ESTUDOS DE PSICOLOGIA
Psychological Studies

RESEARCH REPORT
RELATO DE PESQUISA

School and Educational Psychology
Psicologia Escolar e Educacional

Editor
João Carlos Caselli Messias

Conflict of interest
The authors declare they have no conflict of interests.

Received
January 19, 2021

Final version
Fabruary 1, 2023

Approved
April 17, 2023

Symptoms of stress, anxiety, and depression in university students during the COVID-19 pandemic

Sintomas de estresse, ansiedade e depressão em estudantes universitários durante a pandemia de COVID-19

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How to cite this article: Vieira-Santos, J., Paiva, W. F., & Mandes-Pacheco, C. C. (2023). Symptoms of stress, anxiety, and depression in university students during the COVID-19 pandemic. *Estudos de Psicologia* (Campinas), *40*, e20-0245. https://doi.org/10.1590/1982-0275202340e200245

Abstract

Objective
Investigate how the exposure to the disease and changes in work conditions influenced the perception of stress, anxiety, and depression levels.

Method
405 students from Higher Education Institutions in Brazil answered an online form composed of a sociodemographic and exposure to COVID-19 questionnaire and stress, anxiety, and depression scales.

Results
It was observed that the prevalence of stress, anxiety, and depression among the participants was 56.8%, 41.7%, and 37.0%, respectively. Furthermore, stress assumed a role as a mediator of levels of anxiety and depression.

Conclusion
The data from this study can support the development of institutional actions that help students to better handle the difficulties arising from the pandemic and/or other sources of stressors that impact academic life.

Keywords: Coronavirus infections; Mental health; Students; Universities.

Resumo

Objetivo
Investigar de que maneira a exposição à doença e as alterações nas condições de trabalho influenciaram na percepção dos níveis de estresse, ansiedade e depressão desses alunos.

Método
405 estudantes de instituições de Ensino Superior brasileiras responderam a um formulário on-line composto por um questionário sociodemográfico e de exposição à COVID-19 e escalas de estresse, ansiedade e depressão.

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Resultados

Verificou-se que a prevalência de estresse, ansiedade e depressão entre os participantes foi, respectivamente, 56,8%, 41,7% e 37,0%. Além disso, o estresse assumiu um papel de mediador dos níveis de ansiedade e depressão.

Conclusão

Os dados do presente estudo podem subsidiar a elaboração de ações institucionais que auxiliem os estudantes a manejar melhor as dificuldades advindas da pandemia e/ou de outras fontes de estressores que impactam a vida acadêmica.

Palavras-chave: *Infecções por coronavírus; Saúde mental; Estudantes; Universidades.*

The COVID-19 contagion containment measures brought significant changes to everyone's routine. To prevent contagion, slow down disease discrimination, and delay the peak of the pandemic curve, governments determined a state of quarantine – in which gatherings (such as churches and assemblies, educational spaces, etc.) were prohibited –, as well as a reduction in the number of workers in industry (Anderson et al., 2020). The proposal to contain the disease through quarantine, as highlighted by Brooks et al. (2020), had already been used in similar episodes and proved an unpleasant experience for those who underwent it. As indicated by Brooks et al. losing one's freedom, facing separation from family and friends, living with uncertainty about the progression of the disease, and enduring the boredom of inaction can lead to dramatic effects, generating the possibility of suicide, substantial anger, and lawsuits. In addition to these easily noticeable effects, studies conducted in other pandemics and contamination outbreaks have shown that the combination of epidemic and quarantine produces drastic psychosocial individual and social impacts, which could even be more widespread than the epidemic itself, being already possible to notice an alteration in the levels of stress, anxiety, and depression in the general population (Ornell et al., 2020).

Stress can be understood, according to Faro (2015, p. 21), as a "set of processes for regulating well-being, activated when faced with stimuli evaluated as producing physical, social, or psychological discomfort, and whose repercussions are observed through changes in neuroendocrinological and mental functioning when the individual perceives stimuli as stressors".

Such regulation processes can lead to two distinct states: (a) a state of suffering or distress due to adverse conditions and lack of resources to handle the situation or (b) a state that maintains adequate levels of well-being and health due to the individual's own perceived ability for coping with the stressors present in their daily lives.

Anxiety disorders, according to the Diagnostic and Statistical Manual of Mental Disorders 5 (DSM-5), "share features of excessive fear and anxiety and related behavioral disturbances" (American Psychological Association [APA], 2014, p. 189). Fear corresponds to an emotional response in the face of a real or perceived imminent threat, usually related to periods of increased autonomic arousal (involved in fight or flight mechanisms), thoughts of immediate danger, and escape behaviors. Anxiety, on the other hand, refers to the anticipation of future threat, "more often associated with muscle tension and vigilance in preparation for future danger and cautios or avoidant behaviors" (APA, p. 189). According to DSM-5, Generalized Anxiety Disorder (GAD) is characterized by excessive anxiety and worry (occurring on most days), difficulty controlling one's worry, symptoms of restlessness (or feeling of being on edge), being easily fatigued, difficulty concentrating, irritability, muscle tension, and sleep disturbance, causing clinically significant distress or impaired functioning in important areas of the individual's life (social, occupational, etc.).

Depressive disorders, in turn, according to the DSM-5, have as common characteristics "the presence of sad, empty, or irritable mood, accompanied by somatic and cognitive changes that

significantly affect the individual's capacity to function" (APA, 2014, p. 155), with what distinguishes the different depressive disorders being the duration, timing, or presumed etiology. Major Depression Disorder, according to DSM-5, is characterized by (a) depressed mood or (b) diminished interest or pleasure, plus significant changes in (c) weight (without dieting) or appetite, (d) sleep and (e) movement, (f) fatigue, (g) feelings of worthlessness or excessive or inappropriate guilt, (h) diminished ability for thinking, concentrating, or making decisions, and (i) recurrent thoughts of death and/or suicidal ideation. These symptoms must be present almost every day and for at least six months, not be attributable to another medical condition, and cause clinically significant distress or impairment in functioning in important areas of the individual's life (social, occupational, etc.).

Some studies have investigated the impact of the pandemic on the mental health of university students (Cao et al., 2020; Hajdúk et al., 2020; Maia & Dias, 2020; Son et al., 2020; Yang et al., 2020). For example, Son et al. (2020) surveyed 195 students at a university in Texas, United States of America, and observed that 71% of them indicated that stress and anxiety levels increased after the pandemic began, 44% reported having an increased level of depressive thoughts, and 8% reported some suicidal thoughts associated with the COVID-19 pandemic. The study also sought to identify the factors that were contributing to increased symptoms of stress, anxiety, and depressive thoughts among students. The most commonly mentioned factors with a negative effect were: concern about their own health and that of family members (reported by 91% of participants), difficulty concentrating (89%), disturbed sleep patterns (86%), less social interaction due to distancing (86%), and increased concern about academic performance (82%).

Yang et al. (2020) conducted a survey with 384 students from four universities in Wuhan City, China, and found that COVID-19 was a negative predictor of mental health and that positive thinking and resilience functioned as mediators of COVID-19 victimization experiences and mental health. Also in China, Tang et al. (2020) assessed the prevalence of post-traumatic stress disorder (PTSD) and depression in 2,485 university students who were in home quarantine in order to identify risk factors for psychological distress. In addition to instruments to assess symptoms of stress and depression, data on sleep duration, exposure to COVID-19, length of time in home quarantine, and sociodemographic variables were also collected. The prevalence of PTSD and depression was 2.7% and 9.0%, respectively, and in the participants' perception, experiencing extreme fear was the most significant risk factor for psychological distress, followed by short periods of sleep, being in graduation year, and living in severely affected areas.

Studies comparing the levels of stress, anxiety, and depression in the pre-pandemic scenario and during the pandemic have also been conducted. For example, Maia and Dias (2020) conducted a survey with university students in Portugal, comparing two different samples. Sample 1 was composed of 460 students and data were collected in classrooms at two universities (one in the north and one in the center of the country) in February/March 2018 and then in February/March 2019. Sample 2, on the other hand, was composed of 159 students attending universities from north to south of the country and the collection took place over eight days (the day of suspension of classes in university education and the decree that instituted the state of emergency in the country) through an online form. The results confirmed a significant increase in psychological disturbance (anxiety, depression, and stress) among university students in the pandemic period compared to normal periods.

Hajdúk et al. (2020) also conducted a comparative study among students in Slovakia pre-pandemic and during the pandemic. The first phase of the study was conducted in October 2018 with 1,331 undergraduate and graduate students at Comenius University in Bratislava. Eighteen months later, in the first week of April 2020, 660 students from the first phase agreed to respond to a new

survey. The study found significant relationships between the pandemic caused by COVID-19 and symptoms of stress, anxiety, loneliness, and depression.

Brazil was also affected by the effects caused by the COVID-19 pandemic. Therefore, the present research had as its main objective to examine the levels of stress, anxiety, and depression among Brazilian university students. In addition, it also sought to identify whether (a) exposure to COVID-19 and (b) changes in work conditions relative to the onset of the pandemic impacted the participants' levels of stress, anxiety, and depression.

Method

The present study brings a clipping of data collected in the research project entitled "Impact of the COVID-19 Pandemic on University Students," which investigated different aspects related to the impact of the pandemic on Brazilian university students. The project followed the guidelines of Resolution nº 510/2016 (Conselho Nacional de Saúde, 2016) and was approved by the Ethics Committee for Research with Human Beings of the *Centro Universitário Adventista de São Paulo* (CAAE: 32763120.1.0000.5377, under opinion number 4.096.702).

Participants

A total of 405 university students enrolled in undergraduate courses at Brazilian Higher Education Institutions (HEI) participated in this study. As for the personal characteristics, 77.0% are female, 70.2% were in the age group "up to 24 years old", and 94.6% lived with other people (family, relatives, friends, or in a boarding school). As for the academic characteristics, 85.9% of the participants were studying in private HEI and 43.7% were mid-course. As for their financial situation, 63.2% of them, at the time of data collection, were not working and 50.6% were not working and were financed by their families.

Instruments

The research involved the application of four different instruments, briefly described below.

Sociodemographic and COVID-19 impact on student's daily life questionnaire, designed based on variables measured in the studies of Li et al. (2020) and Tang et al. (2020) and the authors' own observation of the impact of the pandemic on the reality of Brazilian university students. This questionnaire, which is divided into three parts, collected information on: (a) personal characteristics (sex, age, race, region of the country where they live, living arrangements [whether alone or with others], exercising any paid activity before the pandemic, exercising some paid activity at the time of data collection, participation in family economic life), (b) academic characteristics (course they are enrolled, nature of the HEI, modality of the course, year of entry, course duration, academic activities adopted by the HEI during the pandemic, satisfaction with the measures adopted by the HEI regarding academic activities during the pandemic), and (c) exposure to COVID-19 (knowing infected people in your community, living in the areas most affected by the virus, personally knowing a person who died from being infected, having neighbors who were infected, having friends who were infected, having relatives who do not live in the same house who were infected, having people who live in your house who were infected, having been exposed to stressful messages from the media, having been infected).

Patient Health Questionnaire (PHQ-9): A self-reporting instrument composed of nine items, which are answered on a 4-point Likert-type scale (0 - Not at all; 1 - Several days; 2 - More than half the days; 3 - Nearly every day). The instrument has a single dimension, presents validity evidence for the Brazilian population (I. S. Santos et al., 2013) and the Portuguese version is available for free access and use on the platform <https://www.phqscreeners.com/>. The main objective of the PHQ-9 is to screen for symptoms that may indicate the presence of an episode of major depression.

Generalized Anxiety Disorder Questionnaire (GAD-7): A self-reporting instrument composed of seven items, which are answered on a 4-point Likert-type scale (0 - Not at all; 1 - Several days; 2 - More than half the days; 3 - Nearly every day). The instrument has a single dimension, presents validity evidence for the Brazilian population (Moreno et al., 2016), and the Portuguese version is available for free access and use on the platform <https://www.phqscreeners.com/>. The GAD-7 is used to screen for symptoms indicative of Generalized Anxiety Disorder.

Perceived Stress Scale (PSS): A self-reporting instrument that has three versions with validity evidence for the Brazilian population (Faro, 2015), which differ in the number of items (14, 10, and 4 items). In the present study, the version composed of four items was used due to the number of instruments applied. The PSS assesses the level of stress perceived by the respondent.

Procedures

Data collection occurred through an electronic form during the second half of June and first half of July 2020. The invitation, calling on university students to participate in the survey, was conducted in three different ways. The first was by posting the invitation on social media (such as Facebook, Instagram, and WhatsApp). The second was through institutional channels of some private HEIs which broadcasted the invitation among their students. The third was through personal contact with university students and/or contact with university professors who publicized the invitation among their students and/or colleagues.

Upon accessing the form, the potential participant first had access to the Informed Consent Form, at the end of which he/she should mark one of the following options: (a) I agree to participate in this research or (b) I have no interest and/or availability to participate in this research. People who marked the first option were directed to a second section of the form containing the questionnaires that were applied. People who checked the second option were directed to a message thanking them for being interested in the research, but did not have access to the instruments that were applied.

After data collection, it was subjected to analysis in four steps. The first consisted of preparing the data for analysis. The spreadsheet with the data was inspected and the scores from the GAD, PHQ, and PSS scales were calculated. The second step involved examining (a) the distribution of GAD, PHQ, and PSS scores using the Shapiro-Wilk Test and (b) the validity evidence of the scales for the present sample using confirmatory factor analysis. The third step included assessing (a) the scores of each scale by descriptive statistics and (b) the differences in scores of the GAD, PHQ, and PSS scales as a function of exposure to COVID-19 and changes in work status. For variables with two conditions, Student's t-test was applied; and for three conditions, Analysis of Variance (ANOVA) (Marôco, 2007). Finally, the last step corresponded to the search for predictor variables for the levels of stress, anxiety, and depression by means of multiple linear regression analysis (Marôco, 2007). All statistical analyses were performed using RStudio version 3.4.3 (R Development Core Team, 2017).

Results

Confirmatory factor analysis of the scales showed that all of them had adequate fit indices (Marôco, 2014): GAD (CFI = 0.97, TLI = 0.95, RMSEA = 0.10, SRMR = 0.04), PHQ (CFI = 1.00, TLI = 1.00, RMSEA = 0.10, SRMR = 0.05), and PSS (CFI = 0.97, TLI = 0.95, RMSEA < 0.01, SRMR < 0.01). In addition, the Shapiro-Wilk test demonstrated that the scores of the three scales had a normal distribution.

Levels of stress, anxiety, and depression were examined as a function of academic characteristics (course area and time of course), exposure to COVID-19, and changes in work status. The courses were grouped into major fields according to the CAPES Table, namely: (a) Biological Sciences, courses such as Agricultural Sciences, Biological Sciences, and Health Sciences; (b) Exact Sciences, courses in Engineering and Exact and Earth Sciences; and (c) Humanities Sciences, such as Human Sciences, Applied Social Sciences, and Linguistics, Literature, and Arts. The percentage of participants in each area was, respectively, 21.0%, 6.9%, and 72.1% (Table 1).

Table 1

Mean, standard deviation, and result of the test of comparison between conditions of stress (PSS), anxiety (GAD), and depression (PHQ) scale scores as a function of exposure to COVID-19 and changes in work status

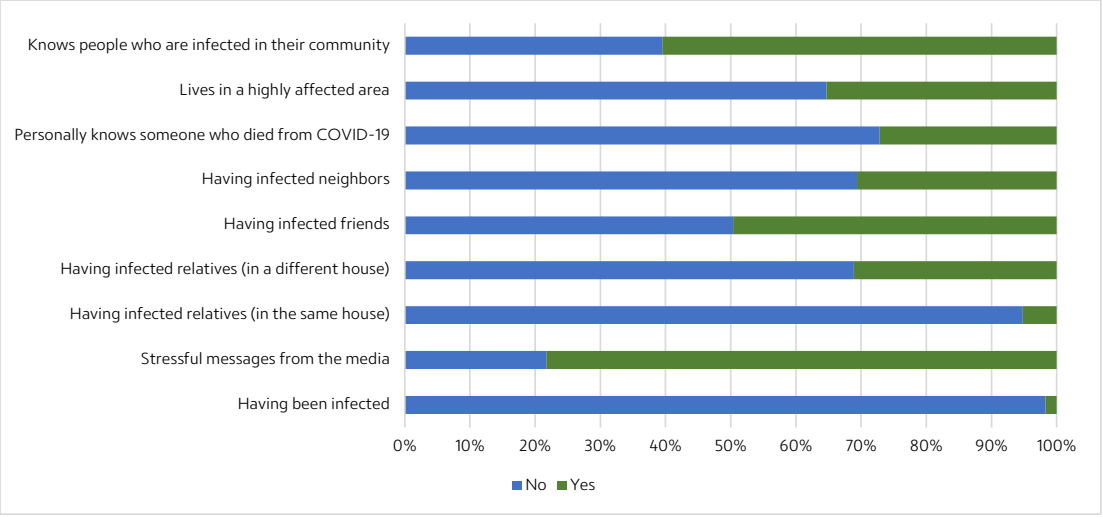
Variables	n	Stress		Anxiety		Depression	
		M (SD)	*t / F*	*M (SD)*	*t / F*	*M (SD)*	*t / F*
Course area							
Biological Sciences	85	9.1 (3.2)	2.2	9.4 (5.4)	4.1 [a]	11.3 (6.1)	6.7 [b]
Exact Sciences	28	7.9 (3.3)		6.9 (5.4)		7.5 (4.8)	
Humanities Sciences	292	9.2 (3.2)		10.1 (5.9)		12.2 (6.9)	
Time of Course							
Beginning	95	9.0 (3.4)	0.2	9.9 (6.4)	0.1	11.1 (7.2)	0.7
Mid-course	177	9.0 (3.2)		9.7 (5.7)		11.7 (6.4)	
End	132	9.2 (3.2)		9.6 (5.6)		12.2 (6.8)	
Exposure to COVID-19							
Knows people who are infected							
Yes	245	9.2 (3.3)	1.0	10.2 (5.9)	-1.9	12.4 (6.9)	-2.8 [b]
No	160	8.9 (3.1)		9.0 (5.6)		10.6 (6.2)	
Lives in a highly affected area							
Yes	143	9.6 (3.1)	2.2 [a]	11.2 (5.9)	-3.8 [b]	13.3 (6.8)	-3.5 [b]
No	262	8.8 (3.3)		8.9 (5.6)		10.80 (6.5)	
Personally knows someone who died from COVID-19							
Yes	110	9.9 (3.0)	3.2 [b]	11.0 (5.7)	-2.8 [b]	13.2 (6.8)	-2.7 [b]
No	295	8.8 (3.3)		9.2 (5.8)		11.1 (6.6)	
Infected neighbors							
Yes	124	9.3 (3.2)	1.0	10.5 (6.0)	- 1.6	13.3 (7.1)	- 3.2 [b]
No	181	9.0 (3.3)		9.4 (5.7)		11.0 (6.4)	
Infected friends							
Yes	201	9.2 (3.2)	0.7	10.4 (5.9)	-2.2 [a]	12.3 (6.8)	-1.7
No	204	9.0 (3.3)		9.1 (5.7)		11.1 (6.6)	
Stressful messages from the media							
Yes	317	9.4 (3.1)	3.0 [b]	10.2 (5.8)	-3.5 [b]	12.2 (6.7)	-3.1 [b]
No	88	8.1 (3.5)		8.0 (5.5)		9.8 (6.5)	
Changes in work status							
No changes	260	8.8 (3.3)	3.3 [a]	9.3 (5.6)	2.6	11.5 (6.7)	1.1
Positive change	14	8.8 (3.0)		8.6 (7.0)		10.1 (8.0)	
Negative change	131	9.7 (3.1)		10.7 (6.1)		12.3 (6.6)	

Note: [a] $p < 0.05$; [b] $p < 0.01$. Positive change - from part-time to full-time or from no paid activity to paid activity; Negative change - from full-time to part-time or unemployed. Three indicators of exposure to COVID-19 did not show significant differences between the groups in any of the psychological variables examined and were therefore excluded from the table. n: Sample size; *t*: Student's t Test Value; F: Analysis of Variance (ANOVA) Value.

Regarding the time of the course, the participants were divided into three groups: (a) Beginning, students in the first year of the course; (b) End, students in the last year of the course; and (c) Mid-course, students between the 2nd and 3rd or 4th year, depending on the course length. The percentage of participants in the beginning, mid-, and end of the course were 23.4%, 43.7%, and 32.6%, respectively. One participant did not provide the data necessary to identify at what time of the course they were.

Exposure to COVID-19 was measured from nine indicators. As can be seen in Figure 1, 78.3% of the participants reported being exposed to stressful media messages, 60.5% reported knowing infected people in their community, and 49.6% reported having infected friends.

Figure 1
Exposure to COVID-19



To assess changes in work status due to the pandemic, we compared the variables: (a) exercizing paid activity before the pandemic and (b) exercizing paid activity now (at the time of collection). The alternatives available for these two variables were: (a) no; (b) yes, eventually; (c) yes, part-time; and (d) yes, full-time. The comparison of responses resulted in three distinct conditions: (a) no change in work status; (b) negative change in work status, resulting in decreased work time (for example, from full-time to part-time) or loss of employment; and (c) positive change in work status, resulting in increased work time (from casual or part-time to full-time) or being hired (for those who were not working before the pandemic). The percentage of participants in each of these conditions was 64.2%, 32.3%, and 3.5%, respectively. Separate analyses of the levels of stress, anxiety, and depression, as well as the variables that impacted each, are described below.

Stress

Overall, the mean score on the PSS-4 was 9.1 (*SD* = 3.2). Faro (2015), when applying the PSS-4 on a sample of the Brazilian population, suggested that scores higher than seven and nine indicated moderate or high level of stress, respectively. In the present research, we chose to divide the participants into two groups regarding the level of stress: (a) individuals with low/normal level of stress and (b) individuals with moderate/high level of stress. Among the participants, 56.8% had moderate/high level of stress.

When comparing the mean stress scores as a function of academic characteristics (course area and time of course), exposure to COVID-19, and changes in work status (Table 1), it was found that participants who: (a) lived in areas most affected by the pandemic, (b) personally knew someone who died of COVID-19, (c) said they were exposed to stressful messages in the media, and (d) had a negative change in work status (when compared to the others) had a significantly higher level of stress. Taking the values suggested by Marôco (2007) to evaluate the effect size of the differences found between the groups, it was found that 'a' and 'd' showed a small effect size and the others showed medium effect size.

Two multiple regressions were performed: (a) one involving all variables of academic characteristics, exposure to COVID-19, and changes in work status, and (b) another involving only the relevant variables identified in the first regression (Table 2). The multiple linear regression indicated the presence of positive and significant correlations of stress level with the variables (a) personally knowing someone who died of COVID-19 (β = 1.0, t = 2.8, p < 0.01), (b) stressful media messages (β = 1.2, t = 3.2, p < 0.01), and (c) negative changes in work status (β = 0.8, t = 2.4, p > 0.05). Although this model explained some of the variance in the stress score (F (4,400) = 6.4, p < 0.01), the association between stress and these explanatory variables was weak (Multiple R = 0.06), explaining only 5.0% of the variance in the PSS score.

Table 2

Multiple regression analysis for stress symptoms as a function of academic characteristics, exposure to COVID-19, and changes in work status

Model	Independent Variables	Regression Equation				
		F	R^2	$R^2\Delta$	β	t
1	Constant	2.2 [b]	0.07	0.04	7.5	12.2 [b]
	Knows an infected person – Yes				-0.2	-0.4
	Lives in a more affected area – Yes				0.4	1.2
	Knows someone who died from COVID-19 – Yes				0.8	2.1 [a]
	Has infected neighbors – Yes				0.0	0.1
	Has infected friends – Yes				-0.1	-0.2
	Has relatives (not living together) who are infected – Yes				0.4	1.2
	Has people living in the same house who are infected – Yes				1.1	1.2
	Is exposed to stressful messages about COVID-19 – Yes				1.1	2.9 [b]
	Respondent is infected – Yes				-2.0	-1.3
	Change in work status – Negative				0.8	2.3 [a]
	Change in work status – Positive				0.1	0.1
	Course area – Exact Sciences				-1.0	-1.3
	Course area – Humanities Sciences				-0.0	-0.0
	Time of Course – Beginning				0.0	0.1
	Time of Course – Mid-course				0.1	0.3
2	Constant	6.4 [b]	0.06	0.05	7.6	20.8 [b]
	Knows someone who died from COVID-19 – Yes				1.0	2.8 [b]
	Is exposed to stressful messages about COVID-19 – Yes				1.2	3.2 [b]
	Change in work status – Negative				0.8	2.4 [a]

Note: [a] p < 0.05; [b] p < 0.01. F: Regression Analysis Value; $R^2\Delta$: Adjusted R square.

Anxiety

The mean GAD-7 score was 9.7 (SD = 5.8). Although the cutoff point for the Brazilian population is not established in the literature, we followed the procedure adopted by other national studies (Schönhofen et al., 2020; M. T. Silva et al., 2018) and chose to use the international version's parameter to classify individuals who presented (score ≥ 10) or not (score < 10) symptoms of Generalized Anxiety Disorder (GAD). Among the participants, 41.73% presented GAD symptoms.

When comparing the mean anxiety scores as a function of academic characteristics (course area and time of course), exposure to COVID-19, and changes in work status (Table 1), it was found that participants who: (a) took a course in the Humanities Sciences compared to those in the Exact Sciences; (b) lived in the most affected areas, (c) personally knew someone who died of COVID, (d) had infected friends, and (e) reported being exposed to stressful media messages had significantly higher levels of anxiety. Apart from 'd' which had a small effect size, all other variables had a medium effect size (Marôco, 2007).

Multiple linear regression indicated a positive and significant association of anxiety level with the variables (a) living in the most affected areas (β = 2.2, t = 3.7, p < 0.01), (b) stressful media messages (β = 2.1, t = 3.1, p < 0.01) and (c) change in work status (β = 1.4, t = 2.3, p < 0.05). This model presents an adequate fit (F (3,401) = 7.8, p < 0.01); however, the correlation between anxiety level and these explanatory variables was weak (Multiple R = 0.07), explaining only 7.0% of the variance in GAD scores (Table 3, Model 2). Given this, another model was tested including stress level as one of the explanatory variables.

Table 3
Multiple regression analysis for anxiety symptoms as a function of academic characteristics, exposure to COVID-19, and changes in work status

Model	Independent Variables	Regression Equation				
		F	R^2	$R^2\Delta$	β	t
1	Constant	2.9 [b]	0.10	0.06	5.5	5.0
	Knows an infected person – Yes				0.1	0.2
	Lives in a more affected area – Yes				1.8	2.8 [b]
	Knows someone who died from COVID-19 – Yes				1.0	1.4
	Has infected neighbors – Yes				0.4	0.6
	Has infected friends – Yes				0.6	1.0
	Has relatives (not living together) who are infected – Yes				-0.5	-0.8
	Has people living in the same house who are infected – Yes				-0.2	-0.1
	Is exposed to stressful messages about COVID-19 – Yes				2.1	3.0 [b]
	Respondent is infected – Yes				-0.9	-0.4
	Change in work status – Negative				1.3	2.1 [a]
	Change in work status – Positive				-0.7	-0.4
	Course area – Exact Sciences				-1.8	-1.4
	Course area – Humanities Sciences				0.6	0.9
	Time of Course – Beginning				1.1	1.4
	Time of Course – Mid-course				0.8	1.2
2	Constant	7.8 [b]	0.07	0.06	6.8	10.4 [b]
	Lives in a more affected area – Yes				2.2	3.7 [b]
	Is exposed to stressful messages about COVID-19 – Yes				2.1	3.1 [b]
	Change in work status – Negative				1.4	2.3 [a]
3	Constant	70.0 [b]	0.45	0.44	-1.8	-2.5 [b]
	Lives in a more affected area – Yes				1.4	3.2 [a]
	Is exposed to stressful messages about COVID-19 – Yes				0.7	1.5
	Change in work status – Negative				0.4	0.8
	Perceived Stress Scale Total				1.1	16.6 [b]
4	Constant	163.1 [b]	0.45	0.44	-1.3	-2.0 [a]
	Lives in a more affected area – Yes				1.4	3.22 [b]
	Perceived Stress Scale Total				1.2	17.3 [b]

Note: [a]p < 0.05; [b]p < 0.01. F: Regression Analysis Value; $R^2\Delta$: Adjusted R square.

The explanatory model containing stress level showed a superior fit to the previous one (F (3,401) = 163.1, p < 0.01), with a positive and significant association of anxiety level with the variables (a) living in the most affected areas (β = 1.4, t = 3.2, p < 0.01) and (b) stress (β = 1.2, t = 17.3, p < 0.01). The correlation between anxiety level and these explanatory variables (living in the most affected areas and stress level) was moderate (Multiple R = 0.45), explaining 44.5% of the variance in GAD scores (Table 3, Model 4).

Depression

The mean scores of the PHQ-9, an instrument used to screen for the risk of occurrence of a major depressive episode, were 11.7 (SD = 6.7). According to I. S. Santos et al. (2013), the Brazilian population's cutoff point for identifying individuals at higher risk of having a depressive episode is higher than 13 points. Therefore, participants who presented scores lower than 13 points were classified as "without risk of depression" and participants with scores equal to or higher than 13 were classified as "at risk of depression". Among the participants, 37.0% presented risk of depression. In addition, the instrument requires the respondent to indicate the degree of difficulty to which the problems mentioned in the instrument's items caused them when performing their routine tasks. Among the participants without risk of depression, 11.0% reported feeling a lot or extreme difficulty, whereas among those who presented risk of depression, this percentage was 63.3%.

When comparing mean depression scores as a function of academic characteristics (course area and time of course), exposure to COVID-19, and changes in work status (Table 1), participants who: (a) were enrolled in a course from the Humanities Sciences compared to those from the Exact Sciences; (b) were enrolled in a course from the Biological Sciences compared to those from the Exact Sciences; (c) knew people who were infected, (d) lived in more affected areas, (e) personally knew someone who died of COVID-19, (f) had infected neighbors, and (g) reported being exposed to stressful media messages, exhibited significantly higher levels of depressive symptoms. All variables had medium effect sizes (Marôco, 2007).

Multiple linear regression indicated the presence of positive and significant correlations between the level of depression and the variables (a) living in the most affected areas (β = 2.2, t = 3.2, p < 0.01), (b) infected neighbors (β = 1.8, t = 2.5, p < 0.05) and (c) stressful media messages (β = 2.1, t = 2.7, p < 0.01). A negative and significant correlation was also observed between the level of depression and taking a course in the Exact Sciences (β = -3.6, t = -2.6, p < 0.05). This model presents an adequate fit (F (3,401) = 9.5, p < 0.01); however, the correlation between anxiety level and these explanatory variables was weak (Multiple R = 0.07), explaining only 7.0% of the variance in PHQ scores (Table 4, Model 2). As with the anxiety analysis, another model was tested including the level of stress as one of the explanatory variables.

The explanatory model containing the level of stress showed a superior fit to the previous one (F (5,399) = 65.0, p < 0. 01), showing a positive and significant association of anxiety level with the variables (a) living in the most affected areas (β = 1.1, t = 2.1, p < 0.05), (b) infected neighbors (β = 1.5, t = 2.8, p < 0.01), and (c) stress (β = 1.3, t = 16.5, p < 0.01). It also showed a negative and significant correlation between the level of depression and attending a course in the Exact Sciences (β = -2.3, t = -2.1, p < 0.05). The correlation between level of depression and these explanatory variables (living in the most affected areas, infected neighbors, and stress level) was moderate (Multiple R = 0.44), explaining 44.0% of the variance in PHQ scores (Table 4, Model 3).

Table 4

Multiple regression analysis for depression symptoms as a function of academic characteristics, exposure to COVID-19, and changes in work status

Model	Independent Variables	Regression Equation				
		F	R^2	$R^2\Delta$	β	*t*
1	Constant	2.9 [b]	0.10	0.06	8.3	6.6 [b]
	Knows an infected person – Yes				0.6	0.7
	Lives in a more affected area – Yes				1.6	2.2 [a]
	Knows someone who died from COVID-19 – Yes				0.9	1.2
	Has infected neighbors – Yes				1.5	1.9
	Has infected friends – Yes				-0.1	-0.1
	Has relatives (not living together) who are infected – Yes				-0.2	-0.2
	Has people living in the same house who are infected – Yes				-0.2	-0.1
	Is exposed to stressful messages about COVID-19 – Yes				0.8	2.6 [b]
	Respondent is infected – Yes				0.5	0.2
	Change in work status – Negative				0.6	0.8
	Change in work status – Positive				-1.6	-0.9
	Course area – Exact Sciences				-3.6	-2.5 [a]
	Course area – Humanities Sciences				0.4	0.5
	Time of Course – Beginning				-0.2	-0.2
	Time of Course – Mid-course				0.2	0.3
2	Constant	8.2 [b]	0.08	0.07	9.0	9.5 [b]
	Lives in a more affected area – Yes				2.2	3.2 [b]
	Has infected neighbors – Yes				1.8	2.5 [a]
	Is exposed to stressful messages about COVID-19 – Yes				2.1	2.7 [b]
	Course area – Exact Sciences				-3.6	-2.6 [a]
3	Constant	65.0 [b]	0.45	0.44	-1.0	0.2
	Lives in a more affected area – Yes				1.1	2.1 [a]
	Has infected neighbors – Yes				1.5	2.8 [b]
	Course area – Exact Sciences				-2.3	-2.1 [a]
	Perceived Stress Scale Total				1.3	16.5 [b]

Note: [a]$p < 0.05$; [b]$p < 0.01$. F: Regression Analysis Value; R2Δ: Adjusted R square.

Discussion

Numerous studies are being conducted to verify the effects of the pandemic on different segments of society, such as in pregnant women (Melo & Araújo, 2020), children (Safadi, 2020), health professionals (Miranda et al., 2020; Ornell et al., 2020; Pan et al., 2020), black population (M. P. A. Santos et al., 2020), and elderly (Hammerschmidt & Santana, 2020; Moraes et al., 2020). A recurring concern in these studies are the issues related to mental health due to the manifestation of psychological symptoms generated by social distancing, such as stress, irritability, sleep alterations, anxiety, among others.

The main objective of the present study was to examine the levels of stress, anxiety, and depression among Brazilian university students. The results indicated that the prevalence of stress, anxiety, and depression among the sample participants was 56.8%, 41.7%, and 37.0%, respectively. Martins et al. (2019) applied the Depression, Anxiety, and Stress Scale in a sample of 1,042 Brazilian university students and found that the prevalence of such problems before the pandemic was 4.5%, 1.7%, and 4.7%, respectively. With due caution in comparing the data from the present research with the investigation by Martins et al. this could be a first indication that the changes involved in the pandemic may have contributed to increased levels of stress, anxiety, and depression. Moreover, since international studies have shown that the pandemic contributed to increased levels of stress, anxiety, and depression (Hajdúk et al., 2020; Maia & Dias, 2020) among university students, it is

possible that the same occurred among Brazilian students. In any case, the data from this research should be analyzed with caution, as the interest and willingness to participate in the study may be affected by the student's perception of the impact of the pandemic on their daily lives, leading students who perceive more negative impacts to be more willing to respond.

The data indicate that for at least 56.8% of the participants, the changes caused by the pandemic in various spheres of life (including academic routine) were perceived as greater than their ability to cope with the situation (Faro, 2015). In this sense, the higher the individual's PSS score, the closer to the state of distress he/she is; the lower the score, the more efficient are the stress coping strategies being used. Yang et al. (2020) suggest that all the changes brought about by the pandemic and subsequent quarantine are similar to those from disaster situations. A disaster is a large-scale negative event that causes psychological trauma and even death. According to the author, adults who were victims of some kind of disaster-related experience may develop sleep disorders, depression, emotional stress, and worsening of psychological symptoms. In this direction, some studies regarding the impact of the pandemic have discussed the likelihood of this situation triggering post-traumatic stress symptoms (Kira et al., 2020; Shi & Hall, 2020; Tang et al., 2020). However, as suggested by Tang et al. (2020), the impact of acute, pervasive, and ongoing stressors on the individual and society, such as those related to the outbreak of highly contagious diseases with worrying lethality levels, are still unknown.

To assess the impact of the COVID-19 pandemic on university students' levels of stress, anxiety, and depression, three aspects were considered: (a) academic characteristics, (b) exposure to COVID-19, and (c) changes in the participant's working status. Exposure to COVID-19 was measured through nine indicators selected from international studies that investigated the impact of the pandemic on university students (Li et al., 2020; Tang et al., 2020) and from the authors' own observation of the impact of the pandemic on the reality of Brazilian university students. The indicators most mentioned by the participants of this research were stressful messages from the media (78.3%), knowing infected people in their community (60.5%), and having friends who were infected (49.6%). Changes in work status were evaluated by comparing the number of paid activities before the pandemic and at the time of data collection (end of the first semester of 2020). Among the study participants, 64.2% had no change in their work status.

The analysis of the impact of exposure to COVID-19 and changes in the participant's work status on levels of stress, anxiety, and depression showed that the following indicators had some kind of impact on at least one of the psychological variables analyzed: (a) living in the most affected areas, (b) personally knowing someone who died of COVID-19, (c) knowing people who were infected, (d) having infected neighbors, (e) changes in work status, and (f) stressful messages from the media. The only indicator that affected all three psychological variables investigated was exposure to stressful media messages. Studies have indicated that frequent exposure to social media and news about COVID-19 may increase the chances of the emergence of anxiety and depression symptoms (Ahmad & Murad, 2020; Duarte et al., 2020). Still, the predictive power of each of these models was low, explaining around 5 to 6% of the variance of each of the assessed psychological variables.

However, when stress level was placed as one of the explanatory variables for anxiety and depression levels, the predictive power of the new models changed significantly. Living in the most affected areas and level of stress explained 44.0% of the variance in anxiety levels. Living in the most affected areas, having infected neighbors, not being enrolled in a course in the Exact Sciences, and level of stress explains 44.0% of the variance in depression levels. These data seem to indicate that when pandemic-related stressors overwhelm the individual's coping resources (resulting in a state

of suffering or distress), it contributes to increased levels of anxiety and depression. Therefore, it is possible that in addition to "direct" exposure to COVID-19 and changes in work status, the individual's assessment of this exposure and their ability to cope with the stressors arising from it play a relevant role in the mental health of Brazilian university students. The study by Yang et al. (2020) seems to corroborate such a hypothesis, since, when evaluating Chinese university students, they found that those who had undergone psychological training prior to the pandemic showed significantly better levels of positive thinking and resilience than those who had not received such training.

Conclusion

The present study has at least three main limitations. The first refers to the absence of data on the levels of stress, anxiety, and depression (of the participants approached) prior to the pandemic, which would allow a more accurate assessment of the impacts on such psychological variables. However, in part, this limitation may have been circumvented due to the sample size and multiple regression analyses performed. The second limitation is related to how the participants were accessed and the period of data collection. The first half of 2020 was quite challenging because of all the changes brought about by the COVID-19 contagion containment measures. Since data collection occurred at the end of the first semester and through social networks or institutional communication channels, it is possible that this interfered with the students' willingness to participate in the surveys. And finally, the third limitation concerns the type of instrument used. The data collected were produced by self-report instruments, which may be affected by the respondent's perception and the level of discrimination they have about their own behavior. However, since the responses presented to stress depend on the individual's assessment of the situation, this limitation seems to be a part of the phenomenon of interest itself.

The pandemic has not yet been controlled, routines are still altered, and the deleterious effects on the university students' mental health (due to all the changes that the pandemic brought to daily life) may persist for a long time. In this direction, the data from this study seems to provide relevant information that can subsidize the elaboration of institutional actions (by the HEIs) and intervention programs aimed at helping university students to manage these effects more efficiently. At first, such actions may focus on the development and/or improvement of stress coping strategies, since stress seems to have a relevant mediating role in the levels of anxiety and depressive symptoms. In addition, the offering of social and emotional support by HEIs and teachers to students, may contribute to decrease the levels of stress, anxiety, and depression. Therefore, thinking of alternatives in this direction also seems to be a viable alternative of assistance to students.

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J. VIEIRA-SANTOS was responsible for conceptualizing the study, data collection, statistical analyses, data interpretation, and writing of the manuscript. W. F. PAIVA contributed to the conception of the project, data collection, and writing of the manuscript. C. C. MENDES-PACHECO contributed to the conception of the project, data collection, and writing of the manuscript.