Anxiety, Stress Perception and Coping Strategy Among Students with COVID-19 Exposure

Andrei Shpakou *, Elżbieta Krajewska-Kułak, Mateusz Cybulski, Dorota Sokołowska, Małgorzata Andryszczyk, Ewa Kleszczewska, Yelena Loginovich, Jakub Owoc *, Andrei V. Tarasov, Natalia A. Skoblina, Krystyna Kowalczuk

Posted Date: 7 June 2023

doi: 10.20944/preprints202306.0528.v1

Keywords: university students; anxiety stress perception; coping strategies; pandemic; COVID-19 patients

Article

Anxiety, Stress Perception and Coping Strategy among Students with COVID-19 Exposure

Andrei Shpakou [1,*], Elżbieta Krajewska-Kułak [1], Mateusz Cybulski [1], Dorota Sokołowska [2], Małgorzata Andryszczyk [3], Ewa Kleszczewska [3], Yelena Loginovich [4], Jakub Owoc [5], Andrei Tarasov [6], Natalia Skoblina [7] and Krystyna Kowalczuk [1]

[1] Department of Integrated Medical Care, Faculty of Health Sciences, Medical University of Bialystok, Bialystok, Poland
[2] East European Academy of Applied Sciences in Bialystok, Bialystok, Poland
[3] Department of Health Care, Prof. Edward F. Szczepanik State Vocational College in Suwałki, Suwałki, Poland
[4] Lithuanian University of Health Science, Kaunas, Lithuania
[5] National Institute of Geriatrics, Rheumatology and Rehabilitation, Warsaw, Poland
[6] Department of Pediatrics and Preventive Medicine, Medical Institute, Immanuel Kant Baltic Federal University, Kaliningrad, Russia
[7] Department of Hygiene, Pirogov Russian National Research Medical University, Moscow, Russia
* Correspondence: andrei.shpakou@umb.edu.pl

Abstract: Background: Studying anxiety, stress and the selection of coping strategies in the COVID-19 pandemic is necessary to minimize the adverse changes associated with the risk of infection and the consequences of the disease. **Objective:** To investigate the level of anxiety, stress perception and coping strategies in relation to the presence of illness. **Material and Methods:** The anonymous cross-sectional online survey was conducted among 3950 university students of northeastern Poland (1822), Lithuania (232) and the Russian exclave of Kaliningrad (1896). Due to the almost identically applied anti-epidemic measures, the respondents were treated as a unified group. The State-Trait Anxiety Inventory, Perceived Stress Scale-10 and Coping Orientations to Problems Experienced questionnaires were used. **Results:** Among 1212 men and 2738 women, COVID-19 was diagnosed in 348 (28.7%) and 1020 (37.3%) individuals, respectively, according to the clinical protocol. The prolonged nature of the process and the longer consequences of the disease were indicated by an increase in anxiety levels. **Conclusions:** The risk of possible infection and coping with illness required the adoption of active anti-stress strategies, which was observed regardless of going through the disease. Convalescents differed from non-diseased individuals in having higher levels of concern about their own emotions and their more frequent turn to religion, notably among the females. The repertoire of strategies among women was broader, with elevated levels of helplessness and avoidance seen as integral strategies.

Keywords: university students; anxiety stress perception; coping strategies; pandemic; COVID-19 patients

1. Introduction

Contemporary research on the COVID-19 pandemic assume that the emerging situation and the associated experience of uncertainty, the threat of infection, the symptoms and course of the disease, self-isolation and quarantine, induced individuals to treat the situation as a crisis with high stress potential [1]. In addition to this, COVID-19 was identified from the literature as an unexpected, large-scale event that disrupted community functioning and caused psychological trauma [2]. Despite considerable efforts to control the situation, the virus is still present in many countries with varying degrees of clinical manifestations [3].

The topic of mental health remains a current issue in medical care and public health against the backdrop of the ongoing pandemic waves. The universality of the psychological reaction in humans during a pandemic can be considered by analogy with reactions observed in other extreme stress

 doi:10.20944/preprints202306.0528.v1

situations [4, 5]. The COVID-19 pandemic caused a parallel epidemic of anxiety and depressive disorders, both during the course of the disease and during recovery [6].–

Recovering patients with the disease eliminated, and especially those with severe COVID-19 have an increased risk of (post-COVID) post-traumatic stress disorder [7]. Patients with an optimistic outlook on life recover faster than those prone to a pessimistic perception of their condition and surroundings [8]. Emotions play an important role, mainly anxiety, which affects functioning from the moment of exposure, through the onset of symptoms, the course of the disease, all the way to the rehabilitation period. All of these conditions affect the level of resilience to stress in a threatening situation and alter the repertoire of individual *coping* strategies as stereotypical behaviors [9].

Given the continuation of the COVID-19 pandemic, its magnitude and variable course, and the fact that young adult university students, and especially women, are among the vulnerable age and demographic groups [10], studying the characteristics of coping strategies is important to ensure proper and necessary psychological support for those infected, those in conditions with possible infection, and those recovering from the disease [11].

An increase in an individual's risk of an unknown disease and the use of ineffective emotional or behavioral strategies can lead to poor coping with stressful situations, which impairs psychosomatic health [12].

Aim of the study: to investigate the level of anxiety, as a state of current experience of the situation and as a personality trait, perception of stress and coping strategies of student adolescents exposed to COVID-19 from three countries of the region along the eastern border of the European Union with almost identically applied anti-epidemic measures.

A comparative stress coping study on identical populations in closely located cities in neighboring countries shows great promise for selecting optimal public health measures for the affected population [13]. The Kaliningrad region of Russia, as well as Lithuania and Poland, are suitable comparators, as they share a common EU border, as well as common histories, cultures and religions, and are currently pursuing reforms and policies in public health and medical care. Fairly restrictive anti-pandemic measures typical of lockdowns have repeatedly been implemented in these countries [14]. As for the other two neighbors on the EU's eastern border, Belarus was not included in this study due to the different, often controversial and much more lenient anti-pandemic measures taken by that country's government. Ukraine was not included in the comparison group due to the armed conflict with Russia, factors of which have their own distinct effect on the mental health of the population. It should be added that the data for these two countries is at the disposal of the authors, and their part concerning Belarus was already published in 2022 [15].

2. Material and Methods

2.1. Study Design and Setting

The inclusion criteria were: being a student, being between 18 years of age and 25 years of age, and have the ability to read one of four languages (Russian, Polish, Lithuanian, English). With regard to COVID-19 disease, this was to be confirmed by the presence of pathognomonic symptoms, while the infection had to be laboratory confirmed by RT-PCR. There were no exclusion criteria.

2.2. Participants

This study is based on a cross-sectional survey conducted in January-February 2022. The online questionnaire offered the necessary assurances of anonymity to allow respondents to provide accurate data on sensitive issues, which is particularly important in the field of mental health. The online survey was conducted among 3950 respondents from three countries on both sides of the EU's eastern border: Poland (N=1822), Lithuania (N=232), and Russia's exclave of Kaliningrad (N=1896) on the border between Poland and Lithuania.

 doi:10.20944/preprints202306.0528.v1

2.3. Procedure

The invitation to participate in the online survey (Google Forms) was distributed through targeted advertisements, including the e-learning platform (Moodle), Skype, Microsoft Teams and university social networks. The proposed information resources were available to students and were widely used in teaching during the COVID-19 pandemic.

The clinical questionnaire included questions about the severity of the disease and an assessment of the effects on selected indicators of respondents' mental health. The structured questionnaire provided important information on the severity of COVID-19 [16]. With the help of a clinical questionnaire, two groups were separated for further study: COVID-19 survivors - 1,368 (34.6%) in varying degrees of severity, and those who did not have the disease (healthy) - 2,582 (65.4%).

Due to the lack of significant differences, the respondents were treated as a unified group. Before initiating the study, permission was obtained from the leadership of the universities participating in the study and an ethics committee to conduct an anonymous survey of students. All participants were informed about the objectives of the study, the methodology and the anonymous and confidential nature of the questionnaire. Access to the questionnaire was granted only if they agreed to participate in the study. No data was missing, since the online platform did not allow for submitting incomplete student's questionnaires. All participants provided informed consent prior to completing the survey online (via computer by clicking "yes"). The research was carried out in accordance with the Declaration of Helsinki and Good Clinical Practice in research. General ethical permission to conduct the study was obtained from the Bioethical Review Board at the Medical University of Bialystok, Poland (document number: (APK. 002. 1932. 2022).

2.4. Measures

Well validated and established measures were employed to assess constructs. We used standardized self-assessment questionnaires. Participants first responded to questions related to their sociodemographic characteristics, including their age, gender, country of residence, as well as their health situation (e.g. vaccinated against COVID-19). They were also asked whether they, their partner, or a significant other was diagnosed with COVID-19. The standardization of the survey's methodology was done by consensus agreed upon by members of the international scientific research team.

2.5. Study Questionnaires

The COVID-19 pandemic and its consequences were identified in the questionnaire as the main stressors affecting daily living. Participants were asked to self-assess primarily anxiety, understood as a transient and situationally conditioned state of the individual and anxiety understood as a relatively fixed personality trait, using translated versions of the standardized State-trait Questionnaire Inventory (STAI) [17]. Each of the 40 statements (20 for anxiety as a trait and 20 as a state) had three responses assigned to assess the intensity of the respondent's emotions. The results were then converted into numerical values so as to allow quantitative evaluation from 20 to 80 points. High numerical values indicate high levels of anxiety. The α-Cronbach coefficient was $\alpha = 0.947$ and yielded satisfactory results.

Stress levels over the past month were then assessed using standardized language versions of the Perceived Stress Scale-PSS-10 questionnaire [18]. The degree of subjective perception of the stressful situation (10 questions) was determined in 5 gradations. The overall score characterized the degree of perceived stress in a gradation from minimum to maximum. Herein, the higher the score, the greater the sense of stress. In terms of internal consistency, Cronbach's alpha value was $\alpha = 0.708$.

The degree of preference for coping strategies was determined using COPE (The Coping Orientations to Problems Experienced) mini-questionnaire [19]. Coping (14 strategies) was assessed using a shortened version of the Brief COPE - Mini COPE (28 questions) recommended in 1997 [20]. Coping level among respondents ranged from 0 (no use of that specific coping strategy) to 3 (the most frequently applied one) for each strategy. All responses were grouped into four main strategic coping

 doi:10.20944/preprints202306.0528.v1

factors: Active coping, Helplessness, Seeking support, Avoidance coping [21], with A-Cronbach's coefficient=0.749.

2.6. Statistical Analysis

Statistical analyses were carried out using the STATISTICA software package ver. 13.0. All analyses were adjusted for gender and countries, as these were considered a priori to be potential confounders. The Shapiro-Wilk test was applied to check normality. Distribution of the quantitative data appeared to diverge from the normal pattern. Therefore, methods of nonparametric and parametric statistics were used. The mean (*M*) and standard deviation (*SD*) was calculated for dependent variables that follow the normal distribution, while the median (*Me*) were computed for non-normally distributed data. Comparative analysis between the selected groups was performed using the T-test for independent samples. In the case of large *SD* values, the non-parametric Mann-Whitney U test was additionally employed, while frequencies and percentages were used for qualitative variables.

3. Results

3.1. Characteristics of the Sample

All analyses were adjusted for age, gender, as these were considered to be potential limiting factors *a priori*. The study focused on students between the ages of 18 and 25 (22.6±5.35). Disease survivors were slightly older: 23.1±5.74 vs 22.3±5.11 ($p<0.05$). The dominant part of the sample was women 2738 (69.3%). The ratio of men to women in the study groups reflects the general trend in the ratio of men to women on university faculties in the three countries. Among 1,212 men: 348 (28.7%) and among 2,738 women: 1,020 (37.3%) were diagnosed with COVID-19 according to the clinical protocol.

Table 1 shows the characteristics of the respondent sample related to membership in the group of healthy and those who had the disease, broken down by gender.

Table 1. Characteristics of the study population by gender of healthy respondents and those who were infected, developing COVID-19 symptoms.

	Have not had a COVID infection (*N*=2582)			**Recovered from COVID infection (*N*=1368)**			**Total (*N*=3950)**		
	Male (*N*=864)	**Female (*N*=1718)**	***t*-test for age**	**Male (*N*=348)**	**Female (*N*=1020)**	***t*-test for age**	**Male (*N*=1212)**	**Female (*N*=2738)**	***t*-test for age**
Age, mean (years ±SD)	21.1±3.91	22.9±5.53	*-8.20; p*<0.001	21.3±4.22	23.7±6.06	*-6.79; p*<0.001	21.2±4.0	23.2±5	*-10.94; p*<0.001
	22.3±5.11			23.1±5.74			22.6±5.35		*-4.50, p*<0.01

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 7 June 2023 doi:10.20944/preprints202306.0528.v1

Vaccinated against COVID-19, *N*; % (95%CI)	605; 70.0; (67.0-73.0)	1251; 72.8; (70.1-74.9)	χ^2=2.2; *p* >0.05	1856; 71.9; (70.1-73.6)	235; 67.5 (61.3-71.1)	741; 72.6; (70.1-75.5)	χ^2=3.32; *p*>0.05	976; 71.3; (68.8-73.5)	χ^2=0.7; *p* >0.05
Contact with persons who has been diagnosed with COVID-19	534; 61.8; (59.0-65.4)	1100; 64.0; (62.3-66.8)	χ^2=1.2; *p* >0.05	1634; 63.3; (62.0-65.6)	295; 84.8 (81.2-88.6)	920; 90.2; (88.8-92.3)	χ^2=7.7; *p* <0.01	1215; 88.8; (87.5-90.7)	χ^2=289.9; *p* <0.001
	829; 68.4; (66.2-71.4)	2020; 7 (72.7-7	χ^2=12.1; *p* <0.001	2849; 72.1; (71.3-74.0)					

Note: *N* is the number of observations, % is the percentage of the total number of study participants in a given group; 95%CI – 95-percent confidence interval; *SD* – standard deviation; *t*-test – value of the Student's t-test; χ^2 - Pearson's chi-squared test.

3.2. Main Findings

Our main set of analyses focused on a section asking about the various symptoms and feelings that people may experience with the developing disease. Clinical symptoms associated with SARS-CoV-2 infection and COVID-19 severity were analyzed. Of the 1,368 students, 166 (12.1%) were virtually asymptomatic (only fatigue, or headache or sore throat were noted), 478 (34.9%) were mild, 629 (46.0%) were moderate, and 95 (6.9%) were severe (hospitalized). Common symptoms included smell reduction - 916 (67.6%), fatigue - 873 (63.8%), headache - 814 (59.5%), taste reduction - 799 (58.7%), wheeze - 552 (40.4%), cough - 530 (38.7%), rash - 157 (11.5%), diarrhea - 123 (9.0%). Moreover, 710 people (51.9%) had a body temperature >37.5°C. Each of those affected (in addition to being asymptomatic) had a combination of 4 or more symptoms. The strength of the correlation between disease severity and individual symptoms (wheeze, cough, fatigue, headache, smell or taste reduction and their combination) was average (r=0.45-0.50, p<0.05) or weak (r=0.20-0.35, p<0.05) (in case of fever). The correlation between the number of symptoms and disease severity was at a high level (r=0.75, p<0.01). As the severity of the disease increased, the importance of such symptoms as smell reduction, taste reduction, fever, wheeze, headache, fatigue and cough or their combination increased.

3.3. Anxiety

The specific impact of belonging to the group of healthy or affected people was significantly reflected in an important mental health indicator of anxiety (trait and state), among others. Statistical results obtained for the overall mean according to the STAI questionnaire (Trait Anxiety) was 41.4±12.2, and for State Anxiety: - 46.1±10.6 (p<0.05). The increase in the difference between trait and

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 7 June 2023 doi:10.20944/preprints202306.0528.v1

state anxiety levels at 4.7±8.61 indicated that the trait was rooted and the process was chronic. The analysis of the surveys shows that with regard to disease severity, the level of anxiety proved to be a differentiating factor between the two groups.

Careful comparisons showed that the lowest anxiety levels as a state were declared by men who did not have COVID-19. A more detailed analysis found that the prevalence of high anxiety (trait) (>45 points) among unaffected students was 35.2%, with anxiety as a state being 50.6%. Students who had COVID-19 experienced higher levels of anxiety (trait and state) than respondents in the unaffected group. When considering the normal values for both genders, high levels of anxiety were found in both male and female groups. Nevertheless, women were more likely to have more severe anxiety symptoms. Basic descriptive values and comparisons of the intensity of anxiety related to the COVID-19 pandemic by groups and gender are presented in Table 2.

Table 2. The comparison of the Trait Anxiety and State Anxiety scores and dependence on affliction state and gender of the respondents (*M* ±*SD*).

Variation in state anxiety	**Have not had COVID-19 infection [1]**		**Recovered from COVID-19 infection [2]**		**Total Sample**		***t*-test**
	Male [M]	Female [F]	Male [M]	Female [F]	Male [M]	Female [F]	
Anxiety (trait)	38.3±11.8	42.1±11.9*	40.8±12.1	43.0±12.5*	39.0±12.0	42.4±12.1#	$p_{[M1-M2]}$<0.01 $p_{[F1-F2]}$<0.01
	40.8±12.0		42.4±12.4		41.4±12.2		$p_{[1-2]}$<0.001
Anxiety (state)	41.9±10.6	48.4±10.2*	44.2±10.6	48.2±10.0*	42.6±10.6	47.7±10.1*	$p_{[M1-M2]}$<0.01 $p_{[F1.F2]}$>0.05
	45.6±10.7		47.2±10.3		41.4±12.2		$p_{[1.2]}$<0.001
Anxiety levels (trait) (N, %, 95%CI)							
Low (<30)	605; 23.4 (21.8-25.1)		250; 18.3; (16.2-20.3)		855; 21.6 (20.4-22.9)		χ^2 =14.1; $p_{[1-2]}$<0.01
Moderate (30-45)	1069; 41.4 (39.5-43.3)		600; 43.9 (41.2-46.5)		1669; 42.3 (40.7-43.8)		N/S
High (>45)	908; 35.2 (33.3-37.0)		518; 37.9 (35.3-40.4)		1426; 36.1 (34.6-37.6)		χ^2 =7.1; $p_{[1-2]}$<0.05
Anxiety levels (state) (N, %, 95%CI)							
Low (<30)	229; 8.9 (7.8-9.9)		89; 6.5 (5.2-7.8)		318; 8.1 (7.2-8.9)		χ^2 =13.4; $p_{[1-2]}$<0.01

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 7 June 2023 doi:10.20944/preprints202306.0528.v1

Moderate (30-45)	1046; 40.5 (38.6-42.4)	512; 37.4 (34.9-40.0)	1558; 39.4 (37.9-41.0)	N/S
High (>45)	1307; 50.6 (48.7-52.6)	767; 56.1 (53.4-58.7)	2074; 52.5 (51.0-54.1)	χ^2 =18.2; $p_{[1-2]}$<0.01

Note: * - *t*-test – value of the Student's *t*-test between male and female (p<0.05).

Prevalence of high levels of anxiety was higher among qualified patients (both women and men). The prevalence of high anxiety (trait) expressed as a percentage was higher in women – 38.5% than in men – 30.8% (p<0.001). Similar results were obtained for anxiety (state) (58.4% vs. 39.3%).

3.4. The Perceived Stress Scale (PSS-10)

We obtained the stress distribution for our sample, as indicated in Table 3. Here, high stress corresponds to a score one *SD* above the mean. Low stress corresponds to a score one *SD* below the average.

Table 3. Distribution of the respondents according to the degree of stress as categorized by the normative data for the PSS-10 (N, %, 95%CI).

Variation in stress	**Have not had COVID-19 infection [1]**		**Recovered from COVID-19 infection [2]**		**Total Sample**		**χ^2 for group comparison & total M&F**
	Male [M]	Female [F]	Male [M]	Female [F]	Male [M]	Female [F]	
Low stress (0-13)	105; 12.2 (10.0-14.3)	94; 5.5 (4.4-6.6)*	39; 11.2 (7.9-14.5)	58; 5.7 (4.3-7.1)*	144; 11.9 (10.1-13.7)	152; 5.6 (4.7-6.4)	χ^2 =45.3 p_{M-F}<0.001
	199; 7.7 (6.7-8.7)		97; 7.1 (5.7-8.5)		296; 7.5 (6.7-8.3)		χ^2 =0.41 p_{1-2} N/S
Moderate (14-26)	675; 78.1 (75.4-80.9)	1291; 75.1 (73.1-77.2)	262; 75.3 (70.8-79.8)	744; 72.9 (70.2-75.7)	937; 77.3 (75.0-79.7)	2035; 74.3 (72.7-76.0)	χ^2 =4.0 p_{M-F} <0.05
	1966; 76.1 (74.5-77.8)		1006; 73.5 (71.2-75.96)		2972; 75.2 (73.9-76.6)		χ^2 =3.16 p_{1-2} N/S

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 7 June 2023 doi:10.20944/preprints202306.0528.v1

High stress (27-40)	84; 9.7 (7.7-11.7)	333; 19.4 (17.5-21.3)*	47; 13.5 (9.9-17.1)	218; 21.4 (18.9-23.9)*	131; 10.8 (9.1-12.6)	551; 20.1 (18.6-21.6)	χ^2 =32.3 p_{M-F} <0.001
	417; 16.2 (14.7-17.6)		265; 19.4 (17.3-21.5)		682; 17.3 (16.1-18.5)		χ^2 =3.93, p_{1-2}<0.05

Note: * - test χ^2 for group male and female (p<0.05).

The incidence of anxiety and stress was related to gender, especially in the convalescent group. COVID-19 patients hospitalized during the pandemic often suffered from psychological distress after hospital discharge. For a more detailed specification of stress coping scenarios, it was necessary to rank the selected methods, which was achieved by assessing coping strategies. High rates prevailed among women. Subjective perceptions of the overall level of tension in a stressful situation allowed to assess and account for efforts to counteract stress.

3.5. Coping Strategies, Measured by the Mini-COPE Scale

Respondents who were not affected by the disease showed a statistically significant moderate negative relationship between their level of using strategies focused on active coping and anxiety. Accordingly, the more intensely students dealt with stressful situations proactively, the less they experienced negative symptoms of anxiety. A statistically significant yet weak negative correlation was shown among convalescent respondents. The helplessness strategy demonstrated a moderately positive relationship with anxiety in both groups, but the strength of the relationship was more pronounced in those in the second group. Avoidance behavior strategy correlated with anxiety, and the strength of the relationship was similar in both groups. A weak association characterizes avoidant behavior with anxiety as a trait, and a moderate association with anxiety as a state.

Respondents who underwent COVID-19 differed from healthy individuals in having higher levels of concern about their own emotions, and a tendency to discharge them (an integral factor of avoidance coping). They were more likely to postpone important decisions in the context of coping in an effort to avoid stress and were characterized by more activities oriented toward seeking social support, and were more likely to engage in passive coping strategies, with the extended duration of the pandemic and its severity increasing the frequency of use (Table 4).

Table 4. The aspects of coping strategies among students in the surveyed groups with and without COVID-19 infection, taking into account gender.

Coping scales and integral strategies	**Have not had COVID-19 infection**			**Recovered from COVID-19 infection**		
	Male	Female	Test *U* Mann-Whitney [M] vs [F]	Male	Female	Test *U* Mann-Whitney [M] vs [F]
Active	2.07±0.73	2.08±0.67	739816	2.09±0.78	2.09±0.70	172933

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 7 June 2023 doi:10.20944/preprints202306.0528.v1

Planning	1.96±0.78	1.98±0.70	740532	1.95±0.80	1.99±0.69	177406
Positive reframing	1.64±0.82	1.69±0.79	717432	1.67±0.82	1.70±0.81	171384
Acceptance	1.67±0.80	1.73±0.70	713925	1.75±0.77	1.76±0.73	176688
Humor	1.51±0.90	1.27±0.89	628825*	1.66±0.92#	1.32±0.92	139611*
Religion	0.60±0.85	0.79±0.91	647150*	0.59±0.82	0.99±0.97##	145279*
Use of emotional support	1.63±0.87	1.95±0.81	584460*	1.67±0.87	1.94±0.78	146804*
Use of instrumental support	1.49±0.82	1.82±0.78	574908*	1.50±0.88	1.80±0.78	142780*
Self-distraction	0.98±0.67	1.08±0.65	673400*	1.01±0.68	1.11±0.66	159896*
Denial	0.57±0.69	0.73±0.71	637077*	0.64±0.74	0.77±0.75	158052*
Venting	1.19±0.71	1.45±0.70	584272*	1.32±0.73#	1.56±0.72	154113*
Substance use	0.39±0.70	0.36±0.64	732727	0.52±0.70	0.58±0.69##	174949
Behavioral disengagement	0.58±0.65	0.68±0.63	663297*	0.61±0.67	0.70±0.66	162232*
Self-blame	1.24±0.86	1.24±0.87	740269	1.29±0.89	1.30±0.90	175504
Integral strategies						
Active coping	1.89±0.64	1.92±0.58	734846	1.90±0.65	1.93±0.59	176949
Helplessness	0.74±0.56	0.76±0.55	720912	0.77±0.57	0.81±0.56	168992
Seeking support	1.56±0.79	1.89±0.73	563814*	1.58±0.82	1.87±0.72	141908*
Avoidance coping	0.91±0.54	1.09±0.5##	589235*	0.99±0.57	1.12±0.53	150008*

Notes: *M* - mean value; *SD* - standard deviation; * differences between males and females in the group ($p<0.05$); # differences between males between groups; ## differences between females between groups (test *U* Mann-Whitney).

Tactics for choosing coping strategies among non-afflicted and healthy individuals were similar by gender. In the context of active coping, the differences between men and women are minimal. Respondents in both groups used psychoactive substances at a similar low rate (this rate is increased among students who had COVID-19, especially women), as is the dominant turn to religion among women in this group. However, the repertoire of coping strategies among women was broader than among men due to the focus on emotions and expression of feelings. The risk of possible infection and apparent disease often activated coping strategies related to active functioning.

4. Discussion

Anxiety and stress are widespread around the world, and their levels increase during emergencies. The COVID-19 pandemic is justly considered such a state of emergency [22]. The purpose of our study was to narrow down the possible correlates of anxiety and stress, as well as

 doi:10.20944/preprints202306.0528.v1

potential coping mechanisms among male and female students according to the presence of COVID-19 disease, from three countries along the eastern border of the European Union.

Young adult students were chosen as the study group, because the physical and mental health, as well as the social mood of this target group reflects the level of well-being, social stability and degree of satisfaction with life in the greater society [23]. As students are distinguished and characterized by distinctiveness, a sense of in-group community and are a tightly organized group, the strictness and disproportionality of the consequences of anti-pandemic measures have affected them greatly compared to other age and social groups [24]. Studies on the mental health of this target group were conducted in the very first weeks of the COVID-19 outbreak in China. It has then established that the epidemic has a significant effect on the mental health of students, and those who were affected present symptoms of disorders similarly to those who have suffered traumatic stress [25].

The territorial selection of the study was due to the fact that this region is located on the eastern border of the EU, where the territories of several countries with almost identical populations of young people in closely located university towns [26] converge, and similar measures against the pandemic were taken by their governments. When observing countries in the region, there was a minor difference in the population prevalence of COVID-19. On the other hand, this region shows high hopes for reform and the search for optimal public health measures [27]. The gender-specific characteristics of adolescent mental health are also an important aspect highlighted in the study [28]. This, too, must be taken into account when conducting a study noting the differences in mental health indicators in subgroups of men and women.

Based on the results of our study, we highlighted two implications for student mental health indicators. The first refers to the negative effect of the COVID-19 situation on mental health, expressed in high levels of anxiety and stress. The second refers to the high adoption of active coping mechanisms. This is a dynamic process that changes as people interact with the environment, and can be stable or unstable at different stages of adaptation to new conditions. We confirmed the high adaptation rate among students during the COVID-19 pandemic. Adaptive coping is a protective factor for students' mental health and can be viewed as a buffer that attenuates the negative impact of COVID-19-related stressors on perceptions concerning COVID-19 infection (or mental health) risk [28]. The pandemic and the severe restrictive measures imposed as a result have contributed to accepting the reality of what happened and assessing the timeliness of the problem. According to the study, anxiety and stress levels were high compared to results from individual countries [29], which showed that about a third of the adult population suffered from anxiety, and more than half from stress. A survey in the UK, for example, was conducted within 20 weeks of the country's quarantine announcement [30]. The findings suggest that anxiety was the highest in the early stages of isolation, but declined, probably because people adjusted to the circumstances. According to our survey, the prevalence of high anxiety (trait) among unaffected students was 35.2%, with anxiety as a state reaching 50.6%. Students who underwent COVID-19 had even higher anxiety levels than respondents in the unaffected group. This is explained by the fact that respondents who were infected with coronavirus were actually frightened by their disease. Their anxiety levels were increased by the uncertain course of the disease and its consequences, forced isolation or hospitalization, and fear of death. Again, high anxiety rates recorded among the healthy indicated an increasing problem [31]. This is due to the fact that they were in an information field that induced their anxiety. General mood in the society, which is characterized by chronic uncertainty, changes in the economic sphere and dissatisfaction among citizens with the state's health care efforts could be added to that factor [32].

Unlike the early, "pre-COVID" studies [33], our study assessed outcomes over the longer duration of the pandemic. Hence we obtained a detailed characterization of the situation, taking gender into account. The prevalence of high anxiety (trait) was higher in women – 38.5% than in men – 30.8% ($p<0.001$). Similar results were obtained for anxiety (state) (58.4% vs. 39.3%). In another study conducted in Turkey, the authors confirm that almost half of the participants experienced anxiety [34] and women dominated here.

 doi:10.20944/preprints202306.0528.v1

Our survey also shows a higher prevalence of stress. The differences clearly depend on being a member of the distinguished groups. The perception of stress is a subjective and variable phenomenon. Special attention is paid to the processes of coping with stress, which determine the positive and negative effects of stress on the individual. A significant proportion of COVID-19 patients reported symptoms in situations of psychological distress. The course of coping was found to depend on personal resources, social support, attitudes toward the disease and the severity of its symptoms [35]. In general, it can be concluded that the higher stress levels of students compared to data from the general population may be related to the commitment and challenges of their "working and studying," which is consistent with previous reports [36]. It should be noted that our representative sample (students aged 18 to 25) had higher anxiety and stress levels compared to other age groups, as also reported by other authors [10]. The proportion of those affected with high levels of stress is comparable to proportions observed in recent studies [37].

Differences by gender are characteristic of two scales: Total "overload" and "perception of stress". The average stress level was 20.6 among the healthy and 21.7 among convalescents, which was higher than in the general population (13.02) [38]. The presence of a gender difference in stress among university students is also consistent with the current literature: most studies have reported that stress is higher in female students [39]. Having considered the foregoing, we believe that women are a problem in COVID-19 and should be considered for post-COVID syndrome treatment, and also in terms of the potential need for longer rehabilitation.

The COVID-19 pandemic not only affected the intensity of stress, but also changed and diversified coping strategies. Having effective strategies for stressful situations is important, because they can prevent experiences that lead to mental disorders related to a critical situation [40]. People use different methods to cope with stress, as was observed in our study as well. Regardless of their attitudes toward the disease, the respondents focused on active ways of coping and positive reformulation, meaning: they chose to focus on the problem and seek instrumental support (i.e., seeking and receiving advice and help from others), as well as emotional support.

No significant differences were found in the choice of active coping strategies in terms of gender, as reported by other researchers [28]. Quarantine measures, the severity of the disease and often inadequate information about the epidemic situation influenced the coping strategies chosen: students who were not sick were more likely to choose active coping and planning, but often refused to believe what happened. Respondents who have undergone coronavirus infection differ in their actions in that they are more likely to choose an avoidance strategy and are less likely to plan. This is most likely due to the fact that the symptoms of asthenic syndrome include chronic and rapid fatigue. In addition, depressive moods, loss of energy and reduced interests tend to dominate in both study groups. It is worth noting that convalescents exhibit maladaptive behavior due to distress, most likely caused by a lack of understanding of their own future actions. A statistically significant difference was found for the strategy of self-distraction, meaning: engaging in other activities to avoid thinking about an unpleasant situation. This strategy was more common among convalescents. They accepted the reality, but more often turned to the use of "tranquilizers" (medications, alcohol) to cope with the situation.

Gender-related differences were also observed: women were more likely to use emotion-focused coping strategies, focusing on negative experiences, and using mental and behavioral withdrawal. The interaction of the gender factor and ailments determined the characteristic coping characteristics of women – they sought not only emotional support, but also instrumental support (advice, assistance, information on coping with difficulties). Women who had no contact with the disease found it harder to accept the situation and denied the reality of the pandemic, while men were more active in distracting themselves from unpleasant thoughts and tried to find positive ways to cope with the stressful situation, such as in physical activity. On the other hand, men, unlike women, avoided seeking instrumental and emotional social support.

Our results stress the need to design prevention and intervention programs to reduce the negative consequences of COVID-19. There is a need to inform people about available resources and practical methods to deal with these emerging issues, along with the continuing stress of COVID-19.

 doi:10.20944/preprints202306.0528.v1

As COVID-19 disrupts communities around the world, further research and understanding of effective coping is crucial to reducing the short- and long-term impact of the pandemic on the psyche of young people. Female gender and professional inactivity appeared to be risk factors for the students' worsening mental health, which may be an indication of the need for further research and planning of psychotherapeutic interventions [41].

5. Limitations

This study has some limitations that are typical for online surveys. We should be careful when comparing our findings to previous research. The results are also limited to students and may not be applied to other age groups or general population. We collected data using self-reported questionnaires that are commonly used, however may not provide a complete picture of mental health. It is also important to note that professional and accurate assessment of mental disorders can only be done by professional psychologists or psychotherapists. The study's findings do not represent the overall impact of COVID-19 on mental health, but they help identify areas in which students might need psychological assistance in critical situations. Finally, it is important to note, that the study captures a relatively narrow time window, which may not apply to other, possibly longer waves of the pandemic.

6. Conclusions

A large percentage of young adults in the community demonstrated anxiety and stress symptoms during the COVID-19 pandemic. There is a correlation between exposure to COVID-19 among university students and anxiety, levels of perceived stress and efforts to counteract stress. The level of anxiety and stress in the "Overload" and "Perception" subscales varies depending on the onset and severity of the disease. For the most part, students were characterized by a clear level of active coping activities. The presence and severity of the disease changed coping strategies.

Respondents who had COVID-19 differed from those without the disease in having higher levels of concern about their own emotions, a tendency to discharge them, especially due to the use of alcohol or other psychoactive substances, as well as their more frequent turn to religion, especially among the female gender. They postponed important decisions in the context of coping, in an effort to avoid stress, and were characterized by a preponderance of activities oriented toward seeking social support.

There is a need for a COVID-19 disease scale management strategy. Public education on coping strategies, the use of effective methods to resist the disease, and resources for practical help are useful. This is likely to be a long-term process that should begin during the pandemic and continue after its end. With the changing situation of the COVID-19 pandemic in mind, our results are the beginning of further cross-border research on the physical and mental health of various social groups.

Author Contributions: Conceptualization, A.S.; methodology, A.S., E.K.-K. and M.C.; formal analysis, investigation, A.S., M.C., E.K.-K., D.S., M.A., E.K., Y.L., A.T., L.P., J.O. and K.K.; resources, A.S.; data curation, A.S.; writing-original draft preparation, A.S. and J.O.; writing-review and editing, A.S. and J.O.; visualization, A.S. All authors have read and agreed to the published version of the manuscript.

Funding: The research was funded by Grant of Polish National Agency for Academic Exchange BPN/SZN/2021/1/00004.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Bioethics Committee of the Medical University of Bialystok (protocol code APK.002.193.2022.

Informed Consent Statement: Informed consent was obtained from all of the subjects involved in the study.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy restrictions.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Vindegaard, N.; Benros M.E. COVID-19 pandemic and mental health consequences: Systematic review of the current evidence. Brain, behavior, and immunity. **2020**, 89, 531–542. https://doi.org/10.1016/j.bbi.2020.05.048.
2. Atzrodt, C.L.; Maknojia, I.; McCarthy, R.D.; Oldfield, T.M.; Po, J.; Ta, K.; et al. Guide to COVID-19: a global pandemic caused by the novel coronavirus SARS-CoV-2. The FEBS journal. **2020**, 287, 3633–3650. https://doi.org/10.1111/febs.15375.
3. Dhama, K.; Nainu, F.; Frediansyah, A.; Yatoo, M.I.; Mohapatra, R.K.; Chakraborty, S.; et al. Global emerging Omicron variant of SARS-CoV-2: Impacts, challenges and strategies. Journal of infection and public health. **2023**, 16, 4–14. https://doi.org/10.1016/j.jiph.2022.11.024.
4. Lindert, J.; Jakubauskiene, M.; Bilsen, J. The COVID-19 disaster and mental health-assessing, responding and recovering. European journal of public health, 31 (Supplement_4). **2021**, iv31–iv35. https://doi.org/10.1093/eurpub/ckab153.
5. Jones, E.; Mitra, A.K.; Bhuiyan, A.R. Impact of COVID-19 on Mental Health in Adolescents: A Systematic Review. Int. J. Environ. Res. Public Health. **2021**, 18, 2470. https://doi.org/10.3390/ijerph18052470.
6. Huarcaya-Victoria, J.; Villarreal-Rao, B.; Luna, M.; Rojas-Mendoza, W.; Alarcon-Ruiz, CA.; Villarreal-Zegarra, D.; et al. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. JAMA Netw Open. **2020**, 3, e203976. https://doi.org/10.1001/jamanetworkopen.2020.3976.
7. Idoiaga Mondragon, N.; Fernandez, I.L.; Ozamiz-Etxebarria, N.; Villagrasa, B.; Santabárbara, J. PTSD (Posttraumatic Stress Disorder) in Teachers: A Mini Meta-Analysis during COVID-19. International journal of environmental research and public health. **2023**, 20, 1802. https://doi.org/10.3390/ijerph20031802.
8. Huang, Q.; Luo, L.S.; Wang, Y.Y.; Jin, Y.H.; Zeng, X.T. Gender Differences in Psychological and Behavioral Responses of Infected and Uninfected Health-Care Workers During the Early COVID-19 Outbreak. Front Public Health. **2021**, 9, 638975. https://doi.org/10.3389/fpubh.2021.638975.
9. Elahi, N.; Miladinia, M.; Zarei, J.; Ghanbari, S. Perception of coronavirus disease (COVID-19) and its relationship with coping strategies and perceived social support in Iranian people: a descriptive correlational study. BMC nursing. **2023**, 22, 109. https://doi.org/10.1186/s12912-023-01276-y.
10. Shah, S.M.A.; Mohammad, D.; Qureshi, M.F.H.; Abbas, M.Z.; Aleem, S. Prevalence, Psychological Responses and Associated Correlates of Depression, Anxiety and Stress in a Global Population, During the Coronavirus Disease (COVID-19) Pandemic. Community Ment Health J. **2021**, 57, 101–110. https://doi.org/10.1007/s10597-020-00728-y.
11. Guessoum, S.B.; Lachal, J.; Radjack, R.; Carretier, E.; Minassian, S.; Benoit L.; et al. Adolescent psychiatric disorders during the COVID-19 pandemic and lockdown. Psychiatry research. **2020**, 291, 113264. https://doi.org/10.1016/j.psychres.2020.113264.
12. Patsali, M.E.; Mousa, D.V.; Papadopoulou, E.V.K.; Papadopoulou, K.K.K.; Kaparounaki, C.K.; Diakogiannis, I.; et al. University students' changes in mental health status and determinants of behavior during the COVID-19 lockdown in Greece. Psychiatry research. **2020**, 292, 113298. https://doi.org/10.1016/j.psychres.2020.113298.
13. Holmes, E.A.; O'Connor, R.C.; Perry, V.H.; Tracey, I.; Wessely, S.; Arseneault, L.; et al. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. The lancet. Psychiatry. **2020**, 7, 547–560. https://doi.org/10.1016/S2215-0366(20)30168-1.
14. World Health Organization. 2019 Novel Coronavirus (2019-nCoV): Strategic Preparedness and Response Plan; World Health Organization WHO. **2020**. Available online: https://www.who.int/publications/i/item/strategic-preparednessand-response-plan-for-the-new-coronavirus (accessed on 6 April 2023).
15. Shpakou, A.; Naumau, I.A.; Krestyaninova, T.Y.; Znatnova, A.V.; Lollini, S.V.; Surkov, S.; et al. Physical Activity, Life Satisfaction, Stress Perception and Coping Strategies of University Students in Belarus during the COVID-19 Pandemic. International journal of environmental research and public health. **2022,** 19, 8629. https://doi.org/10.3390/ijerph19148629.
16. Qiu, H., Wu, J., Hong, L., Luo, Y., Song, Q., & Chen, D. Clinical and epidemiological features of 36 children with coronavirus disease 2019 (COVID-19) in Zhejiang, China: an observational cohort study. The Lancet. Infectious diseases. **2020**, 20, 689–696. https://doi.org/10.1016/S1473-3099(20)30198-5.
17. Spielberger, C.D.; Gorsuch, R.L.; Lushene, R.E. STAI: manual for the State-Trait Anxiety Inventory. Palo Alto: Consulting Psychologists, **1970**.

18. Cohen, S.; Kamarck, T.; Mermelstein, R. A global measure of perceived stress. J. Health Soc. Behav. **1983**, 24, 385–396.
19. Carver, C.S.; Scheier, M.F.; Weintraub, J.K. Assessing coping strategies: A theoretically based approach. J. Personal. Soc. Psychol. **1989**, 56, 267–283.
20. Carver, C.S. You want to measure coping but your protocol's too long: Consider the brief COPE. Int. J. Behav. Med. **1997**, 4, 92–100.
21. Juczynski, Z.; Oginska-Bulik, N. Narzedzia Pomiaru Stresu i Radzenia Sobie ze Stresem. Warszawa, Pracownia Testów Psychologicznych, Poland, **2009**. (In Polish).
22. Ogundipe, H.; Buowari, D.Y.; Dosunmu, K. Psychosocial Impact of the Implementation of COVID-19 Protocols. West African journal of medicine. **2023**, 40, 227–231.
23. Varma, P.; Junge, M.; Meaklim, H.; Jackson, M.L. Younger people are more vulnerable to stress.; anxiety and depression during COVID-19 pandemic: A global cross-sectional survey. Prog Neuropsychopharmacol Biol Psychiatry. **2021**, 109, 110236. https://doi.org/10.1016/j.pnpbp.2020.110236.
24. Shechory Bitton, M.; Laufer, A. Mental Health and Coping in the Shadow of the COVID-19 Pandemic: The Israeli Case. Front Public Health. **2021**, 12, 568016. https://doi.org/10.3389/fpubh.2020.568016.
25. Salehi, M.; Amanat, M.; Mohammadi, M.; Salmanian, M.; Rezaei, N.; Saghazadeh, A.; et al. The prevalence of post-traumatic stress disorder related symptoms in Coronavirus outbreaks: A systematic-review and meta-analysis. Journal of affective disorders, **2021**, 282, 527–538. https://doi.org/10.1016/j.jad.2020.12.188.
26. Opioła, W.; Böhm, H. Euroregions as political actors: managing border policies in the time of Covid-19 in Polish borderlands. Territory, Politics, Governance. **2022**, 24, 1-21. https://doi.org/10.1080/21622671.2021.2017339
27. Kurpas, D.; Stefanicka-Wojtas, D.; Shpakou, A.; Halata, D.; Mohos, A.; Skarbaliene, A.; et al. The Advantages and Disadvantages of Integrated Care Implementation in Central and Eastern Europe - Perspective from 9 CEE Countries. International journal of integrated care. **2021**, 21, 14. https://doi.org/10.5334/ijic.5632.
28. Slobodskaya, H.R.; Safronova, M.V.; Kharchenko, I.I.; Rezun, E.V.; Kornienko, O.S. Russian adolescent mental health in 2002, 2015 and during the COVID-19 pandemic in 2021. Child and adolescent mental health. **2023**, 28, 158–166. https://doi.org/10.1111/camh.12591.
29. Wang, C.; Pan, R.; Wan, X.; Tan, Y.; Xu, L.; Ho, C.; et al. Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. International journal of environmental research and public health. **2020**, 17, 1729. https://doi.org/10.3390/ijerph17051729.
30. Fancourt, D.; Steptoe, A.; Bu, F. Trajectories of anxiety and depressive symptoms during enforced isolation due to COVID-19 in England: A longitudinal observational study. The Lancet Psychiatry. **2021**, 8, 141–149. https://doi.org/10.1016/S2215-0366(20)30482-X.
31. Asmundson, G.J.G.; Taylor, S. How health anxiety influences responses to viral outbreaks like COVID-19: What all decision-makers, health authorities, and health care professionals need to know. J Anxiety Disord. **2020**, 71, 102211. https://doi.org/10.1016/j.janxdis.2020.102211.
32. Neill, R.D.; Blair, C.; Best, P.; McGlinchey, E.; Armour, C. Media consumption and mental health during COVID-19 lockdown: a UK cross-sectional study across England, Wales, Scotland and Northern Ireland. Z Gesundh Wiss. **2021**, 20, 1–9. https://doi.org/10.1007/s10389-021-01506-0.
33. Chau, S.W.; Lewis, T.; Ng, R.; Farrell, S.M.; Molodynski, A.; Bhugra, D. Wellbeing and mental health amongst medical students from Hong Kong. Int Rev Psychiatry. **2019**, 31, 626–629. https://doi.org/10.1080/09540261.2019.1679976.
34. Özdin, S.; Bayrak Özdin, Ş. Levels and predictors of anxiety, depression and health anxiety during COVID-19 pandemic in Turkish society: The importance of gender. International Journal of Social Psychiatry. **2020**, 66, 504–511. https://doi.org/10.1177/0020764020927051.
35. Schou, T.M.; Joca, S.; Wegener, G.; Bay-Richter, C. Psychiatric and neuropsychiatric sequelae of COVID-19 - A systematic review. Brain Behav Immun. **2021**, 97, 328–348. https://doi.org/10.1016/j.bbi.2021.07.018.
36. Reifman, A.; Dunkel-Schetter, C. Stress, structural social support, and well-being in university students. J Am Coll Health. **1990**, 38, 271–277. https://doi.org/10.1 080/07448481.1990.9936199.
37. Vlake, J.H.; Wesselius, S.; van Genderen, M.E.; van Bommel, J.; Boxma-de Klerk, B.; Wils, E.J. Psychological distress and health-related quality of life in patients after hospitalization during the COVID-19 pandemic: A single-center, observational study. PLoS One. **2021**, 16, e0255774. https://doi.org/10.1371/journal.pone.0255774.
38. Cohen, S. Perceived stress in a probability sample of the United States. The Social Psychology of Health. Sage Publications, Inc.: Thousand Oaks, USA, **1988**.
39. Daniali, H.; Martinussen, M.; Flaten, M.A. A global meta-analysis of depression, anxiety, and stress before and during COVID-19. Health psychology : official journal of the Division of Health Psychology, American Psychological Association. **2023**, 42, 124–138. https://doi.org/10.1037/hea0001259.

40. Kar, N.; Kar, B.; Kar, S. Stress and coping during COVID-19 pandemic: Result of an online survey. Psychiatry Res. **2021**, 295, 113598. https://doi.org/10.1016/j.psychres.2020.113598.
41. Talarowska, M.; Rucka, K.; Kowalczyk, M.; Chodkiewicz, J.; Kowalczyk, E.; Karbownik, M.S.; et al. Mental Health of Students at Polish Universities after Two Years of the Outbreak of COVID-19. International journal of environmental research and public health. **2023**, 20, 1921. https://doi.org/10.3390/ijerph20031921.