



Stress, anxiety and depression in undergraduate dental students in the context of the COVID-19 pandemic


Murilo Áquila de Oliveira Viana¹

 [0000-0002-9058-3611](https://orcid.org/0000-0002-9058-3611)


Franklin Delano Soares Forte²

 [0000-0002-5046-6883](https://orcid.org/0000-0002-5046-6883)

Sérgio D'Ávila Lins Bezerra Cavalcanti¹

 [0000-0002-7836-896X](https://orcid.org/0000-0002-7836-896X)

Andreza Cristina de Lima Targino Massoni¹

 [0000-0002-33328315](https://orcid.org/0000-0002-33328315)

¹Universidade Estadual da Paraíba (UEPB), Campina Grande, Paraíba, Brasil.

²Universidade Federal da Paraíba (UFPB), João Pessoa, Paraíba, Brasil.

Correspondence:

Murilo Áquila de Oliveira Viana
E-mail: murilo.viana@aluno.uepb.edu.br

Received: Nov 06, 2021

Approved: Jul 22, 2022

Last revision: Oct 26, 2023

<https://creativecommons.org/licenses/by-nc/4.0/deed.en>



Stress, anxiety and depression in undergraduate dental students in the context of the COVID-19 pandemic

Abstract The aim of the present study was to determine the occurrence of stress, anxiety and depression in undergraduate dental students at public institutions in the state of Paraíba, Brazil, and associations with aspects related to the coronavirus pandemic (SARS-CoV-2). An observational cross-sectional study was conducted with a sample of 488 dental students. Data collection involved the use of two questionnaires. One was developed by the researchers to collect sociodemographic data and information on the pandemic and the 21-item Depression, Anxiety and Stress Scale (DASS-21) was used to identify the occurrence of depression, anxiety and stress. The significance level on the statistical tests was set at 5% ($p < 0.05$). The prevalence of depression, anxiety and stress was 60.0%, 59.8% and 60.9%, respectively. The multivariate analysis revealed that the variable "change in personal health status" remained associated with all three outcomes (anxiety, depression and stress) ($p < 0.001$). The variable "afraid to return to clinical examinations/procedures within the context of the pandemic" remained associated with anxiety ($p = 0.031$) and stress ($p = 0.002$) in the final model. The only variable that remained associated with depression was "self-perceived negative impact on the quality of interpersonal relationships due to the pandemic" ($p = 0.004$). The prevalence of the outcomes studied was high and the multivariate analysis revealed associations with important aspects of the coronavirus pandemic. Such associations underscore the need to discuss the effect of the pandemic on mental health and how dental students are affected by COVID-19.

Descriptors: Pandemics. Mental Disorders. Students, Dental.

Estrés, ansiedad y depresión en estudiantes de pregrado en Odontología en el contexto de la pandemia COVID-19

Resumen El objetivo del estudio fue verificar la ocurrencia de estrés, ansiedad y depresión en estudiantes de graduación en Odontología de Instituciones Públicas del Estado de Paraíba y su asociación con variables relacionadas a la pandemia del Coronavirus (SARS-CoV-2). Este estudio transversal y observacional utilizó dos cuestionarios: uno desarrollado por los investigadores para recolectar datos sociodemográficos e información sobre la pandemia; y otro para identificar la aparición de depresión, ansiedad y estrés - la Escala de Depresión, Ansiedad y Estrés - 21 Ítems (DASS-21). La muestra estuvo compuesta por 488 estudiantes universitarios y el nivel de significancia utilizado en las decisiones de las pruebas estadísticas fue del 5%. Hubo una prevalencia del 60,0% para depresión, 59,8% para ansiedad y 60,9% para estrés. Se observó en el análisis multivariado que la variable "cambio en el estado de salud personal" permaneció asociada a los tres desenlaces analizados ($p < 0,001$): estrés, ansiedad y depresión. La variable "tener miedo de volver a la atención clínica en el contexto de la pandemia" permaneció, en el modelo, final asociada a los resultados ansiedad ($p = 0,031$) y estrés ($p = 0,002$), y con respecto solo a la depresión, la única variable que permaneció asociado fue la "autopercepción de impacto negativo en la calidad de sus relaciones interpersonales debido a la pandemia" ($p = 0,004$). Hubo alta prevalencia de los desenlaces estudiados y su asociación, en el análisis multivariado, con variables importantes de la pandemia de Coronavirus. Este tipo de asociaciones nos hacen reflexionar sobre la necesidad de debatir la salud mental ante la pandemia y cómo estos estudiantes están siendo perjudicados por el COVID-19.

Descriptor: Pandemias. Transtornos Mentales. Estudiantes de Odontología.

Estresse, ansiedade e depressão em estudantes de graduação em Odon contexto da pandemia da COVID-19

Resumo O objetivo do estudo foi verificar a ocorrência de estresse, ansiedade e de estudantes de graduação em Odontologia de Instituições Públicas do Estado da Pa associação com variáveis relacionadas à pandemia do Coronavírus (SARS-CoV-2). O estudo transversal e observacional utilizou dois questionários: um desenvolvido pelos pesquisadores para coleta de dados sociodemográficos e informações sobre a pandemia; e outro para ocorrência de depressão, ansiedade e estresse - o *Depression, Anxiety and Stress Scale* (DASS-21). A amostra foi composta por 488 graduandos e o nível de significância e decisões dos testes estatísticos foi de 5%. Verificou-se uma prevalência de 60,0% para estresse, 59,8% para ansiedade e 60,9% para depressão. Observou-se na análise multivariada que a "mudança no estado de saúde pessoal" permaneceu associada aos três desfechos analisados ($p < 0,001$): estresse, ansiedade e depressão. A variável "estar assustado para atendimentos clínicos dentro do contexto da pandemia" se manteve no modelo final para os desfechos ansiedade ($p = 0,031$) e estresse ($p = 0,002$), e no que diz respeito à depressão, a única variável que permaneceu associada foi a "autopercepção de impacto na qualidade de suas relações interpessoais devido à pandemia" ($p = 0,004$). Houve prevalência dos desfechos estudados, e sua associação, na análise multivariada, com as variáveis da pandemia do Coronavírus. Tais associações nos fazem refletir acerca da importância do debate sobre saúde mental frente ao momento pandêmico e em como esses estudantes estão sendo prejudicados pela COVID-19.

Descritores: Pandemias. Transtornos Mentais. Estudantes de Odontologia.

INTRODUCTION

December of the year 2019 marked the onset of a new lung disease caused by a virus known as the new coronavirus SARS-CoV-2, which soon spread throughout the world and was subsequently denominated COVID-19. Due to its high transmissibility and associated mortality rates, the World Health Organization declared a state of pandemic in March of 2020 and many countries soon adopted strategies to contain the spread of this public health problem¹⁻³.

Preliminary studies addressing the effects of COVID-19 on the mental health of the population found negative psychological impacts ranging from mild to extreme¹. The mental health of healthcare providers, such as dentists, was also affected. Indeed, dentists are among those in the health field most at risk of contamination due to the direct contact with the oral cavity and exposure to aerosols and dental students are more vulnerable due to the fact that they are still developing their clinical skills⁴⁻⁵.

The COVID-19 outbreak delayed the graduation of dental students due to the high risk of contamination and consequent postponement of academic activities, which affected the teaching-learning process and the training of students. Besides fear of contamination, being quarantined at home, the interruption of academic activities, delayed conclusion of the course, uncertainties with regards to the future and boredom characterize conditions that can lead to psychological suffering, favoring disorders such as stress, anxiety and depression.⁶

According to the World Health Organization, the prevalence of depression and anxiety is considerable, accounting for 3 to 18% of all mental disorders in the world⁷. In 2017, the same organization classified Brazil as the country with the highest frequency of individuals living with anxiety disorders (9.3% of the population) and the fifth highest in terms of the prevalence of depression (5.8%)⁸.

In this context, there has been a trend among teaching institutions to be more concerned with the psychological wellbeing of students, as university students tend to be more vulnerable to psychological problems due to the various stressors and educational demands in the academic setting^{9,10}. Psychological suffering tends to be associated with an unsatisfactory academic performance, insomnia, alcoholism, substance abuse, anxiety, depression and suicide, affecting the learning process and quality of life of students¹¹. This is particularly true for students in the health field, considering the additional challenges such students have during their education, such as the offer of patient care and the development of clinical skills, which are characteristics that tend to increase levels of stress, anxiety and depression⁹.

Besides stressors that are common to academic life, the pandemic had a disturbing effect. Although its actual impact on education and mental health in the university setting is not yet known, levels of stress and anxiety are believed to be higher in the majority of university students due to this context, with a negative impact on mental health^{2,12,13}.

The aspects discussed above demonstrate the relevance of understanding the occurrence and context of mental disorders during the pandemic. Therefore, the aim of the present study was to determine the presence of stress, anxiety and depression in undergraduate students of dentistry at public institutions in the state of Paraíba, Brazil, and associations with aspects related to the COVID-19 pandemic.

METHODS

An observational, cross-sectional study with descriptive statistical procedures and quantitative analysis¹⁴ was conducted addressing the occurrence of depression, anxiety and stress among undergraduate students of the dentistry course of four public higher education institutions in the state of Paraíba, Brazil: *Universidade Federal da Paraíba* (UFPB), *Universidade Federal de Campina Grande* (UFCG) and CAMPUS I and CAMPUS VIII of *Universidade Estadual da Paraíba* (UEPB). These institutions were selected for being pioneers in the state of Paraíba and for often being the first choice among students for entrance in dentistry courses.

The four institutions offer five-year undergraduate courses in dentistry (10 semesters), which are divided into three phases: 1) basic knowledge and theoretical discussions; 2) preclinical laboratories; and 3) clinical practice. Considering a finite universe of 1350 dental students at the four institutions, a 5% acceptable rate of error, 95% confidence level and 50% prevalence rate, the minimum sample size was calculated to be 300 participants. All students between the 1st and 10th semester regularly enrolled in their courses were invited to participate in the study.

The 21-item Depression, Anxiety and Stress Scale (DASS-21) was used to measure levels of stress, anxiety and depression. The DASS-21 is a short version of the DASS-42 that saves time and is easy to administer. This scale can be administered in both clinical and non-clinical settings and involves a theoretical model that discriminates symptoms of stress, depression and anxiety^{15,16}. The DASS-21 is a valid, reliable measure for mapping and quantifying symptoms, but cannot be considered a definitive diagnostic tool for these disorders¹⁷⁻¹⁹. The identification of symptoms of anxiety, stress and depression is based on behaviors and sensations experienced in the previous seven days. The scale was translated to Brazilian Portuguese and validated by Vignola and Tucci (2014)²⁰.

DASS-21 is composed of 21 items with response options on a four-point Likert scale [0 ("did not apply to me at all"), 1 (applied to me to some degree or some of the time; 2 – applied to me a considerable degree or a good part of the time; and 3 – applied to me very much or most of the time)] on the frequency or severity of experiences in the previous week with the intention of emphasizing emotional states over traits¹⁶. Each subscale (stress, anxiety and depression) is composed of seven items for the assessment of emotional states related to these disorders. The scores on the seven items for each domain are summed to determine the total scores. The final answers are categorized on a five-point Likert scale classifying stress, anxiety and depression as "normal", "mild", "moderate", "severe" or "extremely severe"¹⁶.

In the present study, levels of depression, anxiety and stress obtained using the DASS-21 were dichotomized to enhance the power of the statistical tests. The "normal" category was classified as "no", corresponding to the absence of symptoms of depression, anxiety and stress, and the "mild", "moderate", "severe" and "extremely severe" categories were classified as "yes", indicating the presence of symptoms of these outcomes.

The data collection instrument also had a brief questionnaire for the characterization of the sample (campus, sex, age, marital status, family income and employment situation) as well as a questionnaire with objective questions addressing the following aspects of the effects of the COVID-19 pandemic: impact of the pandemic on family income; whether anyone in the family received any financial benefits from the government related to the pandemic; whether the respondent practiced any form of social distancing during the pandemic; the negative impact of the pandemic on progression in the dentistry course; whether the students were afraid to return to clinical examinations/procedures within the context of the pandemic; changes in personal health status caused by the pandemic; negative impact of the pandemic on the quality of interpersonal relationships; and whether the students underwent professional mental health therapy

during the pandemic.

Prior to data collection, a pilot study was conducted to test the adequacy of the methods, determine the variables to be collected and the parameters of the data collection instrument and determine the students' understanding of the questions. This step was conducted with 48 dental students at one of the institutions.

Contact was made with the administrative board of each course to obtain written authorization. The sectors also provided the researcher with the number of students per semester of the course.

Data collection was performed with the aid of *Google Forms*. The administrative boards of the four institutions were asked to send the link to the questionnaire via e-mail to all students regularly enrolled in each of the ten semesters of the dental course. An active search for students at the institutions was also conducted through the social medium *Instagram*. The students contacted received clarifications regarding the objectives of the study and were asked to participate. Another recruitment strategy was sending the link to the questionnaire to groups on the message application *WhatsApp* that unite dental students. The statement of informed consent was presented at the beginning of the questionnaire, by which the students had access to the portable document format (PDF) of the file and indicated willingness to participate in the study or not.

Descriptive statistics were performed of the variables of interest. The dependent variables were depression, anxiety and stress. The independent variables were aspects related to the COVID-19 pandemic. Inferential statistical analysis was then performed with either Pearson's chi-square test or Fisher's exact test. The significance level for decisions on the statistical tests was set at 5% ($p < 0.05$).

Logistic regression analysis was then performed to determine the magnitude of the associations, with the calculation of odds ratios (OR) and respective 95% confidence intervals (CI)²¹. Variables with a p-value $< 0,20$ in the bivariate analysis were incorporated into the multivariate models and only those with a p-value < 0.05 after the adjustments remained in the final model. Moreover, Cronbach's α was calculated to estimate the reliability of the DASS-21 questionnaire. All analyses were performed with the aid of the Statistical Package for the Social Sciences (IBM SPSS, version 20.0, Chicago, USA, 2012).

All national and international ethical principles stipulated in the Declaration of Helsinki for studies involving human beings were respected. This study received approval from the Human Research Ethics Committee (presentation certificate: 28826820.5.0000.5187; approval number: 3.834.202).

RESULTS

The initial sample was composed of 535 records, 47 (8.8%) of which were excluded due to answers repeated by the same individual (when a student answered the questionnaire more than once, *Google Forms* registered the repeated answers and the duplicated responses were excluded after a detailed inspection of the database). Cronbach's α coefficient for the DASS-21 was estimated at 0.942, suggesting excellent reliability of the questionnaire in the sample studied. The prevalence of depression, anxiety and stress identified by the DASS-21 was, respectively, 60.0% ($n = 293$), 59.8% ($n = 292$) and 60,9% ($n = 297$).

Students in the third year of the course (7th and 8th semesters) accounted for the largest portion of the sample ($n = 117$, 24.0%). The highest response rate per institution/campus occurred at UFCG (34.4%). The majority of the sample was composed of the female sex ($n = 333$; 68.2%), individuals aged 22 years or younger ($n = 318$; 65.2%) and single individuals ($n = 425$; 87.1%). The most frequent family income was two to four times the monthly minimum wage ($n = 279$; 57.2%). Most students were not employed ($n = 413$; 84.6%) (Table 1).

In terms of aspects related to the COVID-19 pandemic, a non-significant reduction was found in family income during the pandemic ($n = 261$; 53.5%) and at least one resident in the 59.4% of the students' homes ($n = 290$) received financial benefits from the government due to the pandemic. Most of the respondents reported taking precautions, maintaining a distance from others, reducing contact to some extent and not visiting older people, but continued working and shopping at supermarkets and pharmacies ($n = 441$; 90.4%). Most recognized that the pandemic exerted a

negative impact on their progress in the dental course ($n = 456$; 93.4%) and many were afraid to return to clinical examinations/procedures within the context of the pandemic ($n = 203$; 41.6%). Most confirmed that the pandemic exerted a negative impact on their health ($n = 340$; 69.7%) and the quality of their interpersonal relationships ($n = 257$; 52.7%). Nearly all reported not having undergone professional mental health therapy during the pandemic ($n = 454$; 93.0%), although associations with the outcomes were nonsignificant (Table 2).

Table 2 displays the results of the bivariate analysis of related to the COVID-19 pandemic. Statistically significant associations were found between receiving emergency financial aid during the pandemic and the three outcomes of interest: stress ($p = 0.011$), anxiety ($p = 0.011$) and depression ($p = 0.025$). Statistically significant associations were also found for being afraid to return to clinical examinations/procedures within the context of the pandemic, self-perceived worse health status due to the pandemic and self-perceived negative impact on the quality of interpersonal relationships due to the pandemic for the three outcomes [depression ($p < 0.001$), anxiety ($p < 0.001$) and stress ($p < 0.001$)]. No statistically significant associations were found between the outcomes and the other variables studied ($p > 0.05$).

Table 3 displays the results of the multivariate logistic regression analysis. In the final adjusted model, "self-perceived worse health status due to the pandemic" remained associated with the three outcomes: stress (OR = 4.02; 95% CI: 2.51-6.42; $p < 0.001$), anxiety (OR = 4.63; 95% CI: 2.88-7.44; $p < 0.001$) and depression (OR = 4.38; 95% CI: 2.70-7.08; $p < 0.001$). "Afraid to return to dental examinations/procedures within the context of the pandemic" remained associated with anxiety (OR = 1.87; 95% CI: 1.06-3.28; $p = 0.031$) and stress (OR = 2.48; 95% CI: 1.41-4.37; $p = 0.002$) in the final model. The only variable that remained associated with depression was "self-perceived negative impact on the quality of interpersonal relationships due to the pandemic" (OR = 2.38; 95% CI: 1.32-4.31; $p = 0.004$).

Table 1. Characterization of sample.

Item	n	%
<i>Campus</i>		
UEPB - Campus I	97	19.9
UEPB - Campus VIII	123	25.2
UFCG	168	34.4
UFPB	100	20.5
<i>Sex</i>		
Male	155	31.8
Female	333	68.2
<i>Age*</i>		
≤ 22 years	318	65.2
> 22 years	170	34.8
<i>Marital status</i>		
Single	425	87.1
Married	12	2.5
In long-term relationship	51	10.5
<i>Family income</i>		
Up to monthly minimum wage	88	18.0
Two to four times monthly minimum wage	279	57.2
Five or more times monthly minimum wage	121	24.8
<i>Employment</i>		
Not employed	413	84.6
Works up to 20 hours per week	59	12.1
Works 20 to 40 hours per week	16	3.3
<i>Semester of course**</i>		
1 st and 2 nd	109	22.3
3 rd and 4 th	94	19.3
5 th and 6 th	87	17.8
7 th and 8 th	117	24.0
9 th and 10 th	81	16.6
Total	488	100.0

* Dichotomized by the median. ** Two semesters correspond to one year of the course.

Table 2. Bivariate analysis of associations between aspects related to pandemic and outcomes of interest: depression, anxiety and stress.

Variables	Depression				p-value	Anxiety				p-value	Stress				p-value
	Yes		No			Yes		No			Yes		No		
	n	%	n	%		n	%	n	%		n	%	n	%	
<i>Impact of pandemic on family income</i>					0.143 ⁽¹⁾					0.075 ⁽¹⁾					0.214 ⁽²⁾
Increased	11	61.1	7	38.9		14	77.8	4	22.2		14	77.8	4	22.2	
Unaltered	115	55.0	94	45.0		115	55.0	94	45.0		121	57.9	88	42.1	
Diminished	167	64.0	94	36.0		163	62.5	98	37.5		162	62.1	99	37.9	
<i>Financial benefit from government related to pandemic</i>					0.025 ^{(1)*}					0.011 ^{(1)*}					0.011 ^{(1)*}
Yes	186	64.1	104	35.9		187	64.5	103	35.5		190	65.5	100	34.5	
No	107	54.0	91	46.0		105	53.0	93	47.0		107	54.0	91	46.0	
<i>Social isolation during pandemic</i>					0.516 ⁽²⁾					0.257 ⁽²⁾					0.330 ⁽²⁾
No	3	100	0	0.0		2	66.7	1	33.3		3	100.0	0	0.0	
Sought to maintain distance from others, but continued working and shopping at supermarket and pharmacy	264	59.9	177	40.1		259	58.7	182	41.3		265	60.1	176	39.9	
Stayed strictly at home	26	59.1	18	40.9		31	70.5	13	29.5		29	65.9	15	34.1	
<i>Negative impact of pandemic on progress in course</i>					0.150 ⁽²⁾					0.393 ⁽²⁾					0.540 ⁽²⁾
No	0	0.0	1	100.0		0	0.0	1	100.0		0	0.0	1	100.0	
Yes	278	61.0	178	39.0		275	60.3	181	39.7		279	61.2	177	38.8	
To some degree	15	48.4	16	51.6		17	54.8	14	45.2		18	58.1	13	41.9	
<i>Afraid to return to clinical procedures in context of pandemic</i>					< 0.001 ^{(1)*}					< 0.001 ^{(1)*}					< 0.001 ^{(1)*}
No	46	50.5	45	49.5		39	42.9	52	57.1		41	45.1	50	54.9	
Yes	144	70.9	59	29.1		143	70.4	60	29.6		154	75.9	49	24.1	
To some degree	103	53.1	91	46.9		110	56.7	84	43.3		102	52.6	92	47.4	
<i>Pandemic caused changes in personal health status</i>					< 0.001 ^{(1)*}					< 0.001 ^{(1)*}					< 0.001 ^{(1)*}
Unaltered	39	33.1	79	66.9		38	32.2	80	67.8		40	33.9	78	66.1	
Improved	9	30.0	21	70.0		11	36.7	19	63.3		12	40.0	18	60.0	
Worsened	245	72.1	95	27.9		243	71.5	97	28.5		245	72.1	95	27.9	
<i>Negative impact of pandemic on quality of interpersonal relationships</i>					< 0.001 ^{(1)*}					< 0.001 ^{(1)*}					< 0.001 ^{(1)*}
No	29	37.2	49	62.8		30	38.5	48	61.5		35	44.9	43	55.1	
Yes	178	69.3	79	30.7		170	66.1	87	33.9		176	68.5	81	31.5	
To some degree	86	56.2	67	43.8		92	60.1	61	39.9		86	56.2	67	43.8	
<i>Professional mental health therapy during pandemic</i>					0.608 ⁽¹⁾					0.626 ⁽¹⁾					0.801 ⁽¹⁾
No	274	60.4	180	39.6		273	60.1	181	39.9		277	61.0	177	39.0	
Yes	19	55.9	15	44.1		19	55.9	15	44.1		20	58.8	14	41.2	

¹ Pearson's chi-square test, ² Fisher's exact test, * p < 0.05

Table 3. Results of multivariate logistic regression analysis of factors associated with depression, anxiety and stress.

Variables	Depression		
	aOR	95% CI	p-value
<i>Pandemic caused changes in personal health status</i>			
Unaltered	1		
Improved	0.89	0.35-2.26	0.812
Worsened	4.38	2.70-7.08	< 0.001*
<i>Negative impact of pandemic on quality of interpersonal relationships</i>			
No	1		
Yes	2.38	1.32-4.31	0.004*
To some degree	1.55	0.83-2.90	0.166
Variables	Anxiety		
	aOR	95% CI	p-value
<i>Afraid to return to dental procedures within context of pandemic</i>			
No	1		
Yes	1.87	1.06-3.28	0.031*
To some degree	1.48	0.85-2.57	0.167
<i>Pandemic caused changes in personal health status</i>			
Unaltered	1		
Improved	1.18	0.49-2.84	0.713
Worsened	4.63	2.88-7.44	< 0.001*
Variable	Stress		
	aOR	95% CI	p-value
<i>Afraid to return to dental procedures within context of pandemic</i>			
No	1		
Yes	2.48	1.41-4.37	0.002*
To some degree	1.06	0.62-1.82	0.829
<i>Pandemic caused changes in personal health status</i>			
Unaltered	1		
Improved	1.11	0.47-2.62	0.813
Worsened	4.02	2.51-6.42	< 0.001*

aOR: adjusted odds ratio; CI: confidence interval, * p < 0.05.

DISCUSSION

University students throughout the world are more vulnerable to psychological problems due to various stressors and educational demands in the academic setting^{9,10}. The COVID-19 pandemic further impacted the mental health of these students, with levels of stress and anxiety believed to be higher in the majority of this population¹³.

Undergraduate students of dentistry constitute one of the groups with the highest levels of stress among students in the health field due to the need for the development of psychomotor skills required in the course. Besides this high level of stress inherent to dental students, this group is also at the greatest risk of contamination in the context of the pandemic due to direct contact with the oral cavity and exposure to aerosols. Thus, factors such as the fear of contamination, uncertainty with regards to the future and delayed progress in the course are new stressors that tend to affect the mental health of dental students^{4,5,22,23}.

Disorders such as stress, anxiety and depression affect the teaching-learning process and quality of life of students and the occurrence of these disorders may have been increased during the pandemic^{2,11}. The present study described the presence of these disorders in undergraduate students of dental courses at four public universities in a state in Northeast Brazil during the pandemic in the year 2020. The data point to the high prevalence of symptoms of depression, anxiety and stress irrespective of the intensity of such symptoms. This finding is in agreement with data described in previous studies developed during the pandemic with undergraduate students in dentistry courses. For instance, a study conducted in Saudi Arabia and another study conducted in Croatia found high levels of these outcomes [depression (60.6%), anxiety (37%) and stress (34.9%); depression (50.8%), anxiety (50.9%) and stress (49.9%), respectively]. The studies cited used the DASS-21 to measure these disorders^{6,24}, but one should bear in mind that this instrument only measures symptoms of the disorders and cannot be considered a diagnostic tool for these outcomes^{6,24}.

As clinic and classroom activities were suspended at the time of the study and bearing in mind the awareness of the risk of contamination by SARS-CoV-2, the present data point to a tendency toward vulnerability on the part of university students in dental courses with regards to the development of psychological problems resulting from high-pressure situations in the context of the pandemic as well as distancing from routine activities, which can exert a negative impact on mental health⁶. The high levels of depression, anxiety and stress found in these students may also be explained by the unique challenges and characteristics of the undergraduate course in dentistry, with high intellectual and psychosocial demands as well as the need to develop practical skills in this naturally challenging academic environment complicated by the occurrence of a pandemic marked by fear and uncertainty.²⁵

The characterization of the students in the present study is in agreement with that described in previous studies involving similar populations: individuals 22 years of age or younger, single and female^{23,26-28}. Most of the students in this study were not employed, which may be explained by the fact that dentistry is a full-time course and requires exclusive dedication. This result is in agreement with data described in previous studies reporting that 93.9%²⁹ to 98.7% of students do not have employment³⁰.

Financial difficulties are among the factors that most tend to exert a negative impact on the mental health of students. However, no associations were found between a possible negative impact of the pandemic on family income and the outcomes analyzed³¹.

With the aim of ensuring the basic needs of the Brazilian population, the federal government instituted emergency aid for unemployed and self-employed individuals as well as formal and informal workers whose activities were affected by the pandemic and who were not beneficiaries of other financial assistance programs³². Receiving this benefit was considered in the present study and significant associations were found with depression, anxiety and stress in the bivariate analysis. The accentuated unemployment and layoffs caused by the pandemic are associated with lower levels of physical and mental health, causing symptoms of depression and anxiety and exerting a negative impact on quality of life. Thus, emergency aid emerged as a tool to give support in this health context³³.

Teaching institutions in Brazil were advised to develop their activities in an online format due to the context of social distancing throughout the country³⁴. Social isolation is an uncomfortable experience due to the limited freedom to come and go and interact personally with friends and loved ones. This situation can have considerable consequences, such as depression, anxiety and stress³⁵. In the present investigation, however, no statistically significant associations were found between social isolation and the outcomes analyzed. The vast majority of the dental students reported practicing social distancing as much as possible, which is behavior recommended and encouraged by health agencies, considering the fact that social isolation is effective at reducing the dissemination of SARS-CoV-2³⁶.

High levels of anxiety were found among the students who reported being concerned with the delayed progress of the course due to COVID-19³. However, no significant associations were found between the negative impact of the pandemic on progress of the course and the outcomes analyzed (depression, anxiety and stress). This finding is in disagreement with data from a study conducted in Romania, in which students were apprehensive about the impact that online classes would have on their education and the negative impact on their practical training³⁷.

Fear of returning to clinical examinations and procedures within the context of the pandemic was significantly associated with the three outcomes in the bivariate analysis, but the associations were maintained only for anxiety and stress in the multiple logistic regression analysis. Thus, the students were anxious and stressed with the return to clinic activities. With the suspension of these activities, the number of patients would be increased and the organization of distancing and protection measures would constitute a considerable challenge for the development of clinic activities. One should bear in mind that there was no determination of the return to activities at the time of the study or well-organized measures on the part of teaching institutions for the return to clinical practice, such as changes in the physical structure of clinics, a reduction in the number of students in clinics, alternating schedules and more specific biosafety protocols, which would justify this situation of anxiety and stress³⁸.

Confinement, social isolation, the loss of routines, boredom, feelings of frustration and uncertainty about the future, which were common characteristics during the pandemic, exert a direct influence on quality of life and, consequently,

general health. These stressors could lead to difficulty sleeping, insufficient sleep and strong psychological problems, as demonstrated in the multivariate analysis with regard to changes in general health status caused by the pandemic, which was associated with all three outcomes analyzed³⁵.

Significant associations were found between the negative impact of the pandemic on interpersonal relationships and all three outcomes in the bivariate analysis. However, only the association with depression was maintained in the multivariate logistic regression analysis. Iurcov *et al.* (2021)³⁷ found that the degree of satisfaction on the part of students with their mental health was positively correlated with the degree of satisfaction with regards to relationships with friends and family members during the pandemic. For instance, many students needed to move back into the home of family members, which had a negative impact on daily social contact, influencing interactions with friends, roommates and classmates. In this context of unexpected changes due to social isolation, being at home for long periods of time with family members can make students more stressed and anxious³⁹. Thus, COVID-19 exerted a negative impact on the capacity of students to engage in social activities and connect with friends and family, which can consequently contribute to a greater risk of developing depressive symptoms⁴⁰.

The pandemic brought changes and uncertainties faced by the entire population. With regards to dental students, concerns with the continuity of the course and the interruption of the academic routine were stressors that could be associated to a worse mental health status. Unfortunately, however, most of the students did not undergo any type of professional mental health therapy at the time of the study. In the scenario of a world health crisis, there is an urgent need for teaching institutions to offer support to students for the management of feelings and anguish in times of uncertainty, placing value on the physical and mental health of their students. For example, *Universidade de São Paulo* offers a cell phone application that assists in monitoring the mental health of students. The app has several videos addressing subjects such as depression, anxiety, relaxation, etc. and also has personalized graphs based on answers to questionnaires that can assist students in building knowledge about themselves and monitoring their psychological wellbeing.

The associations found in the present investigation underscore the need for discussions on mental health in times of crises, such as the occurrence of a pandemic, and how these students are affected by such events. Teaching institutions and government agencies have a social duty to support these individuals in situations of social isolation, the loss of motivation and moments of apprehension, providing help and means of improving the mental health of students as well as encouraging the adoption of a healthier lifestyle.

Despite the relevant findings of this study, some limitations should be considered when interpreting the results. The cross-sectional design does not enable analyzing cause-and-effect relationships or establishing temporal relationships between variables. Another limitation was the reach of the questionnaire. As data collection was performed online during the COVID-19 pandemic, the links were sent to the students, who then decided whether they would participate in the study.

CONCLUSION

The prevalence of the depression, anxiety and stress was high among undergraduate students in the dentistry course of the four public teaching institutions that participated in the present study. The multivariate analysis revealed associations with important aspects of the coronavirus pandemic. "Self-perceived worse health status due to the pandemic" was associated with all three outcomes. "Afraid to return to clinical examinations/procedures in the context of the pandemic" remained associated with anxiety and stress in the final model and "self-perceived negative impact on the quality of interpersonal relationships due to the pandemic" remained associated with depression.

REFERENCES

1. Ali S, Maguire S, Marks E, Doyle M, Sheehy C. Psychological impact of the COVID-19 pandemic on healthcare workers at acute hospital settings in the South-East of Ireland: An observational cohort multicentre study. *BMJ Open* [Internet]. 2020;10(12):e042930. doi: <https://doi.org/10.1136/bmjopen-2020-042930>

2. Wang C, Horby PW, Hayden FG, Gal GF. A novel coronavirus outbreak of global health concern. *Lancet* [Internet]. 2020;395(10223):470-473. doi: [https://doi.org/10.1016/S0140-6736\(20\)30185-9](https://doi.org/10.1016/S0140-6736(20)30185-9)
3. Organização Mundial de Saúde (OMS). Coronavirus Disease (COVID-19) Dashboard World Health Organization 2020 [cited 2020 Sept 28]. Available from: <https://covid19.who.int/>
4. Coulthard P, Thomson P, Dave M, Coulthard FP, Seoudi N, Hill M. The COVID 19 pandemic and dentistry: The clinical, legal and economic consequences – Part 1: Clinical. *Br Dent J* [Internet]. 2020;229(11):743–747. doi: <https://doi.org/10.1038/s41415-020-2404>
5. Yildirim TT, Atas O. The evaluation of psychological state of dental students during the COVID-19 pandemic. *Braz Oral Res* [Internet]. 2021;10(35):e069. doi: <https://doi.org/10.1590/1807-3107bor-2021.vol35.0069>
6. Hakami Z, Khanagar SB, Vishwanathaiah S, Hakami A, Bokhari AM, Jabali AH, et al. Psychological impact of the coronavirus disease 2019 (COVID-19) pandemic on dental students: A nationwide study. *J Dent Educ* [Internet]. 2021;85(4):494-503. doi: <https://doi.org/10.1002/jdd.12470>
7. Organização Mundial de Saúde (OMS). Cross-national comparisons of the prevalences and correlates of mental disorders. World Health Organization international consortium in psychiatric epidemiology. In *Handbook of working with children, trauma, and resilience: An intercultural psychoanalytic view 2015* [cited 2021 May 10]. Available from: <https://apps.who.int/iris/bitstream/handle/10665/268101/PMC2560724.pdf?sequence=1&isAllowed=y>
8. Organização Mundial de Saúde (OMS). Depression and other common mental disorders: global health estimates 2017 [cited 2019 Dec 14]. Available from: <http://apps.who.int/iris/bitstream/10665/254610/1/WHOMSD-MER-2017.2-eng.pdf>
9. Elani HW, Alisson PJ, Kumar RA, Mancini L, Lambrou A, Bedos C. A systematic Review of Stress in Dental Students. *J Dent Educ* [Internet]. 2014;78(2):226-242. doi: <https://doi.org/10.1002/j.0022-0337.2014.78.2.tb05673.x>
10. Stormon N, Ford PJ, Kisely S, Bartle E, Eley DS. Depression, anxiety and stress in a cohort of Australian dentistry students. *Eur J Dent Educ* [Internet]. 2019;23(4):507-514. doi: <https://doi.org/10.1111/eje.12459>
11. Aboalshamat K, Hou X, Strodl E. Psychological well-being status among medical and dental students in Makkah, Saudi Arabia: A cross-sectional study. *Med Teach* [Internet]. 2015;37(1):75-81. doi: <https://doi.org/10.3109/0142159X.2015.1006612>
12. Araújo FJ, Lima LS, Cidade PI, Nobre CB, Neto MLR. Impact of Sars-Cov-2 and its reverberation in global higher education and mental health. *Psychiatry Res* [Internet]. 2020;288:112977. doi: <https://doi.org/10.1016/j.psychres.2020.112977>
13. Cao W, Fang Z, Hou G, Han M, Xu X, Dong J, et al. The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res* [Internet]. 2020;287:112934. doi: <https://doi.org/10.1016/j.psychres.2020.112934>
14. Antunes JLF, Peres MA. *Epidemiologia da Saúde Bucal*. Guanabara Koogan. Rio de Janeiro; 2006.
15. Garbee WH, Zucker SB, Selby GR. Perceived sources of stress among dental students. *J Am Dent Assoc* [Internet]. 1980;100(6):853-857. doi: <https://doi.org/10.14219/jada.archive.1980.0279>
16. Lovibond PF, Lovibond SH. The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behav Res Ther* [Internet]. 1995;33(3):335-343. doi: [https://doi.org/10.1016/0005-7967\(94\)00075-u](https://doi.org/10.1016/0005-7967(94)00075-u)
17. Antony MM, Bieling PJ, Cox BJ, Enns MW, Swinson RP. Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and a community sample. *Psychological Assessment* [Internet]. 1988;10(2):176-181. doi: <https://doi.org/10.1037/1040-3590.10.2.176>
18. Crawford JR, Henry JD. Depression Anxiety Stress Scales (DASS): Normative data and latent structure in a large non-clinical sample. *Br J Clin Psychol* [Internet]. 2003;42:111-131. doi: <https://doi.org/10.1348/014466503321903544>
19. Apostolo JLA, Mendes AC, Azeredo ZA. Adaptação para a língua portuguesa da Depression, Anxiety and Stress Scale. *Rev Latino-Am Enfermagem* [Internet]. 2006;14(6):863-871. doi: <https://doi.org/10.1590/S0104-07082006000600008>

<https://doi.org/10.1590/S0104-11692006000600006>

20. Vignola RCB, Tucci AM. Adaptation and validation of the depression, anxiety and stress scale (DASS) to Brazilian Portuguese. *J Affect Disord* [Internet]. 2014;155:104-109. doi: <https://doi.org/10.1016/j.jad.2013.10.031>
21. Hair JF, Anderson R, Babin B. *Multivariate Data Analysis*. 7th ed. Prentice-Hall. New Jersey; 2009.
22. Mafla AC, Villa-Torres L, Polychronopoulou A, Polanco H, Moreno-Juvinao V, Parra-Galvis D, et al. Burnout prevalence and correlates amongst Colombian dental students: the STRESSCODE study. *Eur J Dent Educ* [Internet]. 19(4):242-50. doi: <https://doi.org/10.1111/eje.12128>
23. Hakami Z, Vishwanathaiah S, Abuzinadah SH, Alhaddad AJ, Bokhari AM, Marghalani HYA, et al. Effects of COVID-19 lockdown on the mental health of dental students: A longitudinal study. *J Dent Educ* [Internet]. 2021;13:1–9. doi: <https://doi.org/10.1002/jdd.12758>
24. Talapko J, Peric I, Vulic P, Pustijanac E, Jukic M, Bekic S, et al. Mental Health and Physical Activity in Health-Related University Students during the COVID-19 Pandemic. *Healthcare (Basel)*. 2021;9(7):801. doi: <https://doi.org/10.3390/healthcare9070801>
25. Collin V, O'Selmo E, Whitehead P. Stress, psychological distress, burnout and perfectionism in UK dental students. *Br Dent J* [Internet]. 2020;229(9):605-614. doi: <https://doi.org/10.1038/s41415-020-2281-4>
26. Rovida TAS, Sumida DH, Santos AS, Moimaz SAS, Garbin CAS. Estresse e o estilo de vida dos acadêmicos ingressantes em um curso de graduação em Odontologia. *Rev ABENO* [Internet]. 2015;15(3):26-43. doi: <https://doi.org/10.30979/rev.abeno.v15i3.193>
27. Saliba TA, Sandre AS, Sumida DH, Garbin CAS, Moimaz SAS. Stress, cortisol levels and the adaptation of Dental students to the academic environment. *Rev ABENO* [Internet]. 2018;18(3):137-147. doi: <https://doi.org/10.30979/rev.abeno.v18i3.689>
28. Jowkar Z, Masoumi M, Mahmoodian H. Psychological Stress and Stressors Among Clinical Dental Students at Shiraz School of Dentistry, Iran. *Adv Med Educ Pract* [Internet]. 2020;11:113-120. doi: <https://doi.org/10.2147/AMEP.S236758>
29. Toassi RFC, Souza JM, Rosing CK, Baumgarten A. Perfil Sociodemográfico e Perspectivas em Relação à Profissão do Estudante de Odontologia da Universidade Federal do Rio Grande do Sul, Brasil. *Rev Fac Odontol* [Internet]. 2011;52(1/3):25-32. doi: <https://doi.org/10.22456/2177-0018.29914>
30. Loffredo LCM, Pinelli C, Garcia PPNS, Gulnara S, Camparis CA. Característica Socioeconômica, Cultural e Familiar dos Estudantes de Odontologia. *Rev Odontol UNESP* [Internet]. 2004;33(4):175-182.
31. Richardson T, Elliot P, Roberts R, Jansen M. A Longitudinal Study of Financial Difficulties and Mental Health in a National Sample of British Undergraduate Students. *Community Ment Health J* [Internet]. 2017;53(3):344-352. doi: <https://doi.org/10.1007/s10597-016-0052-0>
32. Brasil. Diário Oficial da União. Lei nº 13.982, de 2 de abril de 2020. Altera a Lei nº 8.742, de 7 de dezembro de 1993, para dispor sobre parâmetros adicionais de caracterização da situação de vulnerabilidade social para fins de elegibilidade ao benefício de prestação continuada (BPC), e estabelece medidas excepcionais de proteção social a serem adotadas durante o período de enfrentamento da emergência de saúde pública de importância internacional decorrente do coronavírus (Covid-19) responsável pelo surto de 2019, a que se refere a Lei nº 13.979, de 6 de fevereiro de 2020. [cited 2021 Sept 10]. Available from: <https://www.in.gov.br/en/web/dou/-/lei-n-13.982-de-2-de-abril-de-2020-250915958>
33. Silva CP, Albuquerque FDN, Lopes J. Representações sociais do desemprego, saúde mental e pandemia da covid-19 em uma pequena amostra brasileira. *BJHR* [Internet]. 2021;4(2):7249-7262. doi: <https://doi.org/10.34119/bjhrv4n2-269>
34. Brasil. Ministério da Educação. Diário Oficial da União. Gabinete do Ministro. Portaria nº 343, de 17 de março de 2020. Dispõe sobre a substituição das aulas presenciais por aulas em meios digitais enquanto durar a situação de pandemia do Novo Coronavírus - COVID-19 [cited 2021 Sept 10]. Available from: <http://www.in.gov.br/en/web/dou/-/portaria-n-343-de-17-de-marcode-2020-248564376>

35. Brooks SK, Webster RK, Smith LE, Louise E, Woodland L, Wessely S, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet* [Internet]. 2020;395(10227):912–920. doi: [https://doi.org/10.1016/S0140-6736\(20\)30460-8](https://doi.org/10.1016/S0140-6736(20)30460-8)
36. Silva PGB, Oliveira CAL, Borges MMF, Moreira DM, Alencar PNB, Avelar RF, et al. Distance learning during social seclusion by COVID-19: Improving the quality of life of undergraduate dentistry students. *Eur J Dent Educ* [Internet]. 2021;25(1):124-134. doi: <https://doi.org/10.1111/eje12583>
37. Iurcov R, Pop LM, Ciavoi G, Iorga M. Evaluating the practice of preventive behaviors and the fear of COVID-19 among dentists in Oradea metropolitan area after the first wave of pandemic: a cross-sectional study. *Healthcare* [Internet]. 2021;9(4):443. doi: <https://doi.org/10.3390/healthcare9040443>
38. Al Kawas S, Al-Rawi N, Talaat W, Hamdoon Z, Salman B, Bayatti SA, et al. Post COVID-19 lockdown: measures and practices for dental institutes. *BMC Oral Health* [Internet]. 2020;20(291):1-7. doi: <https://doi.org/10.1186/s12903-020-01281-6>
39. Prieto D, Tricio J, Cáceres F, Param F, Meléndez C, Vásquez P, et al. Academics' and students' experiences in a Chilean dental school during the COVID-19 pandemic: A qualitative study. *Eur J Dent Educ* [Internet]. 2021;25(4):689-697. doi: <https://doi.org/10.1111/eje.12647>
40. Birmingham WC, Wadsworth LL, Lassetter JH, Graff TC, Lauren E, Hung M. COVID-19 lockdown: Impact on college students' lives. *J Am C Health* [Internet]. 2021;22:1-15. doi: <https://doi.org/10.1080/07448481.2021.1909041>

Conflict of Interest: The authors declare having no conflicts of interest.

Funding: No funding to declare.

Authors' contributions: Conception and planning of study: MAOV, FDSF, ACLTM, SDLBC. Data collection, analysis and interpretation: MAOV, FDSF, ACLTM. Drafting or revision of manuscript: MAOV, ACLTM, SDLBC. Approval of final version: MAOV, FDSF, ACLTM, SDLBC. Public responsibility for the content of the article: MAOV, ACLTM.