed at random for classes from other subjects. All of the exams were taken at clinical sites where the students attended classes from respective subject, except pediatrics, where all students visited all clinics, and surgery, where students from different sites were randomly distributed to preceptors from all clinics. For each subject, there was a different number of preceptors (Table 2). Due to the lack of complete data (preceptor gender and rank), full analysis of the psychiatry course exam was not possible.

Sources and Data Collection

Since there is no common rule for keeping records of student's clinical exams at the Zagreb University School of Medicine, administrative officers at each clinical site save the data in a paper form, in their own way. Data were collected from the administrative offices at the following teaching sites: "Rebro", Sisters of Mercy, Merkur, Holy Ghost, Dubrava, "Šalata" and Vrapče. The data on student grades earned at the written exam from the internal medicine course were available from the central administrative department of the School. We recorded the following data for each clinical subject and teaching sites where the exams were taken: frequency of each grade, number of attempts to pass an exam, student's and preceptor's gender, and preceptor's academic rank. The exam from internal medicine course consisted of a written test followed by oral examination at which the final grade is received. From all other subjects there are only oral exams. The passing grades at the Zagreb University range from 2 (sufficient) to 5 (excellent). Grade 1 means that a student failed the exam and has to take it again. Since 1993 the number of exam attempts has been limited to four. We registered a total 6,257 records of exam attempts.

Statistical Analysis

Grade frequencies were presented as contingency tables. The results were displayed as percentages of students who received grades 2-5. The failure rate was analyzed separately. We tested grade differences among clinical sites, student's and preceptor's gender, preceptor's rank, and subjects by chi-square test; $p < 0.05$ was considered statistically significant. Microsoft® Access 2002 and Microsoft® Excel 2002 (Microsoft Corporation, Washington DC, USA) were used for all statistical analyses.

Results

Students grades from different clinical subjects significantly differed. The best grades were awarded

at the ENT exam and the worst at the internal medicine exam ($p < 0.001$; Fig. 1). The failure rate was the highest from radiology course and the lowest from surgery course ($p < 0.001$; Table 1).

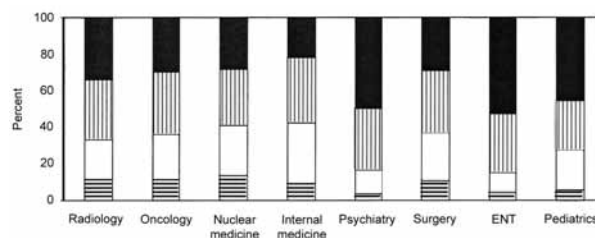


Figure 1. Frequency of grades per clinical subject. Percentage of exams resulting in noted grades is shown on the ordinate. Grade 2 (sufficient) – horizontal lines, grade 3 (good) – gray, grade 4 (very good) – vertical lines, and grade 5 (excellent) – black. Only passing grades are shown.

Passing grades in all clinical subjects significantly differed depending on teaching site, with exception of the internal medicine course (Fig. 2). The proportion of failed exams was higher at clinical sites where significantly lower grades were given (Table 1, Fig. 2). Failed surgery exams could not be tested due to low frequency. At some teaching sites, we did not record any exam failures (Table 1).

Grades received at the written exam of the internal medicine, which is common for all students, significantly differed depending on the teaching site where students attended the course. Students who attended the course at the Dubrava University Hospital earned the best grades (chi-square = 24.5, $p = 0.02$), whereas the students taught at the "Merkur" University Hospital were the least successful (Fig. 3). The written exam of the internal medicine is followed by

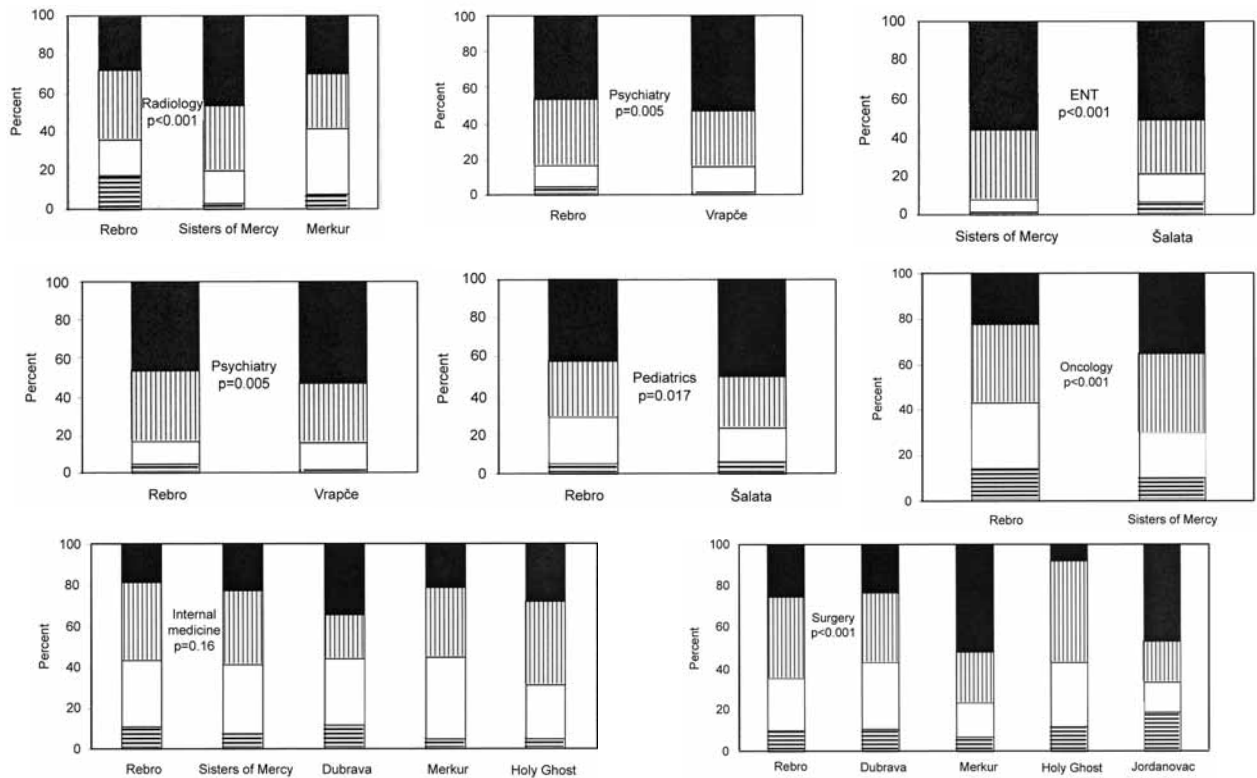


Figure 2. Frequency of grades earned according to the clinical sites of preceptors. Percentage of exams resulting in passing grades is shown on the ordinate. Grade 2 (sufficient) – horizontal lines, grade 3 (good) – gray, grade 4 (very good) – vertical lines, and grade 5 (excellent) – black. Only passing grades are shown. There is significant difference in grades among different clinical sites of each subject, except internal medicine.

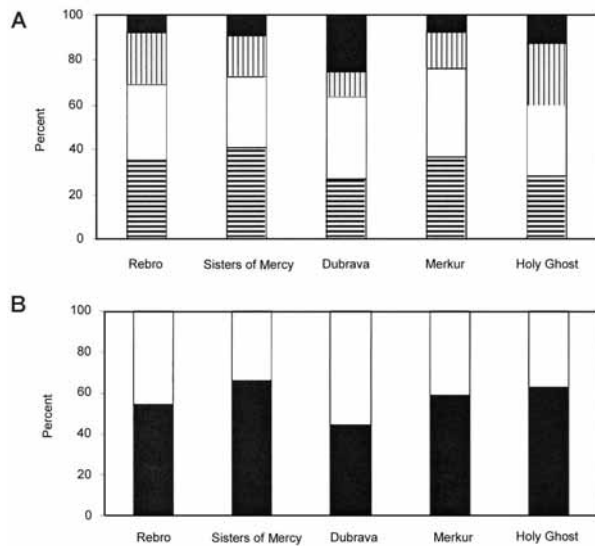


Figure 3. A. Frequency of grades earned at the written exam of internal medicine according to the clinical sites. Percentage of exams resulting in passing grades is shown on the ordinate. Grade 2 (sufficient) – horizontal lines, grade 3 (good) – gray, grade 4 (very good) – vertical lines, and grade 5 (excellent) – black. Only passing grades are shown. **B.** Increase of grades earned at the written exam to the grades at the oral exam of internal medicine according to clinical sites. Black indicates the grades that increased and white those that decreased or remained the same.

an oral exam, where the final grade is concluded. At all teaching sites, the grades improved (Fig. 3), except at the “Dubrava” University Hospital, where most students received final grade that was lower or equal to the grade received on written test (chi-square = 9.6, $p = 0.047$).

There was a significant difference in grades depending on preceptor’s academic rank, with full professors giving the best grades and assistant professors the worst (Fig. 4). This propensity was particularly emphasized at radiology and ENT courses (Web table 1). Assistant professors also failed relatively more stu-

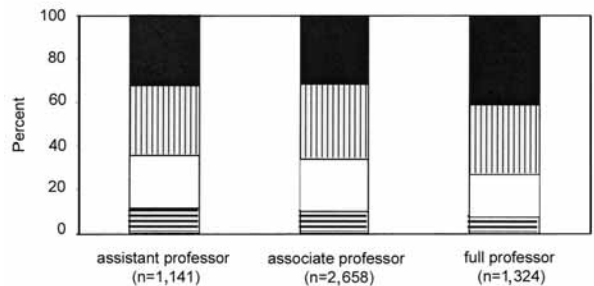


Figure 4. Frequency of grades earned according to preceptor’s academic rank. Grade 2 (sufficient) – horizontal lines, grade 3 (good) – gray, grade 4 (very good) – vertical lines, and grade 5 (excellent) – black. Only passing grades are shown. Numbers of students at examinations is shown in the brackets.

dents than associate professors (11.1% vs 6.4%), who again failed more students than full professors (5.8%; chi-square = 79.9, $p < 0.001$).

We found no significant difference in grades between female and male students in general ($p = 0.06$), although female students achieved significantly higher grades at psychiatry exam, whereas male students performed better at the radiology exam (Web table 2). In general, male preceptors gave significantly better grades (Fig. 5), as illustrated by oncology and pediatrics exam grades (Web table 2). Analyzing the interaction between student and preceptor gender, we found no significant difference in grades between male and female students considering the gender of preceptor, with the exception of pediatrics, where male students received better grades when the preceptor was male (Web table 2).

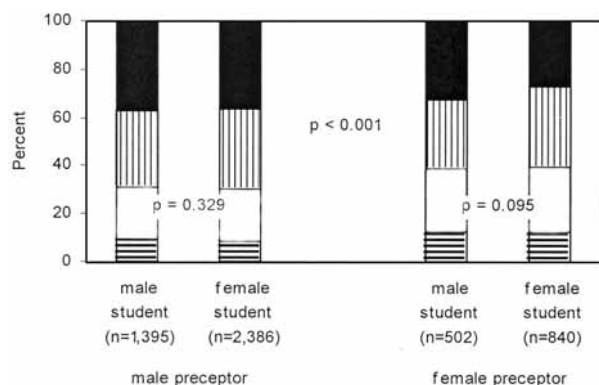


Figure 5. Frequency of grades earned according to student and preceptor gender. Grade 2 (sufficient) – horizontal lines, grade 3 (good) – gray, grade 4 (very good) – vertical lines, and grade 5 (excellent) – black. Only passing grades are shown. Female preceptors gave significantly lower grades than their male colleagues. Numbers of students is in the brackets.

Discussion

Oral exam is the only form of the evaluation of clinical competence of students during their clerkship in majority of clinical subjects included in the curriculum of the Zagreb University School of Medicine, despite the fact that orals have poor reliability (26), because there are many factors that could influence the grades. Our study clearly showed that students at different teaching sites received significantly different grades from clinical subjects. Studies from other university settings showed that probable reasons for the differences in grades were differences in quality of teaching and instructional style (22), as well as the subjectivity of preceptors (14,15). We also showed that student grades depended on the preceptor's academic rank and gender. The best example of the difference between written and oral part of the exam is the case of internal medicine. At one teaching site, students achieved highest scores and best grades on a written test (the same test is applied at all teaching sites). This would be an objective indicator of the teaching quality. However, at the oral part of the exam, teachers from this site were the strictest, and

the final exam grades did not differ or were even worse than those earned at the written test. On the other hand, preceptors from other teaching sites, where students performed worse at the written exam, were more lenient and awarded better grades. This indicates that leniency may be related to poorer teaching performance. In the USA, studies showed significant differences among teaching sites in a psychiatry clerkship (2) and very little or no difference in a surgical clerkship (25). In three Australian medical schools, little difference was found in students' grades (27).

The reasons for higher grades given by higher ranked preceptors are not apparent, but may be a consequence of the preceptor subjectivity. Lower ranked preceptors may have less experience in grading and often insist on factual knowledge rather than comprehension of the subject and clinical skills. Further investigation is required to test this hypothesis.

Why do female preceptors fail more students and give lower grades? Maybe the reason is the inequity of women in the academic setting, observable even today (7), which requires them to invest greater efforts to receive the same credit as men. This may be reflected in higher criteria for grades at examinations.

Our study, in general, showed no bias related to gender of the preceptor or student. The results of other related studies performed in the USA varied from male preceptors' affinity towards female students and female preceptors' dislike towards male students in an ambulatory care clerkship (14), to no recorded bias in the evaluation of surgical residents (15).

We did not find differences in between male and female students in their grades, except in psychiatry and radiology courses. Better performance by women, especially in obstetrics and gynecology, pediatrics, and psychiatry courses (3-6,14) was recorded in the USA, Great Britain, and Ireland; equal overall performance and grades in the internal medicine course (8,10-12) in the USA, Great Britain, and Canada. In Croatia, men received generally higher grades (7). The reasons for the substantial difference in the performance of male and female medical students in specific subjects remain unclear. Many factors may have a bearing on this trend. There is evidence that female students demonstrate superior interviewing (13) and verbal skills (16-20) and perform better in the psychiatric clerkship (8,28). In psychiatry, teaching has been shown to lead to the development of more favorable attitudes to the subject, especially among female students, which had a positive correlation with academic performance (29). Male students performed better in radiology probably because of their higher visual-spatial abilities (16-20).

Better grades at the higher year of medical studies can be explained by greater clinical experience gained at the previous years of studies. It should be taken into account that fourth-year medical students are just at the beginning of their clinical experience. Prior clinical experience has been shown to correlate positively with grades in clinical subjects (30).

Our study had a number of limitations. The most important one was a cross-sectional design of the study, which does not allow causative conclusions.

Also, different numbers of preceptors and students they examined did not allow direct comparisons. Despite these limitations, our study clearly showed that oral examinations are very subjective way of evaluating knowledge and skills of medical students. More objective methods of testing students' knowledge and clinical skills need to be developed. Our study may serve as a first step in the investigation of the factors influencing examination outcomes.

Acknowledgment

We are very grateful to Prof Jadranka Božikov from the Department of Medical Informatics, Zagreb University School of Medicine, for invaluable advice, fruitful discussions and assistance with statistical analysis.

References

- Bergovec M, Kuzman T, Rojnić M, Maković A. Is there a grade inflation at medical schools? Case study of the Zagreb University School of Medicine. *Croat Med J*. 2003;44:92-7.
- Puryear DA, Miller DA. The effect of clerkship site on medical student examination grades. *Med Educ*. 1990; 24:239-42.
- Pritchard DJ. Effects of sex and alphabetical listing on examination performance of medical students. *Med Educ*. 1988;22:205-10.
- Krueger PM. Do women medical students outperform men in obstetrics and gynecology? *Acad Med*. 1998; 73:101-2.
- McDonough CM, Horgan A, Codd MB, Casey PR. Gender differences in the results of the final medical examination at University College Dublin. *Med Educ*. 2000; 34:30-4.
- Anderson JR, Lennox B, Low A. Medical students' performance. An analysis of selection producers and examination marks in Glasgow. *Lancet*. 1964;1:96-100.
- Đanić A, Hadžibegović I, Loparić M. Status of women in small academic medical community: case study of the Zagreb University School of Medicine. *Croat Med J*. 2003;44:32-5.
- Keitner GI, Baldwin LM, McKendall MJ. Gender and psychiatric clerkship performance. *Can J Psychiatry*. 1984;29:327-9.
- Spiegel DA, Smolen RC, Jonas CK. An examination of the relationships among interpersonal stress, morale and academic performance in male and female medical students. *Soc Sci Med*. 1986;23:1157-61.
- Holmes FF, Holmes GE, Hassanein R. Performance of male and female medical students in a medicine clerkship. *JAMA*. 1978;239:2259-62.
- Harward DH, Lyons CM, Porter CQ, Hunter RS. Comparison of the performance of male and female medical students and residents. *J Med Educ*. 1981;56:853-5.
- Weinberg E, Rooney JF. The academic performance of women students in medical school. *J Med Educ*. 1973; 48:240-7.
- Preven DW, Kachur EK, Kupfer RB, Waters JA. Interviewing skills of first-year medical students. *J Med Educ*. 1986;61:842-4.
- Wang-Cheng RM, Fulkerson PK, Barnas GP, Lawrence SL. Effect of student and preceptor gender on clinical grades in an ambulatory care clerkship. *Acad Med*. 1995;70:324-6.
- Hayward CZ, Sachdeva A, Clarke JR. Is there gender bias in the evaluation of surgical residents? *Surgery*. 1987;102:297-9.
- Hyde JS. How large are cognitive gender differences? A meta-analysis using ω^2 and d . *Am Psychol*. 1981;36: 892-901.
- Maccoby EE, Jacklin CN. *The physiology of sex differences*. Stanford: Stanford University Press; 1974.
- Pattison P, Grieve N. Do spatial skills contribute to sex differences in different types of mathematical problems. *J Educ Psychol*. 1984;76:678-89.
- Wattanawaha N, Clements MA. Qualitative aspects of sex-related differences in performances on pencil-and-paper spatial questions, grades 7-9. *J Educ Psychol*. 1982;74:878-87.
- Hogrebe MC, Nist SL, Newman I. Are there gender differences in reading achievement? An investigation using the High School and Beyond data. *J Educ Psychol*. 1985;77:716-24.
- Notzer N, Soffer S, Yadgar O. The role of senior teachers in students' achievements. *Med Educ*. 1986;20:13-6.
- Manyon A, Shipengrover J, McGuigan D, Haggerty M, James P, Danzo A. Defining differences in the instructional styles of community preceptors. *Fam Med*. 2003; 35:181-6.
- Delk JL, Cason GJ, Reese WG. A practical method to enhance fairness of clerkship ratings. *J Med Educ*. 1985; 60:944-5.
- Marienfild RD, Reid JC. Six-year documentation of the easy grader in the medical clerkship setting. *J Med Educ*. 1984;59:589-91.
- Jacobson MJ, Sherman L, Perlman I, Lefferts R, Soroff H. Clerkship site and duration: do they influence student performance? *Surgery* 1986;100(2):306-11.
- Daelmans HE, Scherpier AJ, Van Der Vleuten CP, Donker AJ. Reliability of clinical oral examinations re-examined. *Med Teach* 2001;23(4):422-4.
- Saunders NA, McIntosh J, Prince RL, Feletti GI, Engel CE, Lawrence JR, et al. Comparison of performance of final-year students from three Australian medical schools. *Med J Aust*. 1987;147:385-8.
- Fabrega H Jr, Ulrich R, Keshavan M. Gender differences in how medical students learn to rate psychopathology. *J Nerv Ment Dis* 1994;182(8):471-5.
- Alexander DA, Eagles JM. Changes in attitudes towards psychiatry among medical students: correlation of attitude shift with academic performance. *Med Educ*. 1990;24:452-60.
- Whalen JP, Moses VK. The effect on grades of the timing and site of third-year internal medicine clerkships. *Acad Med*. 1990;65:708-9.

Received: December 18, 2003

Accepted: January 9, 2004

Correspondence to:

Rajna Golubić
III Pile 19
10000 Zagreb, Croatia
rajna_golubic@hotmail.com