







Impact of war on foreign students' satisfaction with quality of dental and medical education in Ukraine

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Abstract: The objective of this study was to evaluate the changes in foreign students' satisfaction with the quality of dental and medical education considering the impact of the war in Ukraine. The present study was organized in the form of a questionnaire-based survey among 300 foreign students of Medical Faculty and Faculty of Dentistry in Ukraine. The questionnaire was administered via Google form in a multiple-choice, closed-ended format. Students' satisfaction with environment safety and comfort ($p < 0.05$) and with the collaborative learning offered ($p < 0.05$) statistically decreased during the war. Sixty percent of the variability in the mean of students' satisfaction with the quality of education during the war could be explained by the satisfaction rate before the war. The need of migration from Ukraine had a stronger inverse correlation with education quality ($r = -0.58$) than the fact of the war itself ($r = -0.32$). The war in Ukraine has had a negative impact on the educational process of foreign medical and dental students, even though the quality of education was considered by students to be as high as before and during the war. The personal effort of professors, the quality of study materials, and adequate technical support could potentially overcome the negative impact of the war on student satisfaction with the quality of medical and dental education by the online mode, if the academic medium could be protected from the direct impact of the war or if the influence of the war within the university community could be minimized.

Keywords: Education, Dental; Foreign Medical Graduates.

Introduction

The aggressive Russian military invasion is still taking place in eastern and southern Ukraine, and active missile attacks continue throughout the country since February 2022.¹⁻³ Nevertheless, Ukrainian universities resumed online education in March 2022 and continue to provide educational services to Ukrainian and foreign students.

Based on the Ukrainian State Center for International Education, there were 76,548 international students in Ukraine, of whom 90.02% were seeking bachelor's or master's degrees, 6.45% were taking language courses, 2.25% were enrolled in post-graduate education, 1.27% were



pursuing doctoral studies, and 0.01% were involved in academic mobility programs in 394 Ukrainian higher education institutions.⁴ Most of the foreign students in Ukraine come from India, Morocco, Turkmenistan, Azerbaijan, Nigeria, China, Turkey, Egypt, and Israel.⁴

Before the war, there was a strong tendency for the number of international students in Ukraine to increase, due to factors such as the development of academic mobility and exchange programs, the personal will of young people from abroad to obtain higher education in a foreign country, and the optimization of enrollment procedures in the Ukrainian education system.⁵ However, it is difficult to predict how the war in Ukraine will affect the education of international students in the nearest future. The war in Ukraine triggers reconsideration of several factors related to the standard educational-philosophical view and international relations.⁶

Since the safety of students is the top priority, most foreign students in Ukraine have been sent back to their home countries. Nevertheless, their education continues in online mode, which is particularly challenging for medical and dental students, as all practical training is hindered and access to clinical facilities and patients are restricted.⁷ Also, the long-term effects of the war on medical education in Ukraine should be taken into account, since significant resources and infrastructure potential will be needed to provide training after the active military actions.^{8,9}

Considering the above information, it is highly important to verify the factors that might affect the quality of medical and dental education in Ukraine during the war to compensate for the impact of the war and adapt the educational process to the critical changes. It is also relevant to search for the key factors that can be used as instruments to overcome the effect of the war on education and to optimize its quality to a level that meets international academic standards.

This study aimed to evaluate the changes in foreign students' satisfaction with the quality of dental and medical education considering the impact of the war in Ukraine.

Methodology

Study design and sample

The study was approved by the Ethic Committee and Institutional Review Board of Medical Faculty #2 (Uzhhorod National University) within the group of studies aimed at the optimization of the educational process and designated as № 6 (04/05/2022).

The study was organized as questionnaire-based survey among foreign students of the Medical Faculty #2 and the Faculty of Dentistry at Uzhhorod National University (Ukraine) during March and April of 2022. The study design followed the consensus-based checklist for the reporting of survey studies.¹⁰ The questionnaire administered via Google Forms with access only available for students who were registered at the educational Moodle system of Uzhhorod National University via the e-mail account linked to the university's domain (uzhnu.edu.ua). Google Forms parameters were modified to limit the access to the questionnaire from all other e-mails, except university-linked ones. An invitation for the participation in the study was sent to the emails of 300 foreign students of the Medical Faculty #2 and the Faculty of Dentistry, who were randomly selected among all university foreign students, while following the distribution of 50 students per year of study. Such approach formed a unique condition for the enrollment of only foreign students of the two schools into the study, while students without accounts/e-mails in university domains could not participate in the survey due to the limited access. Only fully answered questionnaires were considered for further analysis to guarantee correct interpretation of the results.

Questionnaire design

The questionnaire had a multiple-choice, closed-end format, *i.e.*, all possible answers were listed in the questionnaire, from which students could choose only one of the already presented answers, except for two questions in the descriptive part.

The questionnaire had three domains (Domain 1: questions 1-10 dedicated to the evaluation of students' satisfaction with dental and medical education quality before the war; Domain 2:

questions 11-20 dedicated to the evaluation of students' satisfaction with dental and medical education quality during the war; Domain 3: questions 21-25 dedicated to the subjective evaluation of possible connections between the quality of education and related factors).

The descriptive part included 4 questions regarding students' year of study (possible answers: 1, 2, 3, 4, 5, 6), the faculty (possible answers: "Faculty of Dentistry" or "Medical Faculty #2"), the age, and the country of origin, with the last two being open-ended.

Domain 1 and Domain 2 questions were formulated based on the methodology proposed by Stukalina Y. for the evaluation of students' satisfaction in the framework of assuring the quality of higher education delivery.^{11,12} The original questionnaire was modified and simplified to 10 questions, but they followed the original approach for the evaluation of the 4 principle domains, such as: executive environment, physical and technological environment, instructional environment, and psychological environment. The original item "Quality of acquired skills" was adapted to "Quality of acquired practical skills", considering the medical and dental specialties of respondents. Also, the original items for the evaluation of physical and technological environment were changed to "Quality of connection and technical support during on-line classes with direct interaction with the professor (classes continuity, integrity and completeness)" and "Quality of connection and technical support during on-line classes with indirect or semi-direct interaction with the professor (classes continuity, integrity and completeness)", considering the online mode of education and possible direct, semi-direct, and indirect ways of interaction with the professor. A direct interaction between students and professors is based on face-to-face discussion and oral dialogue during practical and laboratorial classes using different video-communication services. Semi-direct interaction is usually implemented in different tests formats as part of a practical class, where questions and answers are mostly related to the technical aspects of the test and could be conducted through a chat within a digital environment in textual format (ongoing textual chat during video

communication). Such approach was usually used to avoid interrupting other students during the test, when only some needed technical help or support. The indirect method of interaction is when students send their questions, homework, or test results via email, and the professor responds by a remote mode. Such approach is usually realized during written exam and/or module control. All this information was provided for the students in the instructions of the developed questionnaire.

Thus, the Domain 1 of the questionnaire (Q1-Q10) included the following questions:

Q1: Rate your satisfaction with the quality of the provided information and its availability before the war.

Q2: Rate your satisfaction with the quality of acquired practical skills before the war.

Q3: Rate your satisfaction with the quality of lessons before the war.

Q4: Rate your satisfaction with the quality of connection and availability of technology support during on-line classes with direct interaction with the professor (classes continuity, integrity and completeness) before the war.

Q5: Rate your satisfaction with the quality of connection and availability of technology support during on-line classes with indirect or semi-direct interaction with the professor (classes continuity, integrity and completeness) before the war.

Q6: Rate your satisfaction with the course content before the war.

Q7: Rate your satisfaction with teaching materials quality and availability before the war.

Q8: Rate your satisfaction with environment safety and comfort before the war.

Q9: Rate your satisfaction with collaborative learning before the war.

Q10: Rate your satisfaction with the support provided by the teaching staff, attending staff, and education managers before the war.

Domain 2 of the questionnaire (Q11-Q20) consisted of questions that were similar to Q1-10, but in the end of each question the phrase “before the war” was changed to “during the war” to evaluate students' satisfaction with the quality of education during the war.

Students were asked to answer questions Q1-10 and Q11-29 using the five-point Likert scale, as follows: 1 – poor, 2 – weak, 3 – satisfactory, 4 – good, 5 – excellent.

Domain 3 had 5 questions (Q21-Q25) aimed at the subjective evaluation of possible connections between the quality of provided education and related factors, such as professor's/lecturer's personal effort, quality and availability of study materials, technical support provided for online education platforms, the fact of the war, which is ongoing in Ukraine, and the need to migrate from Ukraine due to the war:

Q21: Rate the connection between the professor's/lecturer's personal effort and quality of education.

Q22: Rate the connection between the quality and availability of study materials and quality of education.

Q23: Rate the connection between the technical support for online education platforms and quality of education.

Q24: Rate the connection between the fact of the war, which is ongoing in Ukraine, and the quality of education.

Q25: Rate the connection between the need to migrate from Ukraine due to the war and the quality of education.

Possible answers were also provided in a one-to-five-point Likert scale: 1 – no connection, 2 – weak connection, 3 – moderate connection, 4 – good connection, 5 – strong connection.

Ethical aspects

Students did not enter their names in any part of the questionnaire, the survey did not collect identifying information about individuals, and the information obtained cannot link individual responses to participants' identities. Based on that it could be concluded that survey fully followed the principle of anonymity.

Statistical analysis

The data collected with Google Forms was converted into xls-spreadsheet and further imported into Microsoft Excel 2019 software (Microsoft Office 2019, Microsoft Corp., USA) for systematization, tabulation, and statistical analysis with the use of adaptive statistical add-in (XLSTAT, Addinsoft Inc., Long Island, USA). Findings were summarized and presented with the use of descriptive statistics for distribution pattern, mean values, absolute levels of respondents' answers, standard deviations and variance. Inference was provided with correlation analysis to evaluate relationships between the quality of provided education, as dependent variable, and related factors as independent variables. Pearson correlation coefficient (Pearson's r) was used to evaluate the correlation between factors, which were considered statistically significant if $p < 0.05$.¹³ F statistic computed in the ANOVA table was used in linear regression analysis to evaluate variability of the dependent variable (students' satisfaction with education quality during the war) based on the explanatory variable (students' satisfaction with education quality before the war).¹⁴

Results

Of the 300 questionnaires sent, 234 responses were received, which equals to a response rate of 78.0%. The highest response rate was registered among students of the 5th and 6th years of study, which reached 84.0% and 90.0%, respectively, while the lowest response rate was from the students of the 3rd year of study (64.0%). Nevertheless, among 234 students who answered the questionnaires, only 202 (86.32%) completed it in full without missing any

question. The most frequently missed questions were those regarding quality of connection and availability of technology support during on-line classes with direct, semi-direct, and indirect interaction with the professor (7.69% analyzed responses out of 234 received). The final distribution of the 202 fully completed questionnaires was: 1st year – 32 (15.84%), 2nd year – 33 (16.34%), 3rd year – 30 (14.85%), 4th year – 31 (15.35%), 5th year – 38 (18.81%), 6th year – 38 (18.81%). This distribution was sufficient to allow further analysis of the data, since in all cases it reached the critical margin of 60% fully completed surveys.

Considering the answers of the questions from Domain 1 (Q1-10), the highest prevalence of excellent and good satisfaction rates before the war were noted for the following criteria: information quality and availability (114/56.44% and 46/22.77%, respectively), quality of classes (102/50.50% and 58/28.71%, respectively), quality of connection (110/54.46% and 49/24.26%, respectively), and availability of technology support during on-line classes with direct interaction with the professor (124/61.39% and 59/29.21%, respectively).

Excellent or good satisfaction prevalence with course content, teaching materials quality and availability, environment safety and comfort, and support provided from the teaching staff, attending staff and education ranged from 46.53 to 49.01% and from 30.69 to 42.08%, respectively.

The lowest prevalence of excellent satisfaction was obtained for quality of acquired practical skills and collaborative learning, which equaled to 60 (29.70%) and 74 (36.63%) responses, respectively.

Mean prevalence of different levels of satisfaction with quality of education before the war were: poor – 0.89±1.34%, week – 2.43±3.78%, satisfactory – 17.43±6.69%, good – 31.39±7.39%, excellent – 47.87±9.23%.

The mean level of student satisfaction with information quality and availability was 4.30±0.86, with quality of acquired skills it was 3.83±0.95, with quality of conducted lessons it was 4.24±0.85, with quality of connection and availability of technology support during on-line classes with direct interaction with the professor it was 4.29±0.86, with quality of connection and availability of technology support during on-line classes with indirect or semi-direct

interaction with the professor it was 4.51±0.62, with study course content it was 4.36±0.74, with teaching materials quality and availability it was 4.40±0.79, with environment safety and comfort it was 4.24±0.57, with collaborative learning it was 3.84±1.19, and with support from the teaching staff, attending staff and education managers it was 4.24±0.82. General student satisfaction with education quality before the war was 4.22±0.82.

Answers for the questions from Domain 2 (Q11-Q20), revealed slight but not significant decrease in excellent rate prevalence regarding satisfaction with information quality and availability ($p > 0.05$), satisfaction with quality of conducted classes ($p > 0.05$), and satisfaction with quality of connection and availability of technology support during on-line classes with direct, semi-direct, and indirect interaction with the professor ($p > 0.05$).

Prevalence of excellent and good satisfaction with quality of conducted classes, with study course content, with teaching materials quality and availability during the war remained fairly the same as before the war, as changes were not statistically significant ($p > 0.05$).

A significant reduction in excellent satisfaction prevalence was noted for collaborative learning ($p < 0.05$) and environment safety and comfort ($p < 0.05$) during the war compared to before the war. Such changes were accompanied by the increase of poor, week, and satisfactory prevalence in these criteria. Satisfaction with support provided by the teaching staff, attending staff and education managers had an evident increase in excellent rate prevalence during the war compared to before the war.

Mean prevalence of different levels of satisfaction with quality of education during the war were following: poor – 1.98±2.44%, week – 4.85±6.37%, satisfactory – 20.05±11.57%, good – 31.83±6.82%, and excellent – 41.29±17.15%.

A general tendency, with no statistical significance ($p > 0.05$), was found in the comparison with levels before the war: a decrease in the prevalence of excellent and good satisfaction was accompanied by an increase in poor, week and satisfactory prevalence.

During the war, the mean level in student satisfaction with information quality and availability

was 4.20±0.79, with quality of acquired skills it was 3.57±1.18, with quality of conducted lessons it was 4.21±0.56, with quality of connection and technology support during on-line classes with direct interaction with the professor it was 4.24±0.74, with quality of connection and technology support during on-line classes with indirect or semi-direct interaction with the professor it was 4.46±0.69, with course content it was 4.38±0.61, with teaching materials quality and availability it was 4.39±0.53, with environment safety and comfort it was 3.33±1.25, with provided collaborative learning it was 3.28±1.39, with support from the teaching staff, attending staff and education managers it was 4.47±0.84.

Of the above parameters, satisfaction with environment safety and comfort ($p < 0.05$) and satisfaction with provided collaborative learning ($p < 0.05$) were significantly decreased, while general student satisfaction with education quality was relative stable when comparing the periods before and during the war (4.22±0.82 vs. 4.05±0.86, $p = 0.492$) (Table 1).

Based on the R^2 value, 60% of the variability of mean student satisfaction rates with the education quality during the war could be explained by student satisfaction with the education quality before the war, and the latter could be used as an explanatory variable in regression analysis (Figure).

Based on the answers in Domain 3 questions (Q21-Q25), it was found that 125 respondents (61.88%) reported a strong connection between quality of dental and medical education and the professor's/ lecturer's personal effort, while 52 (25.74%) reported a good connection. One hundred and forty-one students (69.80%) rated the connection between quality and availability of study materials and quality of education as good or strong, while 119 (58.91%) reported a strong connection between the technical support for online education platforms and quality of provided education. Only 32 respondents (15.84%) mentioned a strong connection between the fact of the war, which is ongoing in Ukraine, and the quality of education, while 46 (22.77%) and 44 (21.78%) students did not recognize such

Table 1. Comparison of students' satisfaction with education quality before the war and during the war.

Satisfaction criteria	Before the war		During the war		p-value
	Mean value	SD	Mean value	SD	
Satisfaction with provided information quality and its availability	4.31	0.86	4.20	0.79	$p > 0.05$
Satisfaction with the quality of acquired practical skills	3.83	0.95	3.50	1.18	$p > 0.05$
Satisfaction with the quality of conducted lessons	4.24	0.85	4.21	0.56	$p > 0.05$
Satisfaction with the quality of connection and availability of technology support during on-line classes with direct interaction with the professor	4.29	0.86	4.24	0.74	$p > 0.05$
Satisfaction with the quality of connection and availability of technology support during on-line classes with indirect or semi-direct interaction with the professor	4.51	0.62	4.46	0.69	$p > 0.05$
Satisfaction with study course content	4.37	0.74	4.38	0.61	$p > 0.05$
Satisfaction with teaching materials quality and availability	4.40	0.79	4.39	0.53	$p > 0.05$
Satisfaction with environment safety and comfort	4.25	0.57	3.33	1.25	$p < 0.05$
Satisfaction with provided collaborative learning	3.84	1.19	3.28	1.39	$p < 0.05$
Satisfaction with the support provided from the teaching staff, attending staff and education managers	4.25	0.82	4.47	0.84	$p > 0.05$
General satisfaction	4.23	0.82	4.05	0.85	$p > 0.05$

SD: standard deviation; p-value: probability value; $p < 0.05$ was considered statistically significant.

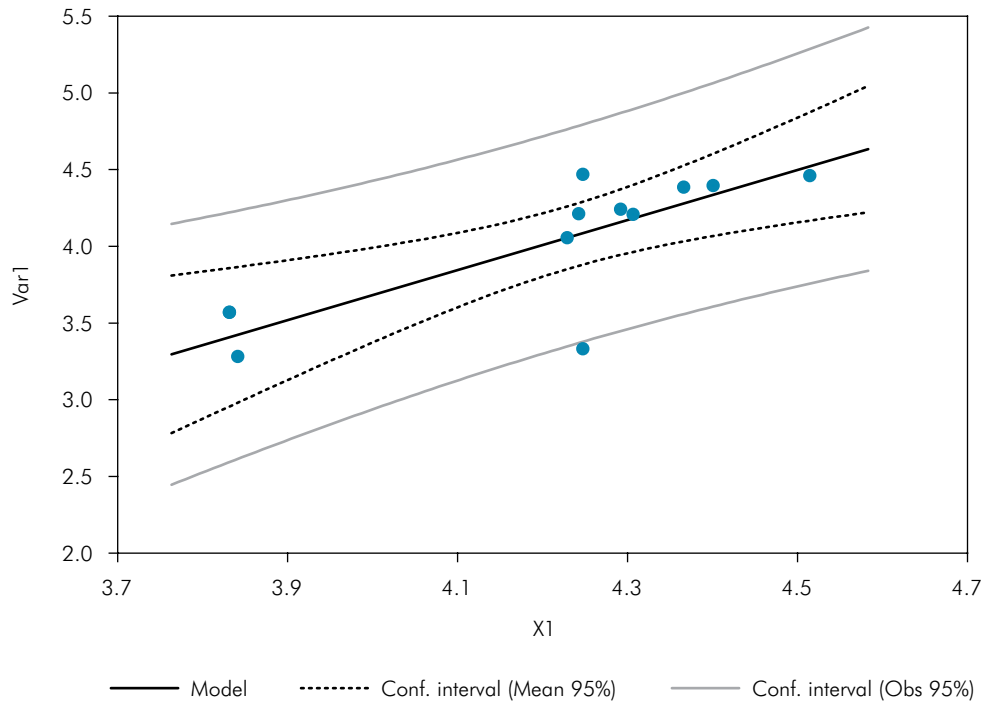


Figure. Regression analysis of students’ satisfaction during the war (Var 1) and students’ satisfaction before the war (X1) ($R^2 = 0.597$)

Table 2. Correlations between studied parameters and satisfaction with the quality of education.

Factors	Quality of education	
	r	p-value
Professor’s/lecturer’s personal effort	0.74	$p < 0.05$
Quality and availability of study materials	0.68	$p < 0.05$
Provided technical support for online education platforms	0.62	$p < 0.05$
Need of migration from Ukraine	-0.58	$p < 0.05$
The fact of war, which is ongoing in Ukraine	-0.32	$p < 0.05$

r: Person’s correlation coefficient, p-value: probability value; $p < 0.05$ is considered statistically significant.

connection or graded it as weak. On the other hand, 60 respondents (29.70%) agreed on a strong impact of their need to migrate from Ukraine due to the war on the quality of provided education, while 40 (19.80%) and 45 (22.28%) surveyed students graded the connections between these factors as good and moderate respectively.

Considering all the above data, the factors professor’s/lecturer’s personal effort, quality and

availability of study materials and technical support for online education platforms were statistically correlated with quality of provided dental and medical education, with Persons’ coefficients $r = 0.74$ ($p < 0.05$), $r = 0.68$ ($p < 0.05$), and $r = 0.62$ ($p < 0.05$) respectively. The need for migration from Ukraine had a stronger inverse correlation with education quality ($r = -0.58$) then the fact of war itself ($r = -0.32$) (Table 2).

Discussion

War provokes a significant negative impact on the education system, not only causing changes in the educational process itself, but also critically disturbing basic social, humanistic, and safety aspects of educational environment.^{7,8,15} Moreover, the education system needs to adapt to the new reality and respond to the corresponding challenges, while modifying old and forming new patterns of academic interaction between students and professors.^{8,16} It is worth mentioning that given the independence of universities and the different impact of the war on institutions located at various

distances from the war effort, changes in the educational environment would vary at different institutions. In present study we demonstrated the impact of war on foreign student satisfaction with medical and dental education quality in a university located in western Ukraine, which has not been directly affected by active warfare, but has undergone specific war-linked transformations.

The results of our study did not show a significant decrease in overall student satisfaction with quality of dental and medical education during the war compare to the period before the war. Such outcome could be due to several factors. It should be kept in mind that the education process before the war was held in online mode due to the COVID-19 pandemic restrictions.¹⁷⁻¹⁹ The education system has been widely adapted to the realities of online education and, based on previously conducted research, has proven to be very effective regarding quality of dental and medical education.²⁰⁻²³ Basically, online mode of studying has not changed during the war for the respondents enrolled in our research, since such approach has been successfully implemented during the previous three years. Before and during the war, the same instruments and practices were used, such as open-source learning platforms, including free blended ones, course management systems, video communication services, data sharing, and social media networks.²⁴⁻²⁸ This could be one of the reasons why respondents have found that the quality of education did not differ in the two periods studied. Nevertheless, it worth mentioning that both before and during the war, the quality of acquired practical skills and collaborative learning were among the lowest rated, as these aspects are among the most problematic for efficient implementation in online mode of studying since COVID-19 restrictions.^{18,20,21,23}

The results regarding the equally high quality of education before and during the war should be interpreted with caution because of the several factors related with the distance of different universities from the warfare and from the EU border that affect students differently.

First of all, we should take into the account the important fact that due to the geographical position of

universities at the most western territory of Ukraine, the educational process has not suffered critical interruptions because of the direct effect of the Russian military activity. Moreover, there were no direct bombings or acts of war in the region where the university is located. Certainly, the situation of the education quality in the cities that have been occupied, completely or partially destroyed by the Russian army is different from the cities investigated in our study. Ukraine territories directly affected by the Russian invasion are affected by the different forms of humanitarian crisis, which is the dominative problem in the present conditions.^{2,3} Nevertheless, the indirect effect of the war in Ukraine on the education system in the western cities should not be underestimated, since such actions significantly impact the safety, integrity, and social aspects of the educational environment. These factors could explain why a statistically significant decrease was noted regarding student satisfaction with environment safety and comfort and collaborative learning.

Secondly, given the potential danger and the proximity of the university district to the EU border, most foreign students enrolled in the present study were transferred to the nearest European Union country at the university's initiative. These measures were taken to allow students to reach their home country as safely as possible, since the safety and well-being of students remain the primary goal of the education system. Again, this shows that the respondents' education has been affected by the war in Ukraine mostly indirectly through the changes in the functionality and integrity of the educational process and directly through the need for temporary migration from Ukraine.

The regression analysis results showed that 60% of the variability in student's mean satisfaction with the education quality during the war can be explained by student satisfaction before the war. This indicates that the information provided by the pre-war satisfaction rates as explanatory variables is significantly better than what a simple mean would provide for predicting students satisfaction during the war. Basically, this means that the efficiency and functionality of the educational process organized before the war plays an important role in keeping a

high level of education during the war. Again, these results apply only to circumstances in which the university environment is not directly affected by the war (human casualties and campus destruction by bombing or ongoing military activities).

Our findings also indicate that the need to migrate from Ukraine had a greater negative effect on education quality than the war in Ukraine itself. Such results could be associated with the disintegration of the social community formed among students before the war because of migration and geographical distance of the university campus from the warfare. It is also important to note that students rated the professor's/lecturer's personal effort and the quality and availability of study materials as the factors that had the greatest impact on education quality. Basically, this means that sufficient direct, semidirect and indirect interaction between professor and student, combined with easily accessible, high quality study materials may partially overcome the negative impact of other environmental factors. These outcomes can also explain why students rated the education quality before the war and during the war equally, since students' satisfaction with the support provided from the teaching staff, attending staff and education managers during the war increased. In addition, the technical support for online education platforms played an important role in maintaining

quality education, which was previously approved during the COVID era.²³⁻²⁵

Conclusions

Considering the specifics of the present study, it can be concluded that the war in Ukraine has a negative impact on the education provided to foreign medical and dental students, even though the quality of education was graded by students as being equally high before and during the war. The efficiency and functionality of the educational process before the war played an important role of keeping a quality education during the war, taking into account that the educational system in the university environment has not been affected directly by the war. The professor's/lecturer's personal effort, the quality and availability of study materials, and the technical support for online education platforms may partially overcome the negative impact of war on the quality of medical and dental education provided via online mode, if the university medium is protected from direct war impact or the influence of the war in the university community is minimized. The need to migrate from Ukraine due to the war had a greater impact on students' satisfaction with the quality of dental and medical education than the war itself.

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