Coronavirus Pandemic

Student stress and worry related to distance education during the COVID-19 pandemic

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Abstract

Introduction: The Coronavirus Disease 2019 (COVID-19) pandemic has caused considerable stress and anxiety in the general population, especially among students. The objective of this study was to determine the stress and anxiety levels among medical rehabilitation students induced by distance education during the COVID-19 pandemic.

Methodology: The sample for this prospective cross-sectional study included 96 students pursuing the medical rehabilitation undergraduate degree at the Faculty of Medicine, University of Novi Sad, Serbia. All respondents took part in an online survey created on the Google Forms platform and accessed via the Facebook social network. The questionnaire included a sociodemographic section, the perceived stress scale (PSS), and the worry about online learning scale (WOLS). All data were analyzed using the IBM SPSS version 25.

Results: The study involved 96 students with an average age of 21.97 ± 1.55 years, 72.9% of whom were female. The total stress reported by the students during the COVID-19 pandemic was higher in females than in males (21.75 [SD = 7.50] vs. 17.84 [SD = 8.58]; $p < 0.05$). Younger students were more susceptible to experiencing stress during the pandemic (rho = -0.217, $p < 0.05$). Moreover, 57.3% of students suffered from moderate stress, while the WOLS scores indicated that distance education induced a high level of discomfort in this cohort (3.8 [IQR = 1.6]).

Conclusions: Medical rehabilitation students showed a moderate level of stress and a high level of concern about distance education. This stress was more prevalent among younger students and females.

Introduction

The first case of the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was reported in December 2019 in the city of Wuhan, Hubei Province, China. As the virus spread rapidly to other parts of the globe, the World Health Organization (WHO) declared a global pandemic on March 11, 2020, that would change the world [1−3]. The first confirmed coronavirus disease 2019 (COVID-19) case in the Republic of Serbia was recorded on March 6, 2020, and on March 15, the Government of the Republic of Serbia adopted measures to prevent its spread and imposed a state of emergency, which involved closing all educational institutions (nurseries, schools, and universities) [4,5].

On March 17, 2020, the Ministry of Education, Science and Technological Development made a decision to implement distance education, which higher education institutions have achieved with the help of their own online platforms [6]. "E-learning is defined as a broad set of applications and processes, which include web-based learning, computer-based learning, virtual classrooms, and digital contents" [7]. The Faculty of Medicine, University of Novi Sad created a proprietary online platform for the implementation of distance teaching and learning called E-learning, and later implemented the SOVA platform [8].

Ample body of evidence indicates that the pandemic has had adverse impact on people's mental health status [4,9,10]. During the COVID-19 pandemic, 38.1% of the Serbian population showed moderate to severe levels of stress, which were particularly prevalent among university students [5]. Stressors that affect the student population can be academic, financial, health-related, or self-imposed. Academic stress pertains to education, and causes students to feel

fear, panic, overload, pressure, and sometimes somatic symptoms [11]. One of the most commonly used scales for assessing a person's perception of the level of stress experienced in certain situations is the perceived stress scale (PSS), which was developed in 1983 [12] and was subsequently translated into Serbian language and validated for use in this context [13]. Increased levels of stress among university students pursuing degrees in the field of healthcare have been noted by several authors [14−16], especially during the COVID-19 pandemic [11,17]. In their study published in 2020, Abdulghani and colleagues noted an increased stress level among medical students, who found online learning during the pandemic challenging [17].

Therefore, the aim of the present study was to determine the level of stress and anxiety experienced by the medical rehabilitation students due to distance education during the COVID-19 pandemic.

Methodology

This study was based on a prospective cross-sectional design and was conducted during the COVID-19 pandemic within the 7-day period spanning from April 19, 2021 to April 26, 2021. The sample consisted of 96 students pursuing undergraduate degree in medical rehabilitation at the Faculty of Medicine, University of Novi Sad, Serbia. The consent of the Head of the Department of Medical Rehabilitation at the Faculty of Medicine, University of Novi Sad (number 01-1062 21) and the Ethics Committee of the Faculty of Medicine, University of Novi Sad (number 01-39/163/1) was obtained prior to commencing this research. All medical rehabilitation students were eligible for participation and were sent an online questionnaire created in the Google Forms platform via the Facebook social network. All individuals were assured that their participation in the study was anonymous and voluntary, and were informed that by accessing the survey, they implicitly gave their informed consent to participate in the research. The survey response rate was 58.18%.

Data collection instruments

The first section of the questionnaire was designed to collect data on the respondents' basic sociodemographic information (gender, age, year of study, and living arrangements), as well as whether the respondents, their family members and friends have had COVID-19 infection. In addition, in this part of the questionnaire, data were collected on the main sources of information students used and the frequency with which they accessed COVID-19 infection reports.

The second part of the questionnaire comprised of the PSS which measures the total level of stress in a given period of time [16]. It consists of ten items, requiring a response on a five-point Likert-type scale reflecting the level of agreement with the given statement (anchored at 0 = never and 4 = very often). The scoring on four items were reversed (e.g., "In the last month, how often have you felt confident about your ability to handle your personal problems?"). Individual scores on the PSS can range from 0 to 40 with higher total scores indicating greater perceived stress [13].

The third part of the questionnaire comprised of the worry about online learning scale (WOLS) (Supplementary Table 1) the aim of which is to assess the level of discomfort with online learning. WOLS is a 5-item self-reported measure of concern about online learning. The scale was developed for the purposes of this research with the goal of determining the psychometric properties of the WOLS scale by administering it to a student sample. Each of its items requires respondents to indicate the degree of agreement with the corresponding statement using a five-point Likert scale ranging from 1 = "strongly disagree" to 5 = "strongly agree", with one of the items ("I have had more time to learn since online education has been adopted") reverse-scored. Therefore, the total score ranges from 5 to 25, with a higher value indicating a greater worry about distance education.

The psychometric properties of the WOLS scale were determined and its internal consistency was satisfactory (α = 0.800). Prior to conducting the exploratory factor analysis (EFA) on the WOLS questionnaire, we performed Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measurement of sampling adequacy to verify that the sample was adequate for conducting this analysis. The EFA showed a one-dimensional scale structure. The convergent validity of the scale was also satisfactory, as indicated by average variance extracted (AVE) = 0.563 and composite reliability (CR) = 0.862. Finally, the scale showed a positive correlation with the scale that measures total student stress during a pandemic (PSS).

Statistical analyses

IBM SPSS Statistics Version 25 was used for data analysis [18]. Frequencies and percentages were calculated for sociodemographic variables. The normality of the distribution of numerical variables was examined by the Shapiro-Wilk test, and skewness and Kurtosis were also presented. Mean ± Standard Deviation (SD) was reported for variables that meet the

normality criterion. Median (Interquartile Range [IQR]) was reported for those variables that deviated from normality. We also used Pearson's correlation coefficient, independent samples t-test, ANOVA test, and their non-parametric substitutions: Spearman's rho Correlation Coefficient, Kruskal Wallis Test and Mann-Whitney U test. Univariate and multivariate linear regression analyses were conducted to examine the correlations of general variables with the WOLS and PSS total scores.

The psychometric properties of the WOLS questionnaire were investigated in detail, whereby EFA was used to examine the factor structure of the scale, and the internal consistency was measured via Cronbach's alpha. Convergent validity was determined via AVE and CR, and the Pearson product-moment correlation coefficient between WOLS and PSS total score was additionally tested.

Results

The study sample comprised of 96 university students with an average age of 21.97 (SD = 1.55) years, 72.9% of whom were female. The participants primarily relied on the internet to obtain information on COVID-19 infection (72.9%), followed by television (17.7%), a family member (7.3%), and the university environment (2.1%). Although only 20% of the respondents had been infected with the COVID-19 virus, 47.9% had a family member that had tested positive for COVID-19, while 91.6% reported having a friend who had this infection. Distance education was more challenging for younger students (rho = -0.251, $p < 0.05$) and those who obtained COVID-19-related information at the university (4.80 [IQR = 1.40]) and through a family member (4.40 [IQR = 1.30]). The total stress induced by the COVID-19 pandemic was higher among female than male students (21.75 [SD = 7.50] vs. 17.84 [SD = 8.58]; $p < 0.05$), as well as among the younger cohort (rho = -0.217, $p < .05$).

Table 1. Worry about online learning scale (WOLS) scores and overall stress levels during the COVID-19 pandemic in relation to different demographic factors.

General characteristics of the respondents	[ALL]	WOLS		PSS	
	N = 96	Value	p	Value	p
Gender			0.100[h]		0.032[d]
Male	26 (27.11%)	4.00 (1.10)[b]		17.84 ± 8.58[a]	
Female	70 (72.9%)	3.60 (1.4)[b]		21.75 ± 7.50[a]	
Age, years	21.97±1.55[a]	-0.251[f]	0.016	-0.217[c]	0.034
Study year			0.059[g]		0.524[e]
I	28 (29.2%)	4.20 (1.00)[b]		22.10 ± 8.16[a]	
II	23 (24.0%)	4.00 (1.40)[b]		21.52 ± 7.47[a]	
III	13 (13.5%)	3.60 (1.8)[b]		21.00 ± 9.85[a]	
IV	5 (5.2%)	4.00 (2.3)[b]		19.50 ± 9.29[a]	
Graduate	27 (28.1%)	3.00 (1.2)[b]		18.51 ± 7.08[a]	
Living with			0.230[g]		0.364[e]
Family	48 (50.0%)	3.80 (1.65)[b]		20.00 ± 8.39[a]	
Alone	30 (31.3%)	3.80 (1.20)[b]		22.76 ± 7.51[a]	
In student dormitories	8 (8.3%)	4.40 (1.00)[b]		18.75 ± 8.92[a]	
Other	10 (10.4%)	3.60 (0.70)[b]		19.20 ± 5.99[a]	
The main source of information on COVID-19 infection			0.050[g]		0.124[e]
Television	17 (17.7%)	3.00 (1.50)[b]		21.05 ± 8.69[a]	
Internet	70 (72.9%)	3.80 (1.30)[b]		19.89 ± 7.69[a]	
University	2 (2.1%)	4.80 (1.40)[b]		31.00 ± 2.00[a]	
Family member	7 (7.3%)	4.40 (1.30)[b]		24.57 ± 7.76[a]	
Frequency of access to COVID-19-related reports	4.00 (1.00)[b]	-0.031[f]	0.769	-0.058[f]	0.578
Has family members that have been infected with COVID-19			0.528[h]		0.783[d]
Yes	45 (47.9%)	3.80 (1.20)[b]		20.77 ± 7.89[a]	
No	49 (52.1%)	3.60 (1.80)[b]		20.32 ± 7.95[a]	
Has friends that have been infected with COVID-19			0.298[h]		0.909[d]
Yes	87 (91.6%)	3.80 (1.40)[b]		20.71 ± 8.10[a]	
No	8 (8.4%)	4.00 (1.30)[b]		20.37 ± 6.61[a]	
Has personally tested positive for COVID-19 infection			0.886[h]		0.101[d]
Yes	19 (20.0%)	3.80 (2.10)[b]		18.00 ± 7.78[a]	
No	76 (80.0%)	3.80 (1.45)[b]		21.35 ± 7.91[a]	

[a]: Mean ± Standard Deviation; [b]: Median (Interquartile Range); [c]: Pearson correlation coefficient; [d]: Independent samples *t*-test; [e]: ANOVA test; [f]: Spearman's rho correlation coefficient; [g]: Kruskal-Wallis Test; [h]: Mann-Whitney U test; N: number of respondents; WOLS: worry about online learning scale; PSS: perceived stress scale; *p*: level of statistical significance.

Sociodemographic characteristics of the sample and the average values achieved on the WOLS and PSS scales are shown in Table 1.

Table 2 shows the descriptive statistics for all measures, and the Shapiro-Wilk test results and Cronbach's alpha coefficients. We tested the normality of the distribution by conducting the Shapiro-Wilk test, since its use with small- and medium-sized samples is questionable [19]. The average PSS total score was 21.04 (SD = 7.93), with 17.7% of students indicating low stress levels, 57.3% experiencing moderate stress, and 24.0% feeling highly stressed by the COVID-19 pandemic. The WOLS scale scores further show that students feel a high level of concern regarding distance education (3.8 [IQR = 1.6]), whereby 25.2% of the respondents reported high level of worry, while 48.4% and 26.4% indicated that they experienced medium and low levels of worry, respectively.

Prior to conducting the EFA analysis on the WOLS questionnaire, we conducted Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin measurement of sampling adequacy (KMO) to verify that the sample was adequate for conducting this analysis. The Bartlett's Test of Sphericity was significant (χ^2 = 168,834, df = 10, $p < 0.001$) and the KMO value was acceptable at 0.719. Item-component loads ranged from 0.49 to 0.89. Thus, the EFA results suggest that WOLS is a one-dimensional construct.

The WOLS questionnaire also exhibits good reliability since the Cronbach's alpha coefficient is high ($\alpha = 0.800$) and its value did not increase upon deleting any of the five scale items (Table 2). Inter-item correlations ranged from 0.253 to 0.757 (Table 3). Item-total correlations were equally robust, ranging between 0.547 and 0.764 (Table 3).

Table 2. Descriptive statistics.

Items and Total Scores	n (%)	Min–Max	Me	IQR	M	SD	Skewness	Kurtosis	Shapiro-Wilk	α
PSS Item 1		0 - 4	2.00	3.00	2.30	1.22	0.059	-1.083	0.883**	0.868
PSS Item 2		0 - 4	2.00	2.00	2.18	1.23	-0.022	-0.979	0.908**	0.864
PSS Item 3		1 - 4	3.00	2.00	2.83	.99	-0.246	-1.108	0.853**	0.868
PSS Item 4		0 - 4	1.00	2.00	1.30	1.08	0.235	-0.826	0.863**	0.894
PSS Item 5		0 - 4	2.00	2.00	1.97	1.01	-0.147	-0.633	0.904**	0.877
PSS Item 6		0 - 4	2.00	2.00	2.16	1.16	-0.088	-0.892	0.912**	0.866
PSS Item 7		0 - 4	2.00	1.00	1.76	1.07	0.269	-0.367	0.908**	0.891
PSS Item 8		0 - 4	2.00	1.00	1.64	1.03	0.055	-0.508	0.904**	0.877
PSS Item 9		0 - 4	3.00	2.00	2.63	1.09	-0.420	-0.565	0.891**	0.872
PSS Item 10		0 - 4	2.00	2.00	1.86	1.36	0.201	-1.169	0.893**	0.868
PSS Total Score		2 - 39	21.00	11.00	21.04	7.93	0.039	-0.375	0.984	0.886
WOLS Item 1		1 - 5	4.00	2.00	3.65	1.49	-0.747	-0.889	0.795**	0.751
WOLS Item 2		1 - 5	4.00	2.00	3.84	1.42	-0.980	-0.398	0.767**	0.700
WOLS Item 3		1 - 5	4.00	2.00	3.91	1.26	-0.917	-0.253	0.803**	0.744
WOLS Item 4		1 - 5	2.00	1.00	2.53	1.18	0.315	-0.838	0.899**	0.799
WOLS Item 5		1 - 5	4.00	2.00	3.71	1.32	-0.680	-0.716	0.837**	0.771
WOLS Total Score		1 - 5	3.8	1.6	3.53	1.00	-0.737	-0.160	0.938**	0.800
PSS Total Score										
Low	17 (17.9%)									
Medium	55 (57.9%)									
High	23 (24.2%)									
WOLS Total Score										
Low	24 (26.4%)									
Medium	44 (48.4%)									
High	23 (25.2%)									

**$p < 0.01$; Me: Median; IQR: Interquartile range; M: Mean; SD: Std. Deviation; α: Cronbach's alpha; PSS: perceived stress scale; WOLS: worry about online learning scale.

All PSS items refer to the preceding month. PSS Item 1: How often have you been upset about something that happened unexpectedly? PSS Item 2: How often have you felt that you were unable to control important things in your life? PSS Item 3: How often have you felt nervous and stressed? PSS Item 4: How often have you felt confident in your ability to deal with personal problems? (reverse-scored); PSS Item 5: How often have you felt that things were going the way you wanted? (reverse-scored); PSS Item 6: How often have you felt that you could not cope with all the things you needed to do? PSS Item 7: How often have you been able to control the irritations in your life? (reverse-scored); PSS Item 8: How often have you felt in control of what was happening in your life? (reverse-scored); PSS Item 9: How often have you felt annoyed by things beyond your control? PSS Item 10: How often you have felt that difficulties have accumulated so much that you cannot overcome them?
WOLS Item 1: I have experienced a decline in motivation to learn due to the pandemic; WOLS Item 2: Due to the pandemic, I find it harder to focus on online education; WOLS Item 3: My commitment to online classes has been reduced; WOLS Item 4: I have had less time to learn since online education has been adopted; WOLS Item 5: I have a harder time mastering the material from online classes.

Table 3. Summary of the EFA results related to the worry about online learning Scale (WOLS).

Items	Inter-item correlations				Item-total correlation	Factor loadings (56.3%)[#]
	2	**3**	**4**	**5**		
WOLS Item 1	0.640**	0.438**	0.253*	0.506**	0.620	0.890
WOLS Item 2		0.757**	0.310**	0.479**	0.764	0.809
WOLS Item 3			0.279**	0.422**	0.645	0.780
WOLS Item 4				0.272**	0.547	0.717
WOLS Item 5					0.555	0.498
AVE					0.563	
CR					0.862	

[#] percentage of the variance accounted by the factor; **$p < 0.01$; *$p < 0.05$; EFA: exploratory factor analysis (varimax rotation); AVE: average variance extracted; CR: composite reliability.

WOLS Item 1: I have experienced a decline in motivation to learn due to the pandemic; WOLS Item 2: Due to the pandemic, I find it harder to focus on online education; WOLS Item 3: My commitment to online classes has been reduced; WOLS Item 4: I have had less time to learn since online education has been adopted; WOLS Item 5: I have a harder time mastering the material from online classes.

Table 4. Summary of the EFA results related to the perceived stress scale (PSS).

Items	Inter-item correlations									Item-total correlation	Factor loadings (50.9%)[#]
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**		
PSS Item 1	0.706**	0.659**	0.353*	0.339**	0.633**	0.223*	0.381**	0.655**	0.621**	0.704	0.864
PSS Item 2		0.633**	0.380*	0.482**	0.683**	0.314**	0.599**	0.527**	0.591**	0.760	0.786
PSS Item 3			0.245*	0.451**	0.630**	0.251*	0.386**	0.646**	0.624**	0.731	0.805
PSS Item 4				0.434**	0.297**	0.326**	0.253*	0.270*	0.259*	0.337	0.756
PSS Item 5					0.464**	0.318**	0.585**	0.359**	0.383**	0.591	0.722
PSS Item 6						0.218*	0.459**	0.518**	0.678**	0.741	0.774
PSS Item 7							0.346**	0.271**	0.286*	0.377	0.674
PSS Item 8								0.392**	0.403**	0.588	0.448
PSS Item 9									0.637**	0.667	0.790
PSS Item10										0.713	0.796
AVE										0.552	
CR										0.823	

[#] percentage of the variance accounted by the factor; **$p < 0.01$; *$p < 0.05$; EFA: exploratory factor analysis (varimax rotation); AVE: average variance extracted; CR: composite reliability.

PSS Item 1: How often have you been upset about something that happened unexpectedly? PSS Item 2: How often have you felt that you were unable to control important things in your life? PSS Item 3: How often have you felt nervous and stressed? PSS Item 4: How often have you felt confident in your ability to deal with personal problems? (reverse-scored); PSS Item 5: How often have you felt that things were going the way you wanted? (reverse-scored); PSS Item 6: How often have you felt that you could not cope with all the things you needed to do? PSS Item 7: How often have you been able to control the irritations in your life? (reverse-scored); PSS Item 8: How often have you felt in control of what was happening in your life? (reverse-scored); PSS Item 9: How often have you felt annoyed by things beyond your control? PSS Item 10: How often you have felt that difficulties have accumulated so much that you cannot overcome them?

Table 5. Linear regressions predicting the PSS and WOLS scores from the information gathered through the survey.

Independent variables	Dependent variable: PSS		Dependent variable: WOLS
	Univariate linear regression analysis: Beta [95% confidence interval]	Multivariate linear regression analysis: Beta [95% confidence interval]	Univariate linear regression analysis: Beta [95% confidence interval]
Gender			
Male	-0.220 [-7.477, -0.338]*	-0.219 [-7.339, -0.445]*	0.164 [-0.097, 0.830]
Female	reference	reference	reference
Age, years (continuous)	-0.217 [-2.135, -0.084]*	-0.210 [-2.060, -0.083]*	-0.255 [-0.292, -0.033]*
Living with			
Family	0.063 [-3.356, 5.356]		-0.225 [-1.022, 0.127]
Alone	0.221 [-0.918, 8.452]		-0.077 [-0.780, 0.452]
Other	reference		reference
The main source of information on COVID-19 infection			
Television	-0.239 [-11.365, 1.482]	-0.258 [-11.492, 0.846]	-0.278 [-1.525, 0.105]
Internet	-0.343 [-11.624, -0.579]*	-0.359 [-11.673, -1.074]*	-0.169 [-1.076, 0.330]
Other	reference	reference	reference
Frequency of access to COVID-19-related reports (continuous)	-0.073 [-2.317, 1.108]		0.016 [-0.203, 0.235]
Has family members that have been infected with COVID-19			
Yes	0.029 [-2.799, 3.701]		0.041 [-0.340, 0.505]
No	reference		reference
Has friends that have been infected with COVID-19			
Yes	0.012 [-5.536, 6.212]		-0.122 [-1.163, 0.306]
No	reference		reference
Has personally tested positive for COVID-19 infection			
Yes	-0.169 [-7.375, 0.664]		-0.070 [-0.716, 0.357]
No	reference		reference
Adj. R²		0.108	0.054

*$p < 0.05$; PSS: perceived stress scale; WOLS: worry about online learning scale.

Convergent validity is deemed adequate when the average variance extracted (AVE) of the latent variable is 0.50 and composite reliability (CR) is 0.70 [20]. As can be seen from Table 3, the CR values for all constructs exceeded 0.70 (0.862) and the AVE values were above 0.50 (0.563).

In order to complete the findings related to the convergent validity of the WOLS questionnaire, we examined whether the total score on this scale correlated with the PSS total score (which is indicative of total stress). The correlation was statistically significant and positive, and even though it was low (r = 0.224, $p < 0.05$) it was in the desired direction.

Based on the psychometric characteristics of the one-dimensional PSS instrument, its item-component loadings ranged from 0.45 to 0.86 (Table 4). The Bartlett's Test of Sphericity was significant (χ^2 = 475.13, df = 45, $p < 0.001$) and the KMO was acceptable at 0.878. Moreover, the high Cronbach's alpha coefficient value (α = 0.886) indicates that this instrument is highly reliable (Table 2). Inter-item correlations ranged between 0.218 and 0.706, while item-total correlations ranged from 0.337 to 0.760 (Table 4). Finally, at CR = 0.823 and AVE =0 552, convergent validity indicators are adequate.

Table 5 shows the linear regression models with the PSS and WOLS total scores as the dependent variables. The multiple regression model predicting PSS total score proved to be statistically significant (F = 3.849, $p < 0.01$). The set of variables involved explains 10.8% of the variance in total student worry during the COVID-19 pandemic. Higher overall concern is reported by women (Beta [β] = -0.220; 95% Confidence Interval [CI]: [-7.477, -0.338]; $p < 0.05$), younger respondents (β = -0.210; 95% CI: [-2.060, -0.083]; $p < 0.05$) and those who do not rely on the internet as the main source of COVID-19-related information (β = -0.359; 95% CI: [-11.673, -1.074]; $p < 0.05$). Univariate model with the WOLS total score as the dependent variable is also statistically significant (F = 6.172, $p < .05$) explaining 5.4% of the variance in the dependent variable. It indicates that younger respondents express greater concern about distance education (β = -0.255; 95% CI: [-0.292, -0.033]; $p < 0.05$).

Discussion

The COVID-19 pandemic has significantly affected all spheres of life, especially the education sector [21]. The closure of schools and universities to ensure social distancing has forced traditional face-to-face learning to be replaced by distance instruction via online platforms [22]. Available data show that this shift has negatively affected 91% of the world's student population [23]. The aim of our study was to determine the level of stress and anxiety experienced by medical rehabilitation students due to distance education during the COVID-19 pandemic.

Based on our findings, the main source of information about COVID-19 infection for students is the internet, followed by television, with a much lower percentage of students relying on a family member or university environment for staying informed. Given that the internet has become the dominant source of information, this pattern is not surprising. Moreover, Zhang and Ba-Thein in their study found that the internet served as the main source of information for medical students during the COVID-19 pandemic [24].

We adopted the PSS questionnaire to determine the level of stress in students, which yielded the average PSS total score of 21.04 ± 7.93, indicating that the participating students experienced moderate levels of stress during the pandemic.

A similar average PSS score (20.37 ± 7.62) was reported by Kostić *et al*. who conducted their study with students attending the University of Niš during the COVID-19 pandemic [25]. These findings are corroborated by several studies indicating that the pandemic had a negative impact on the level of stress perceived by students [13,15]. A lower average PSS score compared to that obtained in our study was observed among students in Serbia prior to the COVID-19 pandemic (14.98 ± 6.32) [13]. Also, a lower average score on the PSS scale compared to ours was recorded among physiotherapy students from Israel, Australia, and Sweden in the period before the COVID-19 pandemic [15].

In our study, the overall stress level during the COVID-19 pandemic was higher among female students, which is in accordance with the findings reported by Kostć *et al.* in 2021 [25]. In their 2020 study, Abdulghani *et al.* also noted a significantly higher level of overall stress among female medical students compared to their male counterparts [17]. These results are not surprising, given that women have long been known to have increased biological and psychological sensitivity to stress [26]. It is also widely established that female students are often more responsible and persistent in performing academic duties, which imposes additional pressure and exposes them to greater stress [27]. Moreover, guided by the social norms of traditional masculinity, men and boys often feel under pressure to inhibit emotional expression and may underreport any stress they

experience due to stigma [28]. Thus, this issue also warrants further investigation.

To assess their perceptions of e-learning and the level of concern about distance education, the students that took part in our study answered five questions comprising the WOLS scale. In our work, WOLS exhibited good reliability and validity, since the Cronbach's alpha coefficient was satisfactory (α = 0.800). The data gathered through the WOLS questionnaire in our study show that medical rehabilitation students feel a high level of concern regarding distance education. The experiences and attitudes of physiotherapy students towards online learning during the COVID-19 pandemic have been previously examined by other authors [11,29,30]. For example, in their 2021 study, Akulwar-Tajane and colleagues revealed a high prevalence of stress among physiotherapy students, which reached 94.4% in relation to online exams during COVID-19 pandemic [11].

In 2020, Hashim *et al.* also examined the attitudes of physiotherapy students from Pakistan, and their findings indicate that 55% of students found face-to-face contact with a professor important for the learning process, which is not possible during online classes [29]. In 2021, Kazi Hakim *et al.* similarly reported that the majority of physiotherapy students (59.4%) preferred the traditional way of learning during the pandemic. However, 35.5% of the respondents opted for blended learning, i.e., a combination of traditional and e-learning [30].

A study on the perception and satisfaction of health science students with e-learning during the COVID-19 pandemic, which involved a sample of 1,255 students from 11 countries, showed that most students find this way of learning adequate for acquiring theoretical knowledge, but do not believe it is useful for developing practical and clinical skills. In particular, 69% of the surveyed students experienced difficulties following online instruction during the pandemic. However, there was a significant difference in satisfaction with online education between developed and developing countries, whereby students from developed countries reported higher satisfaction levels [31]. As Serbia is a developing country, these findings may justify a higher level of concern among students in our study. Prior experience with online learning, as well as good training and an environment conducive for virtual education, are likely the contributing factors to the better satisfaction among students from developed compared to developing countries [31].

The results obtained in our study indicate that younger students find distance education particularly challenging, which can be attributed to their greater fear of the unknown, as the university environment and the instruction style is new for them [32]. These observations are supported by the results obtained by Malkawi *et al.*, who examined student satisfaction with e-learning during the pandemic. These authors noted a significant difference between 1st and 4th year students, with older participants reporting greater satisfaction and more positive attitudes [33].

In addition, students who were informed about COVID-19 infections through the university or a family member reported greater worry about distance education. The greater concern induced by information received at the university can be attributed to the fact that these students are pursuing a health-related degree and are constantly exposed to large amounts of information on the pandemic and its development [34]. However, in 2020, Chao *et al.* reported that greater reliance on the newer media (such as the internet) leads to a greater fear compared to receiving relevant information through the traditional media (TV, radio) [35].

As the main limitation of our study stems from the small sample size, it would be beneficial to replicate this research with a larger number of respondents, as well as students pursuing other degrees, in order to obtain more comprehensive data on student stress and concerns about distance education during the COVID-19 pandemic. However, Hodges and colleagues posit that such a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances should be considered emergency remote teaching (ERT). These authors further point out that, while ERT is certainly valuable under extenuated circumstances, the aim is to phase it out as soon as that is feasible. In some settings, this can be done by initially offering blended or hybrid courses with the view that the conventional teaching mode will resume once the emergency has been resolved [36].

Similarly, Khlaif and colleagues observed that the level of student engagement diminished as a result of ERT, indicating that standard mode of instruction would be preferable. As this study focused on middle school students in Palestine, which is a developing country, it highlights the need to improve the content of online learning to limit the influence of any future crises on education [37]. In the future, we should also examine the impact of online education and the lack of practical teaching and communication with patients during this pandemic on students pursuing health-related degrees

in terms of their achievements, competencies, and work quality.

Limitations: The main study limitation arises from the small sample size, which was drawn from one higher education institution in Serbia and mostly comprised students in the first years of their university course. While this design allowed us to focus on the needs of this specific cohort, it precludes generalizability of our findings. Moreover, as first- and second-year students are transitioning from high school to university and are still in the process of adjusting their learning styles and habits, they are likely to experience greater stress than third- and fourth-year students. Thus, caution needs to be applied when drawing any inferences from our investigation to students pursuing different degrees and those that are already adjusted to the university life.

Conclusions

In conclusion, the results yielded by our study concur with those obtained in numerous prior investigations on the impact of the COVID-19 pandemic on students' mental health, as well as their attitudes towards distance education. Medical rehabilitation students show a moderate level of stress and a high level of concern about distance education, with younger individuals and females exhibiting greater susceptibility to stress and worry. The WOLS scale, which measures concerns about distance education, and was developed for the purposes of this research, exhibits very good psychometric characteristics. Research indicates the presence of negative effects of the pandemic on students' mental health, which is why there is a need for early identification of students with initial symptoms of stress, anxiety, and depression that can lead to reduced academic functioning and compromise their success. The practical recommendations that can be derived from this work are also highly relevant, as high level of discomfort and stress caused by distance education encourages thinking about ways to reorganize teaching and introduce psychological support in schools and universities in order to take care of the mental health of young people.

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Annex – Supplementary Items

Supplementary Table 1. Worry about online learning scale

Items
I have experienced a decline in motivation to learn due to the pandemic.
Due to the pandemic, I find it harder to focus on online education.
My commitment to online classes has been reduced.
I have had less time to learn since online education has been adopted.
I have a harder time mastering the material from online classes.