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Stress, Anxiety, and Depression in Dentistry Students: The Impact of the COVID-19 Pandemic and Sociodemographic Factors

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ABSTRACT

Objective: To assess the influence of the COVID-19 pandemic and sociodemographic factors on stress, anxiety, and depression levels among dental students. **Material and Methods:** This observational study employed a census approach featuring a quantitative, descriptive, and analytical cross-sectional analysis. The research was conducted within a university center in northeastern Brazil from March to May 2021. Two questionnaires were administered: the Depression, Anxiety, and Stress Scale (DASS-21) and another survey focusing on sociodemographic factors. Pearson's chi-square test was employed to examine potential associations between the variables, and multiple logistic regression models were fitted, with a significance level set at 5%. **Results:** The study included 128 dentistry students, predominantly female, with a high monthly family income. The data revealed normal levels across the three DASS subscales. A significant association was observed between anxiety and sex (X^2=10.37; p=0.03). The depression subscale exhibited associations with ethnic group (X^2=47.46; p<0.01), area of residence (X^2=12.44; p=0.03), and appropriate study space (X^2=11.48; p=0.04). Urban residents were 4.29 times more likely to experience depression than their rural counterparts (OR=4.29; 95%CI 1.28-14.42). **Conclusion:** While psychological profiles were as expected, targeted interventions for vulnerable groups are crucial. Future research should use longitudinal designs and assess trailored interventions' effectiveness to enhance mental health outcomes among students.

Keywords: Students, Dental; Dentistry; Mental Health; SARS-CoV-2.

Introduction

The challenges posed by the pandemic compelled nations to enforce stringent isolation protocols, ensuring widespread compliance among citizens to contain the spread of the vírus [1]. Brazilian universities adhered to ordinance no. 343/2020 from the Ministry of Education, transitioning from in-person courses to digital and technological teaching methods amidst the COVID-19 pandemic [2].

The pandemic scenario heightened emotional expressions, amplified by the constraints of social isolation. These challenges impacted sociodemographic factors and disrupted future plans, often resulting in distressing separation from family and friends [3]. Significant increases in depression, fear, insecurity, anxiety, stress, and mood fluctuations, especially in young students, require heightened attention [4]. In addition, dental students commonly experience higher stress levels compared to the general population during their academic training [5]. A recent cross-sectional study employing machine learning disclosed a high prevalence of anxiety (15.5%) and depression symptoms (32.4%) among college students. This highlights the intricate interplay of various factors, including alcohol use, mask-wearing, sleep quality, taking exams after reopening, and family economic status [6].

Acknowledging the profound impact of the COVID-19 pandemic on diverse aspects of human well-being and the existing research gap in mental health [7], particularly among dentistry students, motivated us to initiate this investigation. We opted for the Depression Anxiety Stress Scale-21 (DASS-21) due to its proven effectiveness and reliability in assessing levels of depression, anxiety, and stress [8].

Building upon this foundation, the present study aimed to assess the influence of the COVID-19 pandemic and sociodemographic variables on stress, anxiety, and depression levels among dentistry students.

Material and Methods

Ethical Considerations

This study received approval from a Brazilian Human Research Ethics Committee (Certificate No. 5,414,513). Adhering to both individual and collective ethical principles outlined in the Declaration of Helsinki and Brazilian Resolution, the research was conducted.

Study Type and Location

This study represents a cross-sectional census observational research conducted at a significant university center in Campina Grande, located in Northeastern Brazil. The study population comprised all students enrolled in the Dentistry course at the evaluated higher education institution, following meticulous application of eligibility criteria. The sample was selected conveniently due to the COVID-19 pandemic. The sample size calculation was not included in the study planning due to the restrictions imposed by the pandemic at the time of data collection and the census nature of the study.

Eligible participants included Dentistry students engaged in remote classes during the pandemic's restricted period. Exclusions applied to those completing less than 50% of the questionnaire and students concurrently enrolled in other courses [9]. Students from the initial periods (1st and 2nd) during data collection were also excluded due to limited remote teaching experiences.

Data Collection

Before initiating data collection, researchers (G.J.M.B. and M.C.B.S.) underwent a two-step calibration process. The initial phase included a theoretical session to acquaint themselves with the research, instruments,

and methodologies. Subsequently, researchers (G.J.M.B. and M.C.B.S.) completed the questionnaires to enhance their comprehension of all aspects. The Kappa test was used to assess inter- and intra-examiner reliability ($\kappa =$ 0.81 and 0.79, respectively). A pilot study involving 20 students from the initial periods was conducted to identify potential weaknesses in the research instruments. Data from this phase were not included in the final analysis.

Data collection included distributing questionnaires to students between March and May 2021, aligning with the hybrid teaching model in place. Remote instruction was predominant for theoretical classes, while in-person sessions resumed for clinics and laboratories. Stringent adherence to biosafety measures was observed throughout the data collection process.

The process involved elucidating the methodological procedures and requesting participants' signatures on the research consent form. No losses were incurred, and participants encountered no difficulties while completing the questionnaires.

The study employed two instruments: the Depression, Anxiety, and Stress Scale (DASS-21) for assessing emotional well-being, and a sociodemographic questionnaire developed by the authors. The DASS-21 questionnaire assesses emotional states by examining subjects' behaviors and sensations, streamlining evaluation without the need for multiple instruments. It has been validated and adapted to Brazilian Portuguese [10].

This research employs the tripartite model. The DASS is originally a 42-item assessment (DASS-42). The shortened version with 21 items was selected due to its prior validation and adaptation in the Brazilian context, as well as its ease of application. These items reflect the symptoms experienced by subjects in the preceding week, rated on a Likert scale ranging from 0 ("does not apply to me at all") to 3 ("most of the time applies to me"). The subclass score is the sum of the relevant questions.

For depression, scores below 9 are 'normal', 10-13 are 'mild', 14-20 are 'moderate', 21-27 are 'severe', and above 28 are 'extremely severe'. Anxiety scores under 7 are 'normal', 8-9 are 'mild', 10-14 are 'moderate', 15-19 are 'severe', and above 20 are 'extremely severe'. Stress scores below 14 are 'normal', 15-18 are 'mild', 19-25 are 'moderate', 26-33 are 'severe', and above 34 are 'extremely severe' [11].

Data Analysis

Data analysis employed R Core Team [12]. The three DASS-21 subscales served as dependent variables, while sociodemographic factors acted as explanatory variables. Variables were characterized by frequencies, and Pearson's Chi-square test examined associations between stress, anxiety, and depression levels, and sociodemographic factors.

Multiple logistic regression models were adjusted, considering independent variables, to analyze factors associated with the outcome. The Backward procedure was used to select variables, initially incorporating all the variables. Variables with a probability of association above 0.20 were removed, leaving only those with a significance level below 0.20 ($p<0.20$) in the final model. Crude and adjusted odds ratios (ORs) were calculated with 95% confidence intervals (CIs) and Wald tests.

Results

The study involved 128 participants, with a mean age of 27.2 years (SD=6.7). Regarding stress, 50 (39.1%) of the participants exhibited normal levels, followed by a moderate level 26 (20.3%). The majority of the population showed normal levels for both the "anxiety" and "depression" subscales. Notably, 32 (25.0%) of the participants displayed an extremely severe level of anxiety, making it the second most prevalent level in this domain.

Table 1. The anxiety, depression, and stress levels of participants.

DASS-21 Subscales	Extremely Severe		Severe		Moderate		Mild		Normal		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Stress	16	12.5	17	13.3	26	20.3	19	14.8	50	39.1	128	100.0
Anxiety	32	25.0	14	10.9	27	21.1	12	9.4	43	33.6	128	100.0
Depression	13	10.2	11	8.6	31	24.2	16	12.5	57	44.5	128	100.0

DASS-21: Depression, Anxiety and Stress Scale.

The majority were female and identified as white or mixed race, and were single. The majority lived in urban areas, owned their own homes, and had access to the Internet. A significant proportion had suitable study environments. The monthly family income for 73 (57.0%) participants was four or more minimum wages.

Table 2. Sociodemographic characteristics of the study population.

Variables	N	%
Sex		
Male	40	31.2
Female	88	68.7
Ethnic Group		
Yellow	8	6.2
White	62	48.4
Mixed race	54	42.2
Black	4	3.1
Monthly Family Income*		
Less than 1 minimum wage	2	1.6
1 to 3 minimum wages	51	39.8
4 or more minimum wages	73	57.0
Preferred not to disclose	2	1.6
Residential Area		
Rural	16	12.5
Urban	112	87.5
Marital Status		
Single	85	66.4
With partner	41	32.0
Separated	2	1.6
Housing Situation		
Own	97	75.8
Provided	9	7.0
Rented	15	11.7
Financed	7	5.5
Appropriate Study Space		
Yes	102	79.7
No	26	20.3
Housing with Internet Access		
Yes	127	99.2
No	1	0.7
Internet Quality		
Excellent	43	33.6
Good	70	54.7
Fair	14	10.9
Poor	1	0.8

*The categories were based on the prevailing minimum wage during the data collection period: R$1,100,00.

No significant associations were found between the independent variables and the "stress" outcome ($p>0.05$) (Table 3). However, female gender was related to the "anxiety" outcome ($X^2=10.37$; $p=0.03$) (Table 4). Additionally, the depression subscale showed associations with ethnic group ($X^2=47.46$; $p<0.01$), residential area ($X^2=12.44$; $p=0.03$), and appropriate study space ($X^2=11.48$; $p=0.04$) (Table 5).

Table 3. Association of DASS-21 Stress results with sociodemographic factors.

Variables	Stress												X²	p-value
	Extremely Severe		Severe		Moderate		Mild		Normal		Total			
	N	%	N	%	N	%	N	%	N	%	N	%		
Age														
18 – 34 years	13	12.1	14	13.1	24	22.4	16	15.0	40	37.4	107	100.0	2.60	0.76
Over 35 years	3	14.3	3	14.3	2	9.5	3	14.3	10	47.6	21	100.0		
Sex														
Male	3	7.5	3	7.5	5	12.5	8	20.0	21	52.5	40	100.0	9.82	0.08
Female	13	14.8	14	15.9	21	23.9	11	12.5	29	33.0	88	100.0		
Ethnic Group														
White	8	12.9	10	16.1	14	22.6	8	12.9	22	35.5	62	100.0	5.63	0.98
Yellow	1	12.5	2	25.0	1	12.5	1	12.5	3	37.5	8	100.0		
Black	0	0.0	1	25.0	1	25.0	1	25.0	1	25.0	4	100.0		
Mixed race	7	13.0	4	7.4	10	18.5	9	16.7	24	44.4	54	100.0		
Monthly Family Income														
Less than 1 minimum wage	0	0.0	1	50.0	0	0.0	0	0.0	1	50.0	2	100.0	13.70	0.54
1 to 3 minimum wages	8	15.7	5	9.8	12	23.5	12	23.5	14	27.5	51	100.0		
4 or more minimum wages	8	10.7	11	14.7	14	18.7	7	9.3	35	46.7	75	100.0		
Residential Area														
Urban	14	12.5	14	12.5	24	21.4	18	16.1	42	37.5	112	100.0	2.92	0.71
Rural	2	12.5	3	18.8	2	12.5	1	6.2	8	50.0	16	100.0		
Marital Status														
Single	10	11.8	12	14.1	18	21.2	13	15.3	32	37.6	85	100.0	4.77	0.90
With partner	5	12.2	5	12.2	8	19.5	6	14.6	17	41.5	41	100.0		
Separated	1	50.0	0	0.0	0	0.0	0	0.0	1	50.0	2	100.0		
Housing Situation														
Own	11	11.3	13	13.4	18	18.6	16	16.5	39	40.2	97	100.0	11.36	0.73
Provided	0	0.0	2	22.2	2	22.2	0	0.0	5	55.6	9	100.0		
Financed	1	14.3	1	14.3	1	14.3	2	28.6	2	28.6	7	100.0		
Rented	4	26.7	1	6.7	5	33.3	1	6.7	4	26.7	15	100.0		
Appropriate Study Space														
Yes	14	13.7	12	11.8	22	21.6	14	13.7	40	39.2	102	100.0	3.45	0.63
No	2	7.7	5	19.2	4	15.4	5	19.2	10	38.5	26	100.0		
Housing with Internet Access														
Yes	15	11.8	17	13.4	26	20.5	19	15.0	50	39.4	127	100.0	8.31	0.13
No	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0		
Internet Quality														
Excellent	7	16.3	5	11.6	6	14.0	8	18.6	17	39.5	43	100.0	14.69	0.47
Good	6	8.6	12	17.1	16	22.9	8	11.4	28	40.0	70	100.0		
Fair	3	21.4	0	0.0	4	28.6	3	21.4	4	28.6	14	100.0		
Poor	0	0.0	0	0.0	0	0.0	6	0.0	1	100.0	1	100.0		

*Statistically Significant.

Table 4. Association of DASS-21 Anxiety results with sociodemographic factors.

Variables	Extremely Severe		Severe		Moderate		Mild		Normal		Total		X²	p-value
	N	%	N	%	N	%	N	%	N	%	N	%		
Age														
18 – 34 years	26	24.3	13	12.1	24	22.4	10	9.3	34	31.8	107	100.0	2.20	0.70
Over 35 years	6	28.6	1	4.8	3	14.3	2	9.5	9	42.9	21	100.0		
Sex														
Male	6	15.0	3	7.5	8	20.0	2	5.0	21	52.5	40	100.0	10.37	0.03*
Female	26	29.5	11	12.5	19	21.6	10	11.4	22	25.0	88	100.0		
Ethnic Group														
White	18	29.0	7	11.3	11	17.7	7	11.3	19	30.6	62	100.0	6.09	0.91
Yellow	1	12.5	1	12.5	1	12.5	1	12.5	4	50.0	8	100.0		
Black	0	0.0	1	25.0	1	25.0	0	0.0	2	50.0	4	100.0		
Mixed race	13	24.1	5	9.3	14	25.9	4	7.4	18	33.3	54	100.0		
Monthly Family Income														
Less than 1 minimum wage	0	0.0	1	50.0	1	50.0	0	0.0	0	0.0	2	100.0	13.66	0.32
1 to 3 minimum wages	16	31.4	4	7.8	13	25.5	3	5.9	15	29.4	51	100.0		
4 or more minimum wages	16	21.3	9	12.0	13	17.3	9	12.0	28	37.3	75	100.0		
Residential Area														
Urban	25	22.3	13	11.6	24	21.4	11	9.8	39	34.8	112	100.0	3.58	0.47
Rural	7	43.8	1	6.2	3	18.8	1	6.2	4	25.0	16	100.0		
Marital Status														
Single	22	25.9	8	9.4	18	21.2	9	10.6	25	32.9	85	100.0	2.71	0.95
With partner	9	22.0	6	14.6	9	22.0	3	7.3	14	34.1	41	100.0		
Separated	1	50.0	0	0.0	0	0.0	0	0.0	1	50.0	2	100.0		
Housing Situation														
Own	23	23.7	9	9.3	23	23.7	10	10.3	32	33.0	97	100.0	10.82	0.54
Provided	3	33.3	0	0.0	1	11.1	0	0.0	5	55.6	9	100.0		
Financed	2	28.6	1	14.3	0	0.0	1	14.3	3	42.9	7	100.0		
Rented	4	26.7	4	26.7	3	20.0	1	6.7	3	20.0	15	100.0		
Appropriate Study Space														
Yes	24	23.5	12	118	21	20.6	7	6.9	38	37.3	102	100.0	6.19	0.18
No	8	30.8	2	7.7	6	23.1	5	19.2	5	19.2	26	100.0		
Housing with Internet Access														
Yes	31	24.4	14	11.0	27	21.3	12	9.4	43	33.9	127	100.0	10.03	0.55
No	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0		
Internet Quality														
Excellent	11	25.6	2	4.7	7	16.3	8	18.6	15	34.9	43	100.0	14.32	0.28
Good	16	22.9	10	14.3	17	24.3	4	5.7	23	32.9	70	100.0		
Fair	5	35.7	2	14.3	2	14.3	0	0.0	5	35.7	14	100.0		
Poor	0	0.0	0	0.0	1	100.0	0	0.0	0	0.0	1	100.0		

*Statistically Significant.

Table 5. Association of DASS-21 Depression results with sociodemographic factors.

Variables	Extremely Severe		Severe		Moderate		Mild		Normal		Total		X²	p-value
	N	%	N	%	N	%	N	%	N	%	N	%		
Age														
18 – 34 years	12	11.2	9	8.4	25	23.4	15	14.0	46	43.0	107	100.0	2.76	0.74
Over 35 years	1	4.8	2	9.5	6	28.6	1	4.8	11	52.4	21	100.0		
Sex														0.76
Male	3	7.5	3	7.5	8	20.0	7	17.5	19	47.5	40	100.0	2.57	
Female	10	11.4	8	9.1	23	26.1	9	10.2	38	43.2	88	100.0		
Ethnic Group														
White	9	14.5	3	4.8	17	27.4	4	6.5	29	46.8	62	100.0	47.46	<0.01*
Yellow	2	25.0	0	0.0	2	25.0	2	25.0	2	25.0	8	100.0		
Black	0	0.0	2	50.0	1	25.0	1	25.0	0	0.0	4	100.0		
Mixed race	2	3.7	6	11.1	11	20.4	9	16.7	26	48.1	54	100.0		
Monthly Family Income														
Less than 1 minimum wage	1	50.0	0	0.0	0	0.0	0	0.0	1	50.0	2	100.0	12.51	0.64
1 to 3 minimum wages	5	9.8	4	7.8	17	33.3	7	13.7	18	35.3	51	100.0		
4 or more minimum wages	7	9.3	7	9.3	14	18.7	9	12.0	38	50.7	75	100.0		
Residential Area														
Urban	11	9.8	7	6.2	30	26.8	16	14.3	48	42.9	112	100.0	12.44	0.03*
Rural	2	12.5	4	25.0	1	6.2	0	0.0	9	56.2	11	100.0		
Marital Status														
Single	10	11.8	8	9.4	18	21.2	11	12.9	38	44.7	85	100.0	9.52	0.48
With partner	2	4.9	3	7.3	13	31.7	5	12.2	18	43.9	41	100.0		
Separated	1	50.0	0	0.0	0	0.0	0	0.0	1	50.0	2	100.0		
Housing Situation														
Own	9	9.3	8	8.2	24	24.7	15	15.5	41	42.3	97	100.0	15.80	0.39
Provided	0	0.0	1	11.1	2	22.2	0	0.0	6	66.7	9	100.0		
Financed	1	14.3	0	0.0	2	28.6	1	14.3	3	42.9	7	100.0		
Rented	3	20.0	2	13.3	3	20.0	0	0.0	7	46.7	15	100.0		
Appropriate Study Space														
Yes	7	6.9	9	8.8	27	26.5	12	11.8	47	46.1	102	100.0	11.48	0.04*
No	6	23.1	2	7.7	4	15.4	4	15.4	10	38.5	26	100.0		
Housing with Internet Access														10.11
Yes	12	9.4	11	8.7	31	24.4	16	12.6	57	44.9	127	100.0		0.06
No	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0		
Internet Quality														
Excellent	6	14.0	1.0	2.3	9	20.9	6	14.0	9	20.9	43	100.0	19.05	0.21
Good	4	5.7	9	12.9	16	22.9	8	11.4	16	22.9	70	100.0		
Fair	3	21.4	1	7.1	6	42.9	1	7.1	6	42.9	14	100.0		
Poor	0	0.0	0	0.0	0	0.0	1	100.0	0	0.0	1	100.0		

*Statistically Significant.

Among the three outcomes examined, it's noteworthy that female participants were approximately twice as likely to experience anxiety compared to male participants (OR=2.51; 95% CI: 1.06-5.97). In terms of the depression subscale, the area of residence demonstrated a significant association (LR-test<0.05). Individuals residing in urban areas were about four times more likely to experience depression (OR=4.29; 95% CI: 1.28-14.42) (Table 6).

Table 6. Multiple logistic regression models examining the association between three subscales in the outcome variable and sociodemographic characteristics.

Variables	Stress				
	Crude OR (95%CI)	p-value	Adjusted OR (95%CI)	Wald's test	LR-test
Sex					
Male	1.0		1.0		0.058
Female	2.51 (0.94-6.68)	0.066	2.47 (0.92-6.6)	0.072	
Ethnic Group					
Yellow	—	—	—	—	—
White	—	—	—	—	—
Mixed race	—	—	—	—	—
Black	—	—	—	—	—
Monthly Family Income					
Less than 1 minimum wage	1.0		1.0		0.839
1 to 3 minimum wages	0.34 (0.02-5.87)	0.46	0.45 (0.03-7.8)	0.583	
4 or more minimum wages	0.34 (0.02-5.69)	0.453	0.42 (0.03-7.17)	0.552	
Appropriate Study Space					
Yes	—	—	—	—	—
No	—	—	—	—	—
Residential Area					
Rural	—	—	—	—	—
Urban	—	—	—	—	—
	Anxiety				
	Crude OR (95%CI)	p-value	Adjusted OR (95%CI)	Wald's test	LR-test
Sex					
Male	1.0		1.0		0.03*
Female	2.5 (1.06-5.87)	0.036	2.51 (1.06-5.97)	0.037	
Ethnic Group					
Yellow	—	—	—	—	—
White	—	—	—	—	—
Mixed race	—	—	—	—	—
Black	—	—	—	—	—
Monthly Family Income					
Less than 1 minimum wage	—	—	—	—	—
1 to 3 minimum wages	—	—	—	—	—
4 or more minimum wages	—	—	—	—	—
Appropriate Study Space					
Yes	1.0		1.0		0.944
No	1.15 (0.47-2.79)	0.764	0.97 (0.39-2.41)	0.945	
Residential Area					
Rural	—	—	—	—	—
Urban	—	—	—	—	—
	Depression				
	Crude OR (95%CI)	p-value	Adjusted OR (95%CI)	Wald's test	LR-test
Sex					
Male	—	—	—	—	—
Female	—	—	—	—	—
Ethnic Group					
Yellow	1.39 (0.25-7.76)	0.708	1.58 (0.27-9.21)	0.61	0.312
White	1.0		1.0		
Mixed race	0.72 (0.27-1.93)	0.52	0.58 (0.2-1.64)	0.304	
Black	4.17 (0.53-32.65)	0.174	3.96 (0.47-33.35)	0.206	

Monthly Family Income					
Less than 1 minimum wage	—	—	—	—	—
1 to 3 minimum wages	—	—	—	—	—
4 or more minimum wages	—	—	—	—	—
Appropriate Study Space					
Yes	1.0		1.0		0.119
No	2.39 (0.89-6.42)	0.084	2.34 (0.82-6.65)	0.111	
Residential Area					
Rural	1.0		1.0		0.023*
Urban	3.13 (1.01-9.71)	0.048	4.29 (1.28-14.42)	0.019	

*Statistically Significant.

Discussion

This study revealed that a majority of the participants exhibited normal levels across all three subscales; however, a significant portion experienced moderate levels. These results are in line with those of other recent research, although we explored other independent variables, adding a new perspective to our investigation [13,14]. Similar results surfaced in a Chinese study employing the DASS-21 within the general population. Specifically, 63.6% exhibited normal anxiety scores, while 8.4% reported severe and extremely severe anxiety. Regarding stress, 67.9% displayed normal scores, with 2.6% experiencing severe and extremely severe stress. In terms of depression, 69.7% showed normal results, while 4.3% presented severe and extremely severe depression [15]. These findings emphasize the necessity for enhanced psychological support for university students, particularly those in the dental field, considering the substantial emotional burden they endure [16].

Notably, a substantial fraction of the population reported extremely severe anxiety in our study. Depression and anxiety, often with overlapping symptoms, have been linked to various challenges [10]. Oral health professionals and students faced practice disruptions and redistribution amid the COVID-19 pandemic, necessitating resilience measures for coping [17]. In this context, psychological approaches are essential for mitigating associated psychological problems, despite alterations in psychological care activities and the necessity of online approaches [18].

Historically, medical students played vital roles in pandemics, e.g., the 1918 Spanish flu and the 1952 Copenhagen polio epidemic. Countries, including the United States, Italy, and the United Kingdom, integrate them into COVID-19 task forces. Some permit early graduation for frontline service, while others, like Denmark, maintain students in clinical placements, providing accelerated courses in ventilator therapy and nursing care [19]. Simultaneously, dental students can play a pivotal role in curbing the transmission of COVID-19 by readying themselves for suspected cases and being familiar with the relevant authorities for prompt intervention [20]. This underscores the necessity to reassess the dental education curriculum, with a focus on enhancing students' understanding and approach to managing coronavirus infections [21]. A heightened emphasis on protective protocols is crucial for ensuring students' proficiency in this pivotal area.

The prevalent profile of the studied population revealed a favorable socioeconomic status, notably in terms of high monthly family income, equivalent to the Brazilian minimum wage of US$1,100 during the data collection year. This observation may account for the relatively normal levels observed in the DASS subscales, even amidst the pandemic period. Improved socioeconomic conditions have been associated with a reduced likelihood of psychological issues [22].

Research has demonstrated a direct correlation between higher levels of income and lower prevalence of mental health disorders. The recruitment site for our study population, a private university center, might have

influenced these findings [22]. Access to other dentistry institutions was restricted due to pandemic limitations during data collection.

The hypothesis test indicated an association between female sex and anxiety. However, the logistic regression model did not show a significant relationship. Other authors have highlighted that women are more vulnerable to mental health problems and post-traumatic stress symptoms. Data suggests that women seek health services twice as often as men, potentially leading to increased participation in mental health-focused research and higher visibility [23]. Psychological conditions in females range from 9.6% to 69.3% [24], with prevalent issues like depression, anxiety, and physical complaints affecting around one in three females in the community [25]. In our study population, a blend of factors, including work, study, and family responsibilities, alongside financial pressures related to high course fees and clinical material expenses, may explain this association.

The data revealed an association between ethnic groups and depression in contingency analysis but not in regression models. Unconsidered variables can influence the model, underscoring the importance of evaluating social, cultural, and environmental factors in future studies for a comprehensive understanding. Moreover, the varied racial categories employed in this study could have impacted these statistics, diverging from the classifications used in the majority of studies (white and non-white). The choice to employ a broader range of race/color categories served two purposes: rejecting the Eurocentric perspective that prioritizes the white race/skin and facilitating the recognition of underrepresented race/skin in literature. Self-declaration of race/skin color is influenced by genetic, phenotypic, psychological, socioeconomic, and cultural factors [26]. Despite limited literature on the relationship between race/skin color and mental health in Brazil, our findings contradict certain studies suggesting a higher prevalence of mental health problems in non-white populations [27,28].

The analysis of this study indicates a fourfold higher likelihood of depression among urban residents compared to those in rural areas. This observation could be influenced by the high prevalence of individuals residing in urban areas. Urbanization correlates with increased mental health issues, although further research is required to establish causality. Reduced exposure to nature diminishes physiological and psychological benefits, leading to adverse mental health outcomes [29]. The rising urbanization exposes individuals to environmental stressors, potentially heightening stress and affecting mental health [30]. Urban noise and pollution significantly affect mental health. A meta-analysis revealed a 4% higher depression and a 12% higher anxiety likelihood with a 10 dB(A) increase in road traffic noise [31]. Long-term exposure to air pollution, especially traffic-related, is linked to increased risks of common mental disorders, physical symptoms, and psychotic experiences [32].

In addressing the psychological effects induced by the COVID-19 pandemic, particularly among dental students, the implementation of online psychological interventions, such as Cognitive-Behavioral Therapy (CBT), stands out as a strategic approach [33]. By delivering timely information and support through online platforms, these interventions assist students in effectively managing psychological crises, equipping them with essential tools to navigate challenges [18]. The incorporation of positive psychology exercises and mindfulness interventions further contributes to the enhancement of mental health and well-being in this specific academic context [34].

The positive aspects of our study include its comprehensive statistical analysis, validated survey instrument, examination of context-specific independent variables, and the use of a census-based approach within a large urban institution. Additionally, the recruitment from a private higher education institution diverges from

the typical profile often seen in most studies, further highlighting the uniqueness of our results. This aspect contributes to the characterization of an atypical sociodemographic profile.

Acknowledging the study's limitations, we recognize inherent biases in cross-sectional research, potential memory bias, and the inability to compare with students from public colleges due to COVID-19 health restrictions. Another limitation of the study is the absence of information regarding which students underwent psychological treatment during or after the pandemic due to ethical constraints.

Conclusion

Although the psychological profiles observed among individuals were within expected bounds, our results highlight the importance of targeted interventions for vulnerable demographic groups. These insights emphasize the need for personalized interventions to address mental health disparities and mitigate the impact of these stressors on at-risk populations. Future research should employ longitudinal designs, include diverse educational settings, and assess tailored interventions' effectiveness. Exploring social support networks and coping strategies can enhance mental health outcomes among students in urban environments.

Authors' Contributions

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