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Perceived Stress, COVID-19 Stressors, Loneliness, and Resilience of University Students after the Strictest Lockdown

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The study explored the impact of perceived stress, stressors related to COVID-19, loneliness, and resilience on the mental health of university students after the strictest lockdown. A total sample of 2107 university students (age 18-62 years, mean age = 22.73, *SD* = 3.77; 63.2% of women) was recruited. Brief Resilience Scale, Brief Symptom Inventory, Perceived Stress Scale, and adapted version of the COVIDiStress survey were used. The data were analyzed using hierarchical OLS regression models. The most significant predictors of mental health indicators were perceived stress, loneliness, and resilience. However, the sum score of COVID-related stressors did not significantly increase explained variance. Specific COVID-related stressors, such as pandemic-induced loneliness, worsened relationships, and worries about infection, had notable effects on depression, anxiety, and Global Severity Index of psychopathology. The study contributes to a better understanding of the actual topic related to the COVID-19 pandemic on university students and outlines practical implications for policy making.

Key words: mental health, university students, COVID-19, COVID-related stressors, pandemic

Introduction

The outbreak of the COVID-19 pandemic, with its widespread impact on society, has had a profound impact on mental health worldwide. Based on the data from World Health Organization (WHO), the prevalence of anxiety and depression increased by 25% during the first year of the pandemic (World Health Organization, 2022). As the pandemic was accompanied by severe restrictions, mainly related to social distancing, it changed the way society operated in almost all areas of life, including education. Most universities/courses switched to online learning, which

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The data and analytic code are freely available at https://osf.io/4u5eh/.

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proved to be a burden on students' mental health and well-being (Dhar et al., 2020). The loss of social contact and subsequent intense feelings of loneliness emerged as crucial factors (e.g., Visser & Law-van Wyk, 2021; Park et al., 2020).

Even before the pandemic, researchers have been pointing out that university students are a vulnerable group, which experiences anxiety and depressive symptoms relatively often (Holm-Hadulla & Koutsoukou-Argyraki, 2015; Macaskill, 2013). The situation became even more concerning during the COVID-19 pandemic, as evidence from Slovakia indicated a two-fold increase in the prevalence of moderate-to-severe symptoms of depression and anxiety (34.3% and 20.1% respectively, e.g., Hajduk et al., 2022). Several risk factors, such as 1) gender (women reported more significant mental health problems), 2) loss of income, 3) housing conditions, 4) mental health history, 5) physical activity levels, 6) social support (e.g., inability to spend lockdown with family or low quality of social relationships and social support in general), 7) availability and communication of information regarding the anti-pandemic measures, and 8) loss of daily and study routine, all contributed to the escalation of mental health problems (Woon et al., 2021). The perceived stress level also emerged as a critical factor in the development of mental health difficulties during the pandemic (e.g., Nochaiwong et al., 2021). However, there were indications that resilience, as the ability to recover from stressful events, might serve as a protective factor for mental health during this challenging time (Wu et al., 2020). On the other hand, some researchers observed a slight decrease in perceived stress and mental health difficulties during the later waves of the pandemic (Rogowska et al., 2021; Robinson et al., 2022). Nevertheless, given the significant impact of the pandemic on mental health, it remains crucial to explore the risk and protective factors, particularly among university students.

Therefore, the present study aims to investigate the associations between mental health (depression and anxiety), perceived stress, COVID-19 related stressors, resilience, and loneliness among university students following the strictest lockdown.

Methods

Participants and Data Collection

The data was collected online from 31st of May to 17th of June 2021 in collaboration with the Slovak Council for Higher Education. A total sample of 2107 university students (age 18-62 years, mean age = 22.73, *SD* = 3.77) was recruited. About 63% of our research sample were women. More information about the demographic characteristics of the sample is available in Table 1. More detailed description of the chronology of the pandemic situation can be found at https://osf.io/vjmfd/ (Vargova et al., 2022). Respondents were informed about the aim of the study and agreed to participate. Data collections follow the rules of the Helsinki Declaration. The study was reviewed and approved by the Ethical Scientific Committee of Palacky University Olomouc (no. 2019/05, and no. 2021/10).

Measures

The mental health outcomes were measured using the Brief Symptom Inventory (BSI-53, Derogatis & Melisaratos, 1983). BSI-53 consists of 53 items covering 9 symptom dimensions: 1) somatization, 2) obsession-compulsion, 3) interpersonal sensitivity, 4) depression, 5) anxiety, 6) hostility, 7) phobic anxiety, 8) paranoid ideation and 9) psychoticism.

The Global Severity Index (GSI) combines information about the number of symptoms

Table 1 *Demographic characteristics of the sample of the university students (N = 2107)*

	University students	
	N	%
Gender (female)	1332	63.21
Marital status		
Single	1715	81.39
Living with a partner	310	14.71
Married	72	3.41
Divorced	10	0.47
Study form		
Bachelor's degree	1478	70.1
Master's degree	527	25.0
PhD.	59	2.8
Continuous study (medicine, pharmacy, theology)	43	2.0
Full-time	1997	94.8
External	110	5.2

and the intensity of the respondent's overall level of distress. It was used as a proxy of the severity of mental health state. Items of this questionnaire are rated on 5-point scale from (0) "not at all" to (4) "extremely".

Stress was measured by the Perceived Stress Scale (PSS, Cohen et al., 1983). PSS consists of 10 items, which are rated on 5-pont scale from (0) "never" to (4) "very often".

For the COVID-related stress, an adapted version of the COVIDiStress survey (Lieberoth et al., 2021; the questionnaire is available at supplementary materials https://osf.io/4u5eh/?view_only=963c12a8afcb4ab9b04464a8d849e92e) was used.

The Brief Resilience Scale (BRS, Smith et al., 2008; Furstova et al., 2022) was used as the measure of participants' resilience. This questionnaire consists of 6 statements and respondents indicate their answers on a scale from (1) "strongly disagree" to (5) "strongly agree".

A single-item measure of loneliness (i.e., how lonely have you felt during the last year?) was utilized.

All the measures were adapted to Slovak using the back-translation method and piloted. Descriptive statistics, reliabilities, and bivariate correlations are available in Table 2.

Statistical Analysis

The data were initially screened for careless participants. Based on Mahalanobis distance and longstrings, we considered 144 participants as careless and excluded them from further analyses. Afterward, the reliabilities of the measures/subscales were calculated using the omega total coefficient, and given their sufficient values, the sum scores for the scales were computed. The correlations matrix and other supplementary materials are available at https://osf.io/4u5eh/?view_only=963c12a8afcb4ab9b04464a8d849e92e.

For the main analysis, several hierarchical OLS (Ordinary Least Squares) regression models (with psychological variables being standardized to z-scores) were estimated. Depression, anxiety, and Global Severity Index were treated as dependent variables, while sociodemographic variables, perceived stress,

Table 2 *Descriptive statistics, reliabilities of the measures, and bivariate correlations*

	1	2	3	4	5	6	7	8	9	10
1. Gender	-	-	-	-	-	-	-	-	-	-
2. Age	-0.01	-	-	-	-	-	-	-	-	-
3. Study form	-0.06***	0.56***	-	-	-	-	-	-	-	-
4. Perceived stress	-0.16***	-0.13***	-0.07*	-	-	-	-	-	-	-
5. Depression	-0.05	-0.13***	-0.07*	-	-	-	-	-	-	-
6. Anxiety	-0.17***	-0.10***	-0.08**	0.69***	0.74***	-	-	-	-	-
7. GSI	-0.13***	-0.13***	-0.09**	0.72***	0.89***	0.88***	-	-	-	-
8. Loneliness	0.03	-0.15***	-0.12***	0.49***	0.63***	0.41***	0.53***	-	-	-
9. COVID-stress	-0.13***	0.04	-0.07*	0.55***	0.53***	0.50***	0.55***	0.51***	-	-
10. Resilience	0.21***	0.08**	0.06	-0.53***	-0.50***	-0.55***	-0.55***	-0.30***	-0.34***	-
M	1.37	22.68	1.05	33.52	2.76	2.62	2.40	3.49	3.85	2.9
SD	0.5	3.69	0.22	7.53	1.13	1.06	0.82	1.35	1.07	0.83
ω total	-	-	-	.88	.92	.92	.98	-	.90	.88

Note. GSI = Global Severity Index, Pearson correlation coefficients are reported.
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 3 *The results of linear regression for depression*

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5
Depression					
Gender	**-0.12 (.007)**	**0.11 (.001)**	0.03 (.341)	0.07 (.014)	**0.08 (.003)**
Age	**-0.03 (<.001)**	-0.00 (.452)	0.00 (.739)	0.00 (.778)	-0.00 (.843)
Study form	-0.20 (.087)	-0.16 (.056)	-0.08 (.297)	-0.06 (.392)	-0.04 (.551)
Stress	-	**0.70 (<.001)**	**0.51 (<.001)**	**0.44 (<.001)**	**0.41 (<.001)**
Loneliness	-	-	**0.38 (<.001)**	**0.36 (<.001)**	**0.33 (<.001)**
Resilience	-	-	-	**-0.15 (<.001)**	**-0.15 (<.001)**
COVID-related stress	-	-	-	-	**0.09 (<.001)**
R^2	0.02	0.48	0.59	0.61	0.61
R^2 change	-	0.46	0.11	0.02	0

Note. Standardized regression coefficients are present, the corresponding *p*-values are in parenthesis.

loneliness, resilience, and COVID-related stress were modelled as predictors. The predictors were divided into blocks to examine the change in the explained variance of the dependent variables. The first block (model 1) included sociodemographic variables (gender, age, study form). In the second block (model 2), a summary score of perceived stress was added. Loneliness score was added into the third block (model 3). The fourth block also contained the resilience score (model 4). The final fifth block (model 5) involved a summary score of COVID-related stress. The results for each regression model are presented in Tables 3-5. We set the smallest size of interest (point estimate) to $\beta = .10$.

To explore the effects of the specific COVID-related stressors on mental health outcomes, we computed the fifth block also alternatively – the block included all the stressors as separate variables. Here, we report only a summary of these findings, but all the outputs are available in supplementary materials.

Table 4 *The results of linear regression for anxiety*

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5
Anxiety					
Gender	**-0.34 (<.001)**	**-0.13 (<.001)**	-0.16 (<.001)	-0.09 (.004)	**-0.07 (.022)**
Age	**-0.02 (.010)**	0.00 (.340)	0.00 (.172)	0.01 (.181)	0.00 (.470)
Study form	-0.26(.027)	-0.22 (.010)	-0.18 (.025)	-0.16 (.042)	-0.14 (.088)
Stress	-	**0.68 (<.001)**	**0.61 (<.001)**	**0.50 (<.001)**	**0.45 (<.001)**
Loneliness	-	-	**0.14 (<.001)**	**0.12 (<.001)**	**0.07 (<.001)**
Resilience	-	-	-	**-0.24 (<.001)**	**-0.23 (<.001)**
COVID-related stress	-	-	-	-	**0.13 (<.001)**
R^2	0.04	0.48	0.49	0.53	0.54
R^2 change	-	0.44	0.01	0.04	0.01

Note. Standardized regression coefficients are present, the corresponding *p*-values are in parenthesis.

Table 5 *The results of linear regression for the Global Severity Index (GSI)*

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5
Global Severity Index					
Gender	**-0.26 (<.001)**	**-0.04 (.247)**	-0.09 (.004)	-0.03 (.322)	**-0.01 (.839)**
Age	**-0.03 (<.001)**	-0.00 (.228)	-0.00 (.782)	-0.00 (.716)	-0.01 (.232)
Study form	-0.18 (.13)	-0.14 (.095)	-0.08 (.285)	-0.06 (.405)	-0.03 (.696)
Stress	-	**0.71 (<.001)**	**0.59 (<.001)**	**0.50 (<.001)**	**0.44 (<.001)**
Loneliness	-	-	**0.24 (<.001)**	**0.22 (<.001)**	**0.16 (<.001)**
Resilience	-	-	-	**-0.21 (<.001)**	**-0.20 (<.001)**
COVID-related stress	-	-	-	-	**0.16 (<.001)**
R^2	0.03	0.52	0.56	0.59	0.60
R^2 change	-	0.49	0.04	0.03	0.01

Note. Standardized regression coefficients are present, the corresponding *p*-values are in parenthesis.

Results

Depression. The sociodemographic variables explained 2% of the variance of depression. After adding the score of perceived stress, the R^2 increased to 48%. Loneliness explained an additional 11% of the depression's variance. After adding the resilience score, the R^2 increased to 61%. However, the addition of the COVID-related stress sum score did not increase the explained variance (R^2 change = 0%) Out of the specific COVID-related stressors, only loneliness caused by the pandemic (β = 0.19) had the effect greater than our SESOI (smallest effect size of interest) of .10.

Anxiety. The sociodemographic variables explained 4% of anxiety's variance. The greatest increase was observed for the perceived stress score (explained 48% of the variance). Loneliness and resilience explained further 1% and 4% of the variance, respectively. The sum score of COVID-related stressors explained 1% of the variance. From the specific COVID-related ones, only loneliness caused by the pandemic (β = 0.11) and worries about getting infected (β = 0.10) had an effect at least equal to our SESOI.

Global Severity Index (GSI). Sociodemographic variables explained 3% of the GSI's variance. Perceived stress explained further 49% of the variance. After the inclusion of loneliness, the percentage of explained variance increased by 4%. Resilience explained additional 3% of the GSI's variance, while the COVID-related stress increased the explained variance by 1%. Out of the specific items, only worsened relationships with people from the household (β = 0.10) yielded an effect as high as the SESOI.

Discussion

Our study aimed to explore the impact of 1) perceived stress level, 2) stressors related to the COVID-19 pandemic, 3) loneliness, and 4) resilience on the mental health of university students. In line with previous studies, perceived stress (Huebschmann & Sheets, 2020), loneliness (Park et al., 2020), and resilience (Wu et al., 2020) were significant predictors of mental health outcomes.

The Effect of Sociodemographic Variables

Gender significantly predicted mental health, especially in the case of depression and anxiety, however, the obtained effects were below our SESOI. Although focusing on gender differences in mental health was not our main goal, we consider it important to emphasize this result. Gender differences in mental disorders are among the most stable findings in psychiatry, with a higher prevalence of mood and anxiety disorders observed in women (e.g., Boyd et al., 2015), which is relevant for the pandemic context as well (e.g., Vloo et al., 2021).

The Effect of Perceived Stress

Perceived stress has long been considered a significant predictor of mental health difficulties (Schneidermann et al., 2005). The level of perceived stress typically increases by uncertainty or unexpected and unpredictable factors, such as a pandemic (e.g., Cooke et al., 2020). People who experience higher levels of stress tend to report more significant symptoms of depression and anxiety (Cristóbal-Narváez, 2020). According to Li et al. (2022) perceived stress might be an important mediator that explains the relationship between the COVID-19 pandemic and mental health. In a German study, students who rated the impact of COVID-19 as high, had higher levels of stress, anxiety, and depression (Voltmer et al., 2021). In the current study, stressors related specifically to the COVID-19 pandemic explained a smaller percentage of the variance for anxiety compared to the general stress and pre-existing mental health symptoms.

The Effect of Loneliness

As humans are social beings, social integration and relationships in general are crucial for emotional fulfilment and well-being. However, loneliness may be related to the objectively quantified social isolation, which is not the same thing. Loneliness is more a subjectively experienced feeling of not belonging to someone (Mann et al., 2022). It tends to be higher during adolescence with decreasing tendency during middle adulthood and increasing for late adulthood (Lasgaard et al., 2016). In line with our findings, loneliness has been associated with mental health difficulties (Heinrich & Gullone, 2006), and with somatic difficulties (Heinrich & Gullone, 2006; Park et al., 2020). Based on current research the odds of developing depression are more than double in people who feel lonely often (e.g., Mann et al., 2022).

The Effect of Resilience

While perceived stress and loneliness can be considered as risk factors for the development of mental health difficulties, resilience may play a protective role. Our results are thus in line with previous research that has highlighted the negative relationship between resilience and mental health outcomes (e.g., Konaszewski et al., 2021). Resilience seems to protect against the negative impact of stressful or even traumatic life events and so contributes to better mental health (Davydov et al., 2010), however, some authors argue that lower resilience scores are related to higher perceived stress, chronic stress as well as psychopathology (e.g., Garcia-León et al., 2019). In stressful pandemic times, resilience might be especially important for mental health. Based on longitudinal data, mental distress varied during the first months of the COVID-19 pandemic by resilience levels, with low-resilient adults reporting the biggest increase in mental distress during that time (e.g., Riehm et al., 2021).

The Effect of COVID-related Stressors

Surprisingly, the summary score of the COVID-related stress explained almost no additional variance in mental health outcomes after accounting for the general perception of stress, loneliness, and resilience (see Models 5). When using each one of the COVID-related stressors as an individual predictor of depression, the only significant predictor associated with the COVID-19 pandemic was loneliness, which is directly associated with social isolation (Killgore et al., 2020). A cross-cohort comparative study revealed that being a student emerged as a higher risk factor during lockdown for loneliness (e.g., Werner et al., 2021). Loneliness experienced during the pandemic was strongly associated with depression, anxiety, and somatic complaints (e.g., Li et al., 2021). In the present study, loneliness related to the pandemic and worries about getting infected were significant predictors of anxiety. In the case of the Global Severity Index the only significant predictor related to the pandemic was difficulties in relationships with people from the same household. Family relationships are a strong predictor of psychological distress and psychological difficulties, especially in situations of long-term stay home orders/recommendations (Li et al., 2021). Social support from family and friends may be an important factor in coping with the negative impact of stressors during a pandemic (Li et al., 2021; Woon et al., 2021).

According to a WHO survey, up to 75% of mental health disorders are first observed in early adulthood (e.g., Auerbach et al., 2018). Although longitudinal studies suggest that the deterioration of mental health of university students has peaked during the pandemic and the situation is gradually returning to the pre-pandemic conditions (Robinson et al., 2022), researchers have pointed to an increase in levels of depressive and anxiety symptoms in university students even before the pandemic (e.g., Holm-Hadulla & Koutsoukou-Argyraki, 2015). It is important to consider that 1) approximately 16-27% of students showed signs of depression and 9-21% of anxiety even before the pandemic (e.g., Hajduk et al., 2019; Puthran et al., 2016) and 2) our results suggest that the general level of stress, loneliness, and resilience might play an even more significant role than the difficulties related specifically to COVID-19. In the light of the findings from our study, it is important to consider the broader implications of the COVID-19 pandemic on the mental health trajectory of university students. In the short term, the immediate aftermath of the strictest lockdown has manifested in heightened

perceived stress, exacerbated feeling of loneliness, and discernible impact on students' resilience. Altogether, these factors have contributed to a deterioration in mental health indicators (depression, anxiety, and the global severity) aligning with other research findings (Chen & Lucock, 2022). Looking towards the long term, the enduring effects of these stressors pose a substantial risk for the development of chronic mental health difficulties. Pandemic has not only disrupted the academic life of university students but also has the potential to influence future mental health and well-being of this vulnerable population (Schwartz et al., 2022).

Although the available evidence suggests that the stress reported by university students is attributed to the pandemic, to the best of our knowledge, none of the studies focused specifically on COVID-related stressors. That is, they usually measured the general levels of, for example, perceived stress, which might reflect the pandemic situation only indirectly. Although the bivariate correlations between each of the dependent variables and the COVID-related stressors (and their summary score) are relatively high (see Table 2), after the inclusion of the general perceived stress, loneliness, and resilience (i.e., constructs that are not directly associated with the pandemic), their effect has decreased. The results, therefore, suggest that for mental health outcomes (depression, anxiety, Global Severity Index), general levels of perceived stress, resilience, and loneliness play a more important role compared to the stressors specifically associated with the pandemic. It is worth noting that mental health (disorders) is a continuous spectrum between health and pathology as described, for instance, in the Diagnostic and Statistical Manual of Mental Disorders. For example, the phenomena of fear, anxiety, or avoidant behavior may be both a part of a syndrome or it may meet the criteria for some form of anxiety disorder. In clinical practice and prevention, it may be therefore important to take into consideration symptoms below the diagnostic threshold.

Limits and Perspectives for Future Research

The study contributes to a better understanding of the actual topic related to the COVID-19 pandemic effects on university students, a group that, according to the available evidence, has been significantly affected by the pandemic. Although our study has an exploratory character, the present results contribute to the discussion about the mental health of university students and could lead to practical implications for policy making. These implications may include providing students with easy access to counselling and support, achieved through the development of specialized mental health services within universities, and the establishment of peer support and/or mentorship programs. Additionally, there is a need to emphasize stress management, resilience, and emotional well-being for students. Nonetheless, our study does have several limitations. Data were collected using convenience sampling, which might increase the possibility of self-selection bias in the case of university students. For this reason, students who were experiencing psychological distress at the time of the pandemic and wanted to share their experiences could be more prevalent in our sample. Another limitation is the absence of pre-pandemic data specific to university students in Slovakia. Moreover, the study lacks information on whether students enrolled in the study have overcome the COVID infection, which could have potentially deteriorated their mental health. Future research should consider these limitations when striving to enhance our understanding of this critical issue.

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