

# The impact of a hazardous external environment on the quality of life, physical activity, and health of students in Ukraine, Poland, and Romania

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## Abstract

### Background and Study Aim

The issue of quality of life, physical activity, and health of students is becoming increasingly relevant in the context of the ongoing conflict in Ukraine. Daily shelling of cities and settlements for over two years may have significantly affected the quality of life of Ukrainian students. While students in Poland and Romania do not experience the direct impact of military actions, regional instability and mass migration processes may also influence their health and well-being. In this context, the aim of the study is to identify key trends and issues related to the quality of life and health of students in Ukraine, Poland, and Romania.

### Material and Methods

The study involved students from Ukraine (n=193), Poland (n=40), and Romania (n=215). The SF-36 questionnaire, adapted into three languages: Ukrainian, Polish, and Romanian, was used to assess quality of life. Data collection was conducted online. The results were processed using PyCharm CE and specialized Python codes with relevant libraries. Cronbach's alpha coefficient ( $\alpha$  Cronbach's = 0.765) was used to assess the internal consistency of the questionnaire responses. Factor analysis was conducted, with the number of factors (8) determined using the Kaiser criterion. The Mann-Whitney U test was used. Mean values, standard deviations, and percentage ratios were calculated. The significance level was set at 0.05.

### Results

Data analysis revealed significant differences in quality of life, physical activity, and health of students depending on the country and gender. Ukrainian students, affected by the ongoing conflict, showed a substantial decrease in mental health indicators. The average mental health score for Ukrainian female students was 25.42%, and for male students, it was 23.92%. This indicates high levels of stress and anxiety caused by constant threats and instability. Polish students are older than Romanian and Ukrainian students, with the highest indicators of height and weight. In Poland, women reported better mental health ( $58.67 \pm 15.94$ ) compared to men ( $55.09 \pm 12.82$ ). Men demonstrated better physical health indicators ( $50.50 \pm 6.96$ ) compared to women ( $47.58 \pm 6.57$ ). In Romania, men showed better results in the psychological health component ( $42.79 \pm 8.61$ ) compared to women ( $39.67 \pm 8.70$ ) and higher physical functioning scores.

### Conclusions

The results of the analysis highlight that the war in Ukraine significantly impacts the physical and mental health of Ukrainian students. The considerable cross-country differences in student health indicators underscore the need to consider the specific conditions and challenges faced by students in different countries. These differences are particularly important for developing targeted programs that can effectively support students in wartime conditions.

### Keywords:

SF-36, stress, anxiety, wartime conditions, well-being

## Introduction

The quality of life of students is becoming an increasingly important factor in their overall health.

Students face numerous factors that affect their health and well-being, including levels of physical activity, stress, depression, and anxiety. Common issues among students include headaches, stress, depression, and anxiety disorders. These problems are often exacerbated by unhealthy habits such as

smoking and low physical activity. A hazardous external environment, particularly military conflicts and social instability, further negatively impacts the health and quality of life of students. Understanding these interrelationships is essential for developing strategies to improve student health and enhance their quality of life.

The impact of war on quality of life has been examined in various studies. Giacaman [1, 2, 3] shows that prolonged conflict and occupation have significantly worsened the quality of life for Palestinians, with 52% of families living below the poverty line despite higher levels of health, literacy, and education. Another study [4] emphasizes that the civil war in Syria has deteriorated living conditions for children, increasing the number of displaced persons and exacerbating problems in healthcare and education. Some studies [5, 6] note that post-traumatic stress significantly affects quality of life, with women and former child refugees experiencing higher levels of stress and long-term cardiovascular health issues. Mousa et al. [7] find that personal growth initiatives improve life satisfaction among survivors of ethnopolitical violence and genocide, underscoring the importance of such interventions.

Many studies [8, 9] indicate the negative consequences of war on the quality of life of the population. The mental health and quality of life of Ukrainian refugees in Germany have significantly deteriorated due to the war [10]. Survival mechanisms during the war in Ukraine, studied among the Romanian population, reveal critical strategies and adaptive methods [11]. War trauma and coping strategies among Ukrainian refugees in Poland highlight the importance of psychosocial support [12]. An analysis of the impact of the armed conflict in Ukraine on the Romanian population shows significant social and economic changes [13]. These and other studies [14, 15, 16, 17] emphasize that the war in Ukraine significantly affects the physical and mental health of the population, worsens the quality of life, and creates long-term social, medical, and psychological problems for the affected individuals. This is particularly important for the younger generation and students, as they are in a critical period of development, and their health and well-being directly impact their educational achievements and future prospects.

Studies in various countries have identified significant factors affecting the quality of life of students [18, 19, 20, 21]. These factors include physical activity, mental health, social relationships, and living conditions. Spina et al. [22] conduct a research among 219 students from a private college and find out moderate correlation between engagement and quality of life in the domains of vitality and mental health. Another study among 534 female students at a public university found that the level of cyberchondria increased the risk

of depression, while non-smoking students had a significantly lower risk of depression [23]. A study among 90 university students revealed that during the COVID-19 pandemic, students experienced negative feelings such as exhaustion and irritation, which correlated with adaptation to studies and quality of life [24].

Among 561 medical students and 332 non-medical students, it was found that medical students had higher scores in the mental component [25]. A study among 333 medical students showed that the level of physical functioning was significantly higher in fifth-year students compared to first-year students [26]. Targeted physical activity positively impacted the quality of life of 325 students [27]. Among 214 university students, 75.7% engaged in light physical activity [28]. In other countries, studies have shown that physical activity has a weak but positive correlation with quality of life [29].

The authors emphasize the importance of a comprehensive approach to studying these aspects and developing support programs aimed at improving the health and quality of life of students. In this context, research results from various parts of the world reveal key trends and issues specific to each region. Such an approach allows for a better understanding of the impact of different factors on the quality of life of students and the development of effective strategies to support them. It also highlights several directions for research in different countries and continents.

#### *Regional differences in student health and quality of life in Asia.*

Numerous studies have been conducted in the Asian region (China, Thailand, the Philippines, Iran) regarding the quality of life of students. Among 2,757 Chinese students, sleep quality and quality of life were found to mediate the relationship between anxiety and depression [30]. In a Chinese university, students' quality of life ranged from 43.83 to 93.34 depending on various factors [31]. In Thailand, medical students had higher physical quality of life compared to healthcare workers [32]. In the Philippines, the average quality of life scores were 85.83 in physical functioning, 69.20 in pain, and 51.72 and 51.36 in vitality and emotional role limitations, respectively [33].

In Iran, the average health-related quality of life score was  $2.55 \pm 0.40$ , and students' quality of life was significantly correlated with gender, age, family status, education level, faculty, and place of residence [34]. Biopsychosocial interventions improved students' quality of life [35], and metacognitive therapy enhanced the quality of life for high school students [36]. One study found that quality of life and resilience negatively correlated with suicidal thoughts [37]. Medical students in Tehran scored higher in five domains of quality of life compared

to veterinary students [38]. Additionally, 38.2% of students use nicotine, with higher rates in rural areas [39]. Physical activity among students was positively associated with quality of life [40].

Studies conducted in the Asian region highlight the importance of sleep quality, physical activity, and mental health as key factors influencing students' quality of life. The results show that interventions aimed at improving these aspects can significantly enhance the overall well-being of students. It is also noted that physical activity and various therapeutic approaches, such as biopsychosocial and metacognitive interventions, contribute to improved quality of life and mental health indicators among young people.

#### *Regional differences in student health and quality of life in Europe.*

Various aspects of student health and well-being have also been studied in Europe (Germany, Turkey, Italy, Serbia, Kosovo, Croatia, Cyprus, Denmark, France, the United Kingdom, Spain). In Germany, among 380 medical students, men showed higher maximum speed and heart rate, but carbohydrate and fat intake did not meet recommendations [41]. Moreover, 76.6% of students displayed signs of orthorexia, with a higher proportion among physical education students [42]. Additionally, the connection between mental health indicators and lifestyle was emphasized among German students [43].

In Turkey, 91.8% of medical students suffered from premenstrual syndrome, which moderately affected their quality of life [44]. Additionally, 90.4% of students experienced headaches at least once in their lifetime, negatively impacting their quality of life [45]. These data highlight the need for further research and addressing issues related to the quality of life of students in Turkey. In Italy, among 1,104 first-year students, female gender and smoking were associated with poorer quality of life indicators [46]. This underscores the importance of considering gender differences and harmful habits in shaping the quality of life of students.

In Serbia and Kosovo, 82.3% of students in Belgrade and 76.0% in Kosovska Mitrovica were exposed to passive smoking daily [47]. Additionally, among 1,624 students at the University of Belgrade, 16.5% suffered from chronic diseases, which negatively impacted their quality of life [48]. Furthermore, in Serbia, smoking adversely affected students' quality of life through the mediation of depression [49]. These findings highlight the importance of combating smoking and improving conditions for students with chronic illnesses.

In Eastern Croatia, 61.7% of 517 students had a high level of physical activity [50], indicating a positive impact of physical activity on their health and well-being. In Cyprus, 18.1% of students

suffered from burnout, which was accompanied by poor sleep quality and low levels of mental health [51]. In Denmark, graduating students showed higher levels of health literacy and self-rated health compared to beginners [52]. In France, 20.99% of students experienced psychological stress, and 5.14% were at risk of suicide [53]. In the United Kingdom, symptoms of depression and anxiety were associated with a deterioration in quality of life [54].

In Spain, in Granada, most students do not follow a high-quality diet but do meet the minimum recommended physical activity levels [55].

Research conducted in this region highlights the significant impact of various factors on student health and quality of life. The results show that aspects such as physical activity, smoking, stress levels, and dietary habits play a crucial role in shaping students' overall well-being. These studies underscore the need to develop and implement programs aimed at improving the health and quality of life of students, taking into account regional and cultural specificities.

#### *Regional differences in student health and quality of life in North America.*

In North America (Canada, USA), significant attention is given to the mental health and quality of life of students. In Ontario, Canada, 65.4% of students experienced overwhelming anxiety, and 89.5% felt overwhelmed by their responsibilities [56]. In the USA, studies have shown that observation as an aspect of mindfulness is negatively associated with physical health, whereas mindfulness in actions and non-judgment are positively associated with emotional well-being [57]. These findings highlight the importance of monitoring students' mental health and developing targeted support programs. Regular assessment and interventions can help improve the overall quality of life for students in these countries.

#### *Regional differences in student health and quality of life in South America.*

In South America (Chile, Brazil, Peru, El Salvador), research focuses on identifying issues related to the physical and mental health of students. In Chile, a study among 248 hospital class students showed similar quality of life scores between students with mental illnesses and those with other health conditions [58]. Additionally, isolation, health status, and gender significantly impact the quality of life of students in Chile [59].

In Brazil, research has revealed that isolation, health status, and gender also play a significant role in students' quality of life, as shown in Southeastern Brazil and among 3,402 Brazilian medical students [60, 61]. Nursing students in their 2nd and 3rd years in Brazil demonstrated the lowest quality of life scores [62]. Additionally, 26% of students

were underweight, 27% were overweight, and 29% reported a deterioration in health over the past year. Among 84 students, there was a high quality of life in six domains and low in two [63, 64].

In Peru, men had higher physical health scores compared to women, and students with fewer academic difficulties had higher mental health scores [65]. Perceived stress and avoidant coping behavior predict the mental health of students in Peru [66]. In El Salvador, students participating in a government loan program at a private school showed lower quality of life scores [67].

Studies conducted in this region highlight the significant impact of physical and mental health on students' quality of life. The results show that factors such as isolation, health status, gender, and academic difficulties play key roles in shaping students' overall well-being. It is also noted that students participating in government support programs often demonstrate lower quality of life scores. These studies emphasize the need to develop and implement programs aimed at improving the health and quality of life of students, taking into account their specific needs and regional characteristics.

*Regional differences in student health and quality of life in Australia and Africa.*

In Australia, research has also analyzed factors affecting students' quality of life. One study found no significant differences in mental health indicators between students and non-students, highlighting the stability of these indicators regardless of educational status [68].

In Africa, particularly in Egypt, the study of student health is gaining increasing importance, considering specific regional characteristics. Research has shown that the prevalence of fibromyalgia among students was 12.4%, which significantly negatively impacted their quality of life [69]. In a study in Nigeria [70], the impact of a group cognitive-behavioral therapy program on students' psychological well-being, quality of life, and ability to cope with difficulties was demonstrated. These findings underscore the importance of considering regional characteristics when developing support programs and improving student health in these regions.

The analysis of existing studies highlights the importance of a comprehensive approach to studying the quality of life and health of students, especially in conditions of war and social upheaval. It is evident that there is a need to identify the specific needs of the student youth and to find effective strategies to meet them. In this context, the aim of the study is to identify key trends and issues related to the quality of life and health of students in Ukraine, Poland, and Romania.

## Materials and Methods

### *Participants*

The study involved students (n=448) from Ukraine (n=193), Poland (n=40), and Romania (n=215). Among the Ukrainian students, 83 were from a university in the western part of Ukraine, and 110 were from the eastern part of Ukraine. Most students from Ukraine and Romania study at faculties of physical culture. Among the students from Poland, 50% study at the Academy of Physical Education and Sports. The survey was conducted online and participation was voluntary. All participants were informed about the aims of the study and consented to participate by checking the appropriate box in the online form. The study was approved by the ethical committee of university, and all data were anonymized to protect participant confidentiality.

### *Study Design*

To assess the quality of life, the SF-36 questionnaire, adapted into three languages: Ukrainian, Polish, and Romanian, was used. Data collection was conducted online using a survey platform. The processing of questionnaires included verifying data accuracy by comparing responses with standard values. Exclusion criteria included incomplete data and incorrect responses, which were removed from the final analysis.

The SF-36 questionnaire has been successfully used in various studies, for example, among students in China [31], Cyprus [51], Serbia and Kosovo [71], Denmark [52], and Egypt [69]. These studies have confirmed its reliability and validity, underscoring its significance as a tool for assessing quality of life. However, a new environment requires retesting to confirm its applicability in these specific conditions. This is due to potential cultural differences that may influence respondents' perceptions and answers.

### *Reliability and Validity Testing of the SF-36 Questionnaire*

To assess the internal consistency of the responses to the SF-36 questionnaire, Cronbach's alpha ( $\alpha$  Cronbach's) statistic was used. The results show that the  $\alpha$  Cronbach's value for the SF-36 questionnaire is approximately 0.765. This indicates that the questionnaire items demonstrate moderately high internal consistency. The value of 0.765 falls within the confidence interval of 0.733 to 0.795, indicating fairly good reliability of the questionnaire. Therefore, the SF-36 questionnaire demonstrates a moderately high level of internal consistency, confirming its reliability.

To validate the SF-36 questionnaire, factor analysis (Principal Component Analysis, PCA) was used, with the number of factors determined using the Kaiser criterion, which indicated the presence of 8 factors.

The rationale for this approach is determined

by the following points. The Shapiro-Wilk test for normality of the survey data distribution indicated that the data does not follow a normal distribution. Therefore, factor analysis was used to check the reliability of the survey, considering the following criteria: sample size  $n=443$  students and the absence of outliers or anomalous values. The sample size permits factor analysis. The Grubbs test was applied to check for outliers or anomalous values. The test showed the presence of outliers in columns 9 and 11, which were replaced with mean values.

Factor 1 (Physical Limitations and Illnesses) includes the following questions: 1, 2, 9, 11, 12, 13, 14, 15, 16, 17, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31. Factor 1 explains the largest portion of the data variance, accounting for 42.95%. This indicates that variables related to physical limitations and illnesses have the greatest impact on the overall variability in the data.

Factor 2 (Emotional State and Psychological Well-being) includes the following questions: 3, 4, 5, 6, 7, 8, 10, 18, 19, 20, 21. Factor 2 explains the second-largest portion of the variance (20.90%). This indicates that emotional state and psychological well-being also play a significant role in the data variability.

Factor 3 (Social Support and Interaction) includes the following questions: 32, 33, 34, 35, 36. Factors 3 (9.88%), 4 (8.12%), 5 (5.44%), 6 (4.87%), 7 (4.24%), and 8 (3.60%) explain smaller portions of the variance, but they still contribute to the overall variability in the data.

Based on these results, it can be concluded that the SF-36 questionnaire is a reliable and valid tool for measuring the quality of life of students.

#### *Statistical Analysis*

The results were processed using PyCharm CE and specialized Python codes with relevant libraries. Cronbach's alpha coefficient ( $\alpha$  Cronbach's = 0.765) was used to assess the internal consistency of the questionnaire responses. Factor analysis was conducted, with the number of factors (8) determined using the Kaiser criterion. To check for the presence (or absence) of outliers or anomalous values in the questionnaire, the Grubbs' test was applied. The Mann-Whitney U test was used. Mean values, standard deviations, and percentage ratios were calculated. The significance level was set at 0.05.

## Results

The Shapiro-Wilk test indicated that the data were not normally distributed. Therefore, the Mann-Whitney U test was applied to compare the values of the indicators between the groups of students.

#### *Physical Health Component (PH): Men and Women*

The Mann-Whitney U test for the variable PH (Physical Health Component) showed statistically

significant differences in PH between groups of students from Poland and Ukraine (Mann-Whitney  $U = 3074.0$ ,  $p = 0.043$ ) and between Poland and Romania (Mann-Whitney  $U = 3454.0$ ,  $p = 0.048$ ). However, no statistically significant differences were found between Ukraine and Romania (Mann-Whitney  $U = 21351.0$ ,  $p = 0.612$ ). Therefore, the comparison between Ukraine and Romania in this context may be less informative.

*Men.* The results of the Mann-Whitney U test for the variable PH (Physical Health Component) showed no statistically significant differences between men from Poland and Ukraine ( $U = 405.0$ ,  $p = 0.349$ ), Poland and Romania ( $U = 1568.0$ ,  $p = 0.433$ ), and between men from Ukraine and Romania ( $U = 3610.0$ ,  $p = 0.574$ ). Therefore, it can be concluded that there are no statistically significant differences in physical health among men from these countries.

*Women.* The results of the Mann-Whitney U test for the variable PH (Physical Health Component) showed a statistically significant difference between women from Poland and Ukraine ( $U = 882.0$ ,  $p = 0.017$ ), indicating significant differences in physical health between these groups. However, no statistically significant differences were found between women from Poland and Romania ( $U = 417.0$ ,  $p = 0.276$ ), and between women from Ukraine and Romania ( $U = 4864.5$ ,  $p = 0.081$ ). Therefore, significant differences in physical health are observed only between women from Poland and Ukraine.

#### *Mental Health Component (MH2): Men and Women*

The results of the Mann-Whitney U test for the variable MH2 (Mental Health Component) show that there are no statistically significant differences between students (male and female) from Poland and Ukraine (Mann-Whitney  $U = 3781.5$ ,  $p = 0.840$ ). However, there are statistically significant differences between students from Poland and Romania (Mann-Whitney  $U = 3132.5$ ,  $p = 0.006$ ), as well as between students from Ukraine and Romania (Mann-Whitney  $U = 15011.5$ ,  $p < 0.001$ ). These results indicate substantial differences in the perception of the MH2 variable among students from different countries.

*Men.* The results of the Mann-Whitney U test for the variable MH2 (Mental Health Component) showed no statistically significant difference between men from Poland and Ukraine ( $U = 444.0$ ,  $p = 0.693$ ). However, statistically significant differences were found between men from Poland and Romania ( $U = 1139.5$ ,  $p = 0.008$ ), as well as between men from Ukraine and Romania ( $U = 2397.0$ ,  $p = 0.003$ ). Therefore, significant differences in the mental health component are observed between men from Poland and Romania, and between men from Ukraine and Romania.

*Women.* The results of the Mann-Whitney U test for the variable MH2 (Mental Health Component)

showed no statistically significant differences between women from Poland and Ukraine ( $U = 1394.0, p = 0.823$ ), Poland and Romania ( $U = 463.5, p = 0.614$ ), and Ukraine and Romania ( $U = 3670.0, p = 0.164$ ). Therefore, no statistically significant differences in the mental health component were found among women from these countries.

To analyze the SF-36 questionnaire data, factor analysis using the Kaiser criterion was employed, which identified 7 factors. The results of the analysis (Figure 1) show that Factor 1 explains the largest share of variance among all factors, accounting for 42.95%. Factors 2 and 3 explain 20.90% and 9.88% of the variance, respectively. Factors 4, 5, 6, 7 and 8 explain 8.12%, 5.44%, 4.87%, 4.24% and 3.60% of the variance, respectively. These results allow for the assessment of each factor's contribution to the total variance and their significance in the context of data analysis.

A linear regression model was used to assess the effectiveness of the SF-36 questionnaire in predicting the physical and mental health of students

Based on the results obtained from the analysis of the linear regression model for predicting physical (PH) and mental (MH) health using the SF-36 questionnaire data, the following conclusions

can be drawn.

For physical health (PH), the mean squared error was 0.0812, indicating a low degree of deviation between the predicted and actual values. The  $R^2$  value of 0.9979 suggests a high accuracy of the model, explaining almost 99.8% of the data variance.

In the case of mental health (MH), the model demonstrated even higher accuracy. The mean squared error was only 0.0061, and the  $R^2$  value was 0.9999, indicating an almost perfect match between the predicted values and the actual data.

Thus, the modeling results indicate a high predictive ability of the SF-36 questionnaire regarding the physical and mental health of students, confirming its reliability and validity in the context of this study.

A fragment of the results for the first 10 rows of the questionnaire is presented in the table 1 below.

The total number of participants across all universities was 448 students (Table 2).

Analysis of the data shows that there are notable differences in the average age, height, and weight among students from Poland, Romania, and Ukraine. Polish men and women are, on average, older than their Romanian and Ukrainian counterparts. Polish students also have the highest average height and weight, which may be related to differences

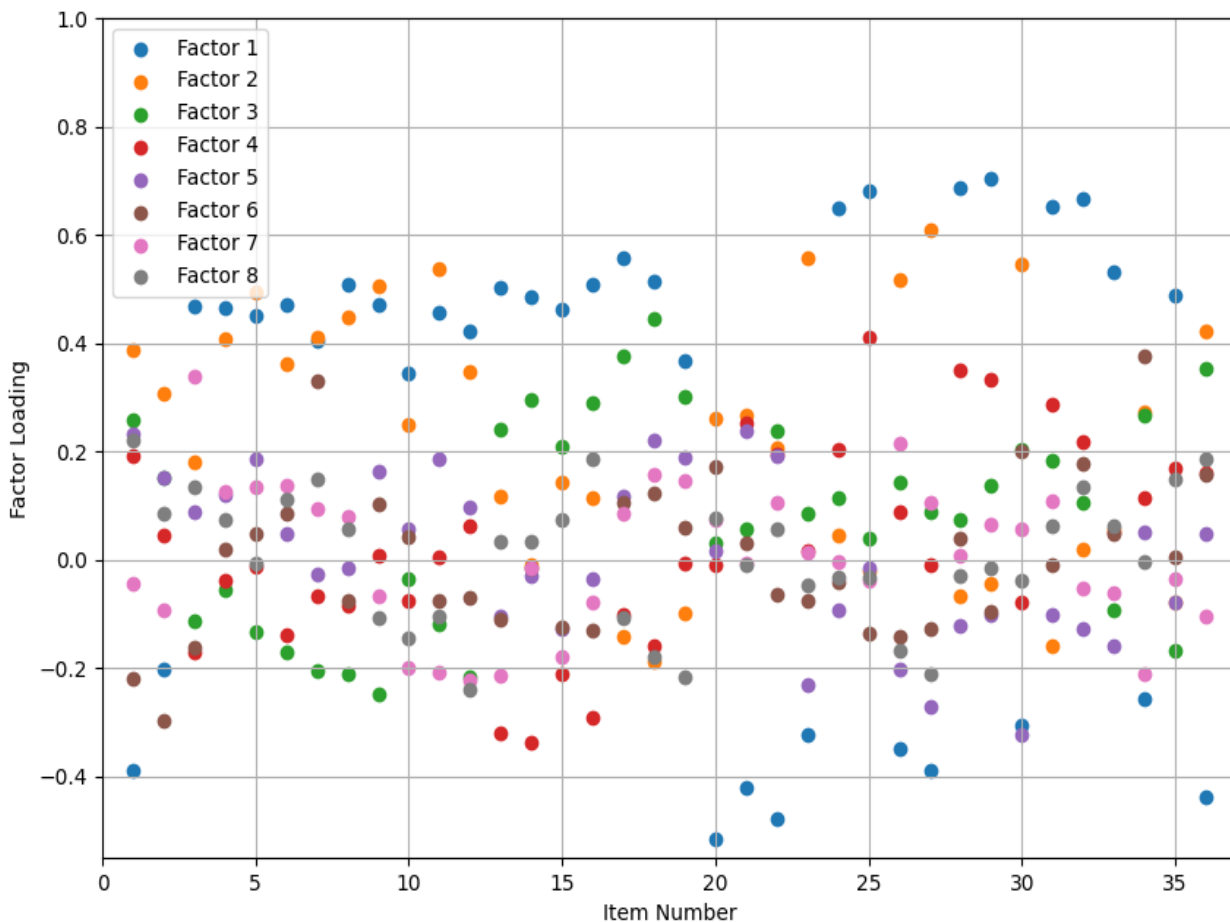


Figure 1. Factor Loadings Plot

in lifestyle, diet, and other factors. Romanian and Ukrainian students show more similar results across all parameters. The standard deviations in weight and age indicate significant variability within groups, especially among men in Ukraine and Poland.

Survey Results are presented in Table 3.

Data analysis (Table 3) shows that there is a slight difference in physical and mental health indicators between genders in each country. Overall, men have slightly better physical health scores, whereas women in Poland and Ukraine report better mental health. The psychological health component shows similar results between genders in Poland and Ukraine, but in Romania, men perform better.

Data analysis (Table 4) shows that there is a slight difference in physical and mental health indicators between genders in each country. Overall, men have slightly better physical health scores, whereas women in Poland and Ukraine report better

mental health. The psychological health component shows similar results between genders in Poland and Ukraine, but in Romania, men perform better.

*The impact of the war on the quality of life of Ukrainian students is reflected in the following indicators:*

#### *Physical Health*

The data from the tables show that the physical health indicators (PH %) of students in Ukraine are somewhat lower compared to Poland and Romania. The average physical health score for Ukrainian female students is 22.88%, and for male students, it is 23.29%. In Poland, these scores are 21.24% and 22.54%, respectively, and in Romania, they are 22.29% and 23.21%. These data indicate that despite the ongoing conflict, Ukrainian students demonstrate comparatively high physical health indicators. However, it is important to consider that the impact

**Table 1.** Results of the assessment of the effectiveness of the SF-36 questionnaire in predicting the physical and mental health of students using a linear regression model.

True PH	Predicted PH	True MH	Predicted MH
54.0	53.72	50.87	50.94
59.2	59.36	32.58	32.54
57.6	57.72	36.91	36.86
38.2	38.33	31.89	31.88
50.5	50.87	37.52	37.45
52.5	52.11	51.01	51.1
54.2	53.98	40.33	40.38
44.3	44.47	42.72	42.72
57.8	57.9	49.0	48.94
47.2	47.22	25.37	25.33

Note. True - these are the actual values, Predicted - these are the values predicted by the model.

**Table 2.** Characteristics of Students

University	Gender	n	Age	Height	Weight
Poland	female	18	21.89±3.31	165.94±5.84	60.06±12.45
	male	22	20.5±3.08	180.64±7.98	80.23±14.35
Romania	female	56	19.96±4.27	164.93±5.94	58.11±9.48
	male	159	19.61±3.91	179.4±6.74	77.57±16.99
Ukraine	female	150	18.89±4.25	165.52±6.22	55.77±10.05
	male	43	21.02±7.76	179.58±7.81	74.14±11.84

Note: Significance Level <0.05

**Table 3.** Survey Results

University	Gender	PF	RP	BP	GH	VT	SF	RE	MH	MH2	PH
Poland	female	88.61±18.05	69.44±37.92	52.61±16.73	54.56±21.88	42.78±25.04	56.94±17.79	55.56±45.73	58.67±15.94	38.09±9.99	47.58±6.57
	male	90.68±20.37	71.59±38.8	58.14±14.53	61.23±17.61	54.09±17.57	56.82±15.78	53.03±45.61	55.09±12.82	37.49±9.65	50.5±6.96
Romania	female	82.14±20.38	80.36±28.89	62.77±10.08	63.57±19.07	47.68±19.45	64.96±16.06	58.93±40.2	58.14±12.42	39.67±8.7	49.92±6.18
	male	90.25±16.33	86.01±25.25	63.68±11.63	71.79±17.7	59.09±20.99	65.25±14.73	75.89±36.92	60.68±13.7	42.79±8.61	52.0±4.95
Ukraine	female	87.37±19.09	70.5±33.79	61.75±12.18	69.26±18.54	54.3±20.57	59.67±14.56	49.11±35.54	56.93±12.93	38.0±8.4	51.26±6.44
	male	88.84±13.13	76.74±31.99	63.84±10.33	65.91±22.41	56.98±23.71	63.66±17.64	54.26±39.19	53.58±14.4	38.12±9.7	52.17±5.98

Note: Significance Level <0.05; PF - Physical Functioning; RP - Role Physical; BP - Bodily Pain; GH - General Health; VT - Vitality; SF - Social Functioning; RE - Role Emotional; MH - Mental Health; MH2 - Mental Health Component; PH - Physical Health Component.

**Table 4.** Percentage Values of Total Number of Students for Various Physical and Mental Health Indicators by University and Gender

University	Gender	PF %	RP %	BP %	GH %	VT %	SF %	RE %	MH %	MH2 %	PH %
Poland	female	39.56	31.0	23.49	24.36	19.1	25.42	24.8	26.19	17.0	21.24
	male	40.48	31.96	25.96	27.33	24.15	25.37	23.67	24.59	16.74	22.54
Romania	female	36.67	35.88	28.02	28.38	21.29	29.0	26.31	25.96	17.71	22.29
	male	40.29	38.4	28.43	32.05	26.38	29.13	33.88	27.09	19.1	23.21
Ukraine	female	39.0	31.47	27.57	30.92	24.24	26.64	21.92	25.42	16.96	22.88
	male	39.66	34.26	28.5	29.42	25.44	28.42	24.22	23.92	17.02	23.29

Note: Significance Level <0.05; PF - Physical Functioning; RP - Role Physical; BP - Bodily Pain; GH - General Health; VT - Vitality; SF - Social Functioning; RE - Role Emotional; MH - Mental Health; MH2 - Mental Health Component; PH - Physical Health Component.

of stress and limited access to medical services may negatively affect their health in the long term.

#### *Mental Health*

The ongoing conflict significantly impacts the mental health of students. The average mental health score (MH %) for Ukrainian female students is 25.42%, and for male students, it is 23.92%. In Poland, these values are 26.19% and 24.59%, respectively, and in Romania, they are 25.96% and 27.09%. These data indicate that Ukrainian students experience significant mental strain related to constant threats and instability. High levels of stress and anxiety can lead to long-term mental health disorders such as depression and post-traumatic stress disorder (PTSD).

#### *Vitality and Social Functioning*

Indicators of vitality (VT %) and social functioning (SF %) also reflect the negative impact of the war. Ukrainian female students have a vitality score of 24.24%, and male students have a score of 25.44%. Social functioning scores are 26.64% for female students and 28.42% for male students. In Poland, these scores are somewhat lower: vitality is 19.1% for women and 24.15% for men, and social functioning is 25.42% for women and 25.37% for men. In Romania, vitality and social functioning scores are higher: 21.29% and 29.0% for women, and 26.38% and 29.13% for men, respectively. These data show that the war affects students' ability to maintain an active and socially meaningful lifestyle.

Overall, the war in Ukraine has a complex negative impact on the health and quality of life of students. Although the physical health of Ukrainian students remains relatively high, mental health, vitality, and social functioning are significantly affected by constant stress and instability.

## **Discussion**

The results of our study conducted among students from Ukraine, Poland, and Romania show significant differences in physical and mental health indicators based on gender and country. In Poland, men demonstrated higher levels of physical functioning and mental health compared to women.

Gender differences were also observed in Romania and Ukraine, with men having better self-assessed physical health.

The results of the analysis highlight that the war in Ukraine significantly impacts the physical and mental health of Ukrainian students. Statistically significant differences in the physical health component between students from Ukraine and Poland may indicate that Ukrainian students experience more physical difficulties and stress due to the effects of military actions. At the same time, the absence of significant differences in the mental health component between Ukrainian and Polish students suggests that the impact of the war on mental health might be similar in these countries. However, substantial differences in mental health between Ukrainian and Romanian students emphasize that military actions and associated stress factors have a serious impact on the mental well-being of students.

Despite the military actions, Ukrainian students demonstrate comparatively high physical health indicators. However, it is important to consider that the impact of stress and limited access to medical services could negatively affect their health in the long term. Our results show that Ukrainian students experience significant mental strain related to constant threats and instability. High levels of stress and anxiety may lead to long-term mental health disorders, such as depression and post-traumatic stress disorder (PTSD). Additionally, the war affects students' ability to maintain an active and socially meaningful lifestyle.

Studies conducted in other countries support our observation of the negative impact of war on quality of life [1, 2, 3]. Hussain [5] and Muhtz [6] note that post-traumatic stress significantly affects quality of life, especially among women and former child refugees. Elsafti [4] emphasized that the civil war in Syria worsened living conditions for children, increased the number of displaced persons, and exacerbated problems in healthcare and education. The results of these studies confirm our findings regarding Ukrainian students.



A comparative analysis of the characteristics of participants in our study also revealed significant differences. In Poland, men ( $n=22$ ) were on average older than women ( $n=18$ ) and had a higher body weight ( $80.23\pm 14.35$  kg vs.  $60.06\pm 12.45$  kg). In Romania, men ( $n=159$ ) also had a higher body weight compared to women ( $77.57\pm 16.99$  kg vs.  $58.11\pm 9.48$  kg). In Ukraine, it was found that men ( $n=43$ ) had a higher body weight ( $74.14\pm 11.84$  kg) compared to women ( $n=150$ ) ( $55.77\pm 10.05$  kg). These differences in physical characteristics may influence physical health indicators and require further analysis. For example, a study conducted in Canada found that 65.4% of students experienced overwhelming anxiety, and 89.5% felt overwhelmed by obligations, which confirms the significance of the mental health issues we identified [56].

These results underscore the need for further research and the development of support programs aimed at improving the health and quality of life of students, especially in the context of military actions and other extreme situations.

Comparing physical health data (PF, RP, BP) of students from Ukraine, Poland, and Romania shows that men in all three countries have slightly higher indicators than women. This is consistent with data from Germany, where men also demonstrated higher physical health indicators compared to women [41]. However, in Turkey, biological factors significantly affect women's quality of life, highlighting the need for further study of gender differences [44].

Mental health indicators (MH, MH2) also differ between men and women. In Romania, men showed the best results on the MH2 scale ( $42.79\pm 8.61$ ), while the values were somewhat lower in Poland and Ukraine. These results correlate with studies in the United Kingdom, where symptoms of depression and anxiety were associated with a deterioration in quality of life [54]. In Germany, students also demonstrated low levels of mental health, highlighting the importance of support programs [43].

The percentage values of physical and mental health indicators also confirm the identified differences. For example, in Poland, 24.15% of men reported high vitality (VT), which is higher than that of women (19.1%). This corresponds with findings from a study in Canada, where 65.4% of students experienced overwhelming anxiety [56]. In the USA, observation as an aspect of mindfulness was negatively associated with physical health, which should also be considered when analyzing the data [57].

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a higher body weight ( $74.14\pm 11.84$  kg) compared to women ( $n=150$ ) ( $55.77\pm 10.05$  kg). These differences in physical characteristics may influence physical health indicators and require further analysis.

Similar differences have been observed in other countries. For example, in China, students also showed significant differences in physical condition depending on gender, which affected their quality of life [30]. In Turkey, women more frequently suffered from premenstrual syndrome, which also negatively impacted their quality of life [44]. In Germany, men demonstrated higher maximum speed and heart rate, but their carbohydrate and fat intake did not meet recommendations [41]. These data confirm that physical characteristics and gender differences play an important role in assessing the health and quality of life of students in different countries.

Studies conducted in different countries emphasize the importance of a comprehensive approach to studying student health. The results of our research show that gender and regional differences significantly impact the quality of life of students. These studies highlight the need to develop support programs aimed at improving the physical and mental health of students, taking into account the specific needs of different groups.

## Conclusions

Our study highlights the significant impact of war on the quality of life of students. The war in Ukraine has a complex negative effect on the health and well-being of students, necessitating the development of specialized support programs and interventions to mitigate the adverse effects. During wartime, such programs may be limited, but in the post-war period and during recovery, it is essential to focus on psychological support, access to medical services, and improving living conditions for students.

Our study underscores the necessity for further research and the development of support programs aimed at improving the health and quality of life of students. It is crucial to consider gender and regional differences when designing such programs to ensure they are more effective and meet the specific needs of students.

The results of our study are consistent with data from other studies in various countries and regions that have experienced war. This confirms the common trends and issues related to the quality of life of students. Such an approach underscores the need for international cooperation and the exchange of experiences to improve the health and well-being of the student youth. Integrating successful practices and strategies from different countries can contribute to the development of more effective and comprehensive approaches to supporting students in various conditions, especially during the post-war recovery period.

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