

Zagreb University School of Medicine: Students' Grades during War

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Aim. To investigate whether examination grades of the students at the Zagreb University School of Medicine changed during the 1991-1995 war in Croatia.

Methods. The retrospective descriptive study included examination grades from 5 major courses in the first 5 years of the medical studies: Anatomy (first year), Physiology (second year), Pathology (third year), Internal Medicine (fourth year), and Surgery (fifth year). We compared the war-period (1991-1995) with two control periods: before (1989-1990) and after the war (1996-2000). The passing grades at the Zagreb University range from 2 to 5, with 2 as the lowest and 5 as the highest grade. There were a total of 17,682 examinations from the 5 courses in the studied periods.

Results. Grades were higher in the pre-war and post-war periods than in the war period ($p < 0.001$ for both comparisons). Grades in the individual courses followed the general trend, except for the surgery course, where grades during the war were better than in the control periods, and the physiology course, where continual worsening, irrespective of the war, was observed.

Conclusion. Medical students obtained significantly lower grades in 5 major courses during the war than before or after it. Thus, it is reasonable to assume that different factors, some related and some unrelated to war, could have adversely influenced students' performance.

Key words: Croatia; students, medical; schools, medical; universities; war

War, as a major human disaster, affects many aspects of life, including medical education (1). It causes not only material and health damages, but also mental distraction (2,3). During the 1991-1995 war in Croatia (4,5), medical schools continued their work at their premises (6), but during general or air raid alerts, students and teachers hid in shelters or basements, together with the patients (1). The alerts usually lasted for a few hours.

Throughout the war, the Zagreb University School of Medicine maintained the continuity and quality of its curriculum. This was accomplished by efficient reorganization of the curriculum, despite the lack of resources and financial support (6). However, alerts interrupted the teaching more than 50 times during the fall and winter of 1991, forcing students, teachers, and patients to take cover in safe School's basements. The war in the country continued until 1995. During the attack with medium-range missiles at the city of Zagreb in May 1995, a high school, Croatian National Theatre, and Children's Hospital had been hit (5). There were 6 dead and almost 200 wounded. The war ended in August 1995, when most parts of the country were liberated and the armed operations ceased.

We wanted to examine the influence of war on the grades earned by Zagreb University School of Medicine students from 5 major courses. Due to the

general negative effect of war on all areas of life, we expected lower grades during the war period because of stress and unfavorable learning conditions.

Methods

Study Design

We compared the grades during the five years of war (January 1991 – December 1995) to pre-war (January 1989 – December 1990) and post-war period (January 1996 – December 2000).

Sources and Data Acquisition

Data were taken from the files of the Department of Anatomy, Department of Physiology, Student's Office at the Zagreb University Hospital Center, Dean's Office, and the computer database of the Zagreb University School of Medicine.

Main Outcome Measures

We collected the following data: student gender, grade, and month and the year of examination. The passing grades range from 2 to 5, with 2 as the lowest (*sufficient*) and 5 as the highest (*excellent*) grade. Grade 1 means a failure and a student has to take the examination again; these grades were not documented in student files and could not be included in the study. We analyzed grades from 5 major examinations, one in each year of the study; these examinations have to be passed before the student is allowed to advance to the next academic year. The courses included were Anatomy (first year), Physiology (second year), Pathology (third year), Internal Medicine (fourth year), and Surgery (fifth year). In total, we registered 17,682 grades from those 5 courses in a 12-year period (Table 1).

Courses

For the Anatomy course, the literature and examination form have not changed during the last 12 years. The written ex-

Table 1. Number of analyzed grades in 5 major courses at the Zagreb University School of Medicine, shown by courses and periods

Courses	Pre-war period (1989-1990)	War period (1991-1995)	Post-war period (1996-2000)	Total (1989-2000)
All	3,253	7,861	6,568	17,682
Surgery	674	1,576	1,562	3,812
Internal Medicine	642	1,537	1,367	3,546
Pathology	619	1,565	1,299	3,483
Physiology	567	1,597	1,190	3,354
Anatomy	751	1,586	1,150	3,487

amination consists of four parts, followed by a practical and oral examination (7). The grades earned on the written and practical parts of the examination influence the final grade, which is obtained at the oral examination.

The Physiology examination has changed during the studied period. Before and at the beginning of the war, the examination consisted of a written and oral part. Since 1993 (a year of the war period), there has been only a written examination. The basic literature changed in 1996: the Guyton's Medical Physiology (8) was replaced with Berne's Physiology (9).

During the 1989-1998 period, the Pathology examination was composed of written, practical (micro-slides and macro preparations), and oral part. In 1999, a system of interim examinations was introduced, which eventually replaced the written and practical parts. The oral part of the examination remained the same.

Internal Medicine course had oral examination until 2000, when a written test was introduced as a precondition for the oral part of the examination. The final grade is the arithmetic mean of the two parts.

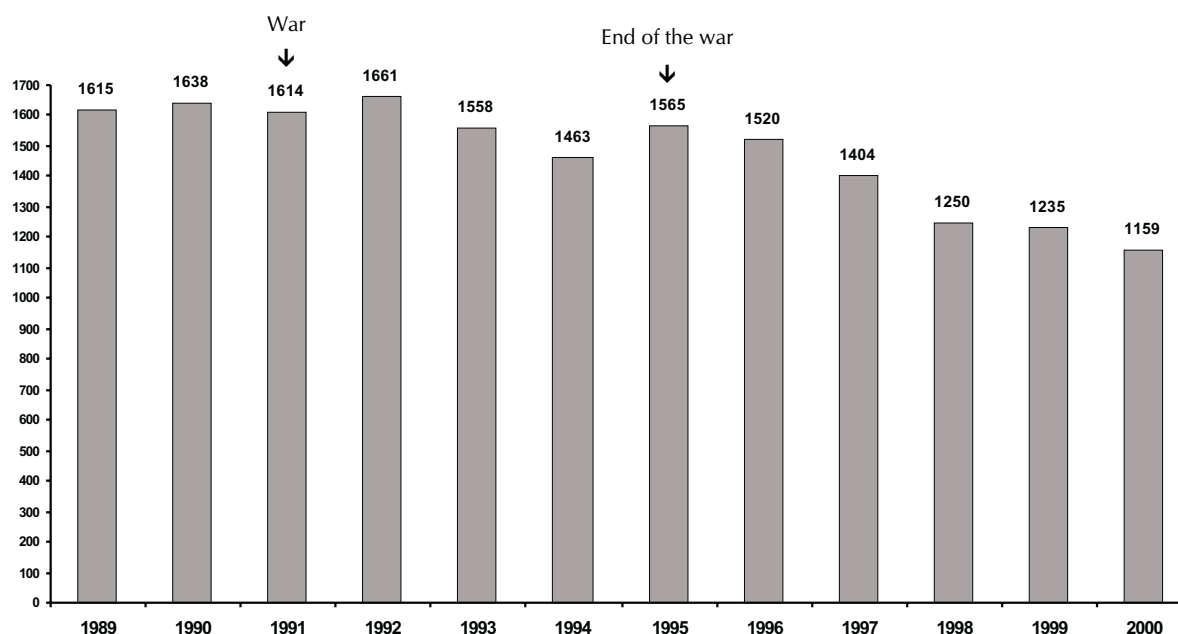
The Surgery examination was oral only and has not changed during the studied periods.

Statistics

The frequencies of examination grades for the studied periods are presented as contingency tables. The results of the 5 examinations are shown as percentages of students who earned grades between 2 and 5. The differences were tested by chi-square test, and $p < 0.01$ was considered significant.

Results

From 1989 to 2000, the number of examinations per year at the Zagreb University School of Medicine declined but did not significantly change during the war (Fig. 1).

**Figure 1.** The number of examinations passed per year at the Zagreb University School of Medicine, 1989-2000.

The grades from 5 courses were significantly lower during the war period than in the pre- and post-war periods ($p < 0.001$) (Fig. 2).

The examination grades for the course in Anatomy were lower during the war, but the difference was significant only in comparison with the post-war period ($p < 0.001$).

Slightly better grades in Pathology during the pre-war period did not show significant difference ($p = 0.921$) in comparison with the war period, but war period grades were significantly worse than grades in post-war period ($p < 0.001$).

The grades in Physiology worsened over time ($p < 0.001$).

The grades in Internal Medicine were significantly lower during the war than in the pre- and post-war periods ($p = 0.005$ and $p < 0.001$, respectively).

The grades in Surgery seemed better during the war-period than before ($p = 0.049$) or after the war ($p = 0.031$), although the differences were not significant.

Discussion

Our analysis showed that student grades in 5 major courses in the first five years of medical curriculum at the Zagreb University were worse during the war period than during the pre- and post-war periods. However, it is difficult to draw conclusions on the causative relationship between the war and studying

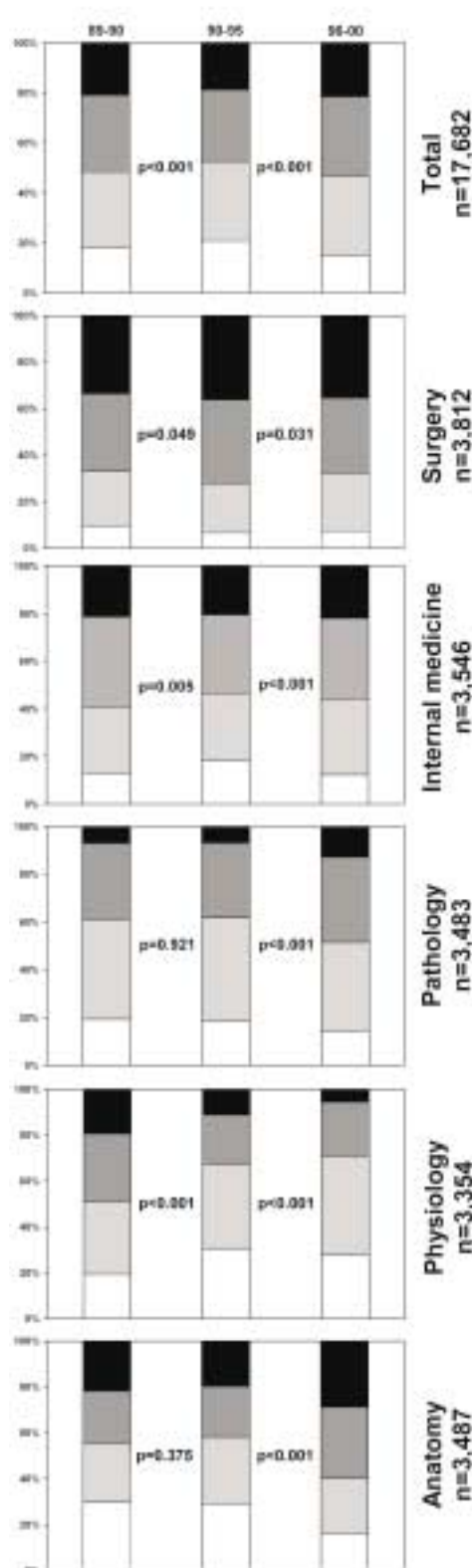


Figure 2. The grades earned by students of the Zagreb University School of Medicine during the pre-war (1989-1990), war (1991-1995) and post-war (1996-2000) periods. Only passing grades (2, 3, 4, and 5) were analyzed. Percents of students who earned given grade are shown on ordinate. The worst (passing) grade is 2 (sufficient) and the best 5 (excellent). White – grade 2, light gray – grade 3, dark gray – grade 4, black – grade 5.

success because many factors, some related and some unrelated to the war, could have influenced the quality of studying. War can adversely affect the studying success, primarily through stress, but also through other factors, such as time available for studying, quality of lectures, students' ability and willingness to attend lectures, and increased number of curricular and extracurricular activities (1).

However, some other changes also took place during the studied periods. The students who attended lectures in Osijek (at the time, a branch of the Zagreb University School of Medicine) and came mostly from the war-affected parts of Croatia were transferred to Zagreb in November 1991 to finish their studies, because Osijek was under persistent attacks (6). There were about 50 students from Osijek per year. We did not differentiate their grades from the grades of Zagreb students; however, the number of grades received by students from Osijek were probably too small to affect the total grade score during the war (around 1,500 examinations).

It is also possible that the adverse effect of the war on students' performance could have been seen better if the analysis had also included the number of repeated (failed) examinations, the time the students needed to pass the examination (the time from the end of course until passing the examination), and number of lost academic years (10). For example, we could not differentiate between the students who passed an examination on the first try and those who took it one or more times (up to the maximum 4) before passing it, although the latter were obviously less successful.

Beside stress and danger, increased efforts and number of activities of students, and especially of medical community, during the war could have also affected the time available for studying (Table 2). Students were engaged in different activities related to the medical aspect of war, such as organization and attending first aid classes, collecting data about war victims, humanitarian and peace-promoting activities (1), and even direct engagement in the field (11).

Table 2. Potential factors influencing examination grades of medical students during the 1991-1995 war period

Factors related to war	Factors unrelated to war
Time available for studying	Change of the mandatory reading
Quality of lectures	Change of examination form
Possibility to attend lectures	(introduction of interim
Extracurricular activities (medical work, humanitarian work, peace-promoting activities)	examinations, introduction of written part of examination, exclusion of oral part of examination)
Stress	

A possible explanation for the increased grades from Anatomy tests could be the fact that some of the questions were repeated in the tests during the study period.

Continuously worsening grades in the Physiology examination could be ascribed to more difficult mandatory reading, as well as to stricter written examination without a possibility of grade improvement on the oral examination (Fig. 2) in the late war and post-war period.

After the introduction of interim examinations, the grades in the Pathology course showed change for the better. Continuous studying for preliminary examinations makes it easier for the students to conquer subject matter; it lowers the pressure imposed on students by the high quantity of information needed to pass the examination (12).

It is hard to explain better grades in Surgery during the war period. The teachers were professionally engaged in the war, so it could have led to a decrease in their criteria, since they were under high emotional stress. The alternative explanation is that the students were highly motivated for surgery, as there was a need for surgical knowledge in war. On the other hand, the results of the Surgery examination, the only examination that did not change over time, could indicate that the war simply did not affect the grades.

In conclusion, our results show that examination grades are sensitive indicators of the quality and change in the medical curriculum, if not an indicator of direct effect of the war. We could not have performed a controlled research on direct effects of war, but this retrospective descriptive study indicates that such effects should be seriously studied.

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