Psychological disorders and coping strategies among undergraduate medical students during the COVID-19 pandemic in Brazil

Transtornos mentais e estratégias de enfrentamento entre estudantes de medicina durante a pandemia da covid-19 no Brasil

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ABSTRACT

Introduction: Medical students are commonly considered a vulnerable public to the emergence of mental disorders. In the COVID-19 pandemic context, recent evidence suggests that the COVID-19 crisis may have affected the medical student's mental health.

Objective: We aimed to investigate the prevalence of depression, anxiety, and stress symptoms in undergraduate medical students, the associated factors, and the relationship between coping strategies and psychological symptoms during the COVID-19 pandemic period.

Method: This is a cross-section study with 141 undergraduate medical students from a public medical school in Brazil. The student's mental health was assessed with the Depression, Anxiety and Stress Scale (DASS-21) and the coping strategies were assessed with the Brief Coping Orientation to Problems Experienced inventory (Brief COPE). Data were collected from December 1, 2020, to February 28, 2021, through the Google Form platform. Descriptive analysis, chi-square, multivariate Poisson regression, and Spearman's correlation were performed.

Result: Regarding the students' mental health, 78 (55.3%; 95%CI: 47.1-63.3) were categorized as having depression symptoms, 71 (50.4%, 95%CI: 42.2-58.5) as having anxiety symptoms, and 86 (61%; 95%CI: 52.8-68.7) as having stress symptoms. About the associated factors, skin color/race had an association with depression and stress, year of the course had an association with stress only, history of psychological/psychiatry treatment had an association with anxiety and stress and self-rated mental health had an association with depression, anxiety, and stress. In relation to the coping strategies, problem-focused strategies had no significant correlations with depression, anxiety, and stress. Emotion-focused strategies had a weak negative correlation with depression only. Avoidance strategies had a moderate positive correlation with depression, anxiety, and stress.

Conclusion: Overall, our results show high prevalence rates of depression, anxiety, and stress in Brazilian undergraduate medical students and the significant relationship between coping strategies and the presence of psychological impairment during the COVID-19 pandemic.

Keywords: Medical students; Mental Health; Health Profile; Coping Strategies and COVID-19.

RESUMO

Introdução: Os estudantes de Medicina são comumente considerados um público vulnerável ao surgimento de transtornos mentais. No contexto da pandemia da covid-19, evidências recentes sugerem que a saúde mental dos estudantes de Medicina pode ter sido afetada.

Objetivo: Este estudo teve como objetivo investigar a prevalência de sintomas de depressão, ansiedade e estresse entre estudantes de Medicina, os fatores associados e a relação entre estratégias de enfrentamento (coping) e sintomas psicológicos durante o período de pandemia da covid-19.

Método: Trata-se de um estudo transversal realizado com 141 estudantes de Medicina de uma faculdade pública de Medicina do Brasil. Avaliou-se a saúde mental dos estudantes por meio da Escala de Depressão, Ansiedade e Estresse (DASS-21), e adotou-se o inventário Brief Coping Orientation to Problem Experienced (Brief COPE) para analisar as estratégias de enfrentamento. Os dados foram coletados de 1º de dezembro de 2020 a 28 de fevereiro de 2021, por meio da plataforma Google Form. Realizaram-se análises descritivas, teste qui-quadrado, regressão multivariada de Poisson e correlação de Spearman.

Resultado: Em relação à saúde mental dos estudantes, 78 (55,3%; IC95%: 47,1-63,3) foram categorizados com sintomas de depressão, 71 (50,4%, IC95%: 42,2-58,5) com sintomas de ansiedade e 86 (61%; IC95%: 52,8-68,7) com sintomas de estresse. Sobre os fatores associados, cor/raça teve associação com depressão e estresse; ano do curso, apenas com estresse; histórico de tratamento psicológico/psiquiátrico, com ansiedade e estresse; e autoavaliação de saúde mental, com depressão, ansiedade e estresse. Em relação às estratégias de enfrentamento, as estratégias focadas no problema não apresentaram correlações significativas com depressão, ansiedade e estresse. As estratégias focadas na emoção tiveram uma correlação negativa fraca apenas com a depressão. As estratégias de evitação tiveram uma correlação positiva moderada com depressão, ansiedade e estresse.

Conclusão: De modo geral, nossos resultados mostram altas taxas de prevalência de depressão, ansiedade e estresse em estudantes de Medicina e uma relação significativa entre estratégias de enfrentamento e a presença de comprometimento psicológico durante a pandemia da covid-19.

Palavras-chave: Estudantes de Medicina; Saúde Mental; Perfil de Saúde; Estratégias de Enfrentamento; Covid-19.

INTRODUCTION

Medical school can be a stressful experience for undergraduate medical students. In a previous integrative review about symptoms of mental disorders in Brazilian medical students, the prevalence ranged from 5.6% to 45.7% for depression, 13.4% to 41.4% for anxiety and, 40.95% to 78.98% for stress[1]. In general, the main associated factors are female gender, maladaptive personality, financial difficulties, pre-existing mental disorders, thoughts of dropping out of medical school, later stages of the course, little involvement in leisure activities, lack of emotional support, and academic overload[2]. In addition to these factors, the coronavirus pandemic affected the mental health of medical students due to changes in their lives and medical training[3,4].

Since the World Health Organization (WHO) declared on the 30th January of 2020 the COVID-19 outbreak as a public health emergency of international concern[5], the pandemic has rapidly escalated into a global health crisis. In Brazil, due to the emergence of the pandemic and the implementation of non-pharmacological measures such as isolation and social distancing, places and events with large circulation of people had their face-to-face operations partially or totally suspended[6]. Regarding university activities, the Ministry of Education (MEC) authorized the replacement of in-person classes by remote ones[7].

Before COVID-19, fear and anxiety had already been identified among medical students in countries where SARS (Severe Acute Respiratory Syndrome) occurred[8]. In the COVID-19 pandemic context, Brazilian medical students were feeling uncertain about the future of their training and reporting damage to their mental health[4]. Additionally, the estimated overall prevalence of anxiety and depression in medical students during the COVID-19 pandemic was 28% (95%CI: 22–34) and 25% (95%CI: 20–32), respectively[9]. Comparing periods before and during the COVID-19 pandemic, an Indian survey showed higher levels of anxiety and stress among medical students[10]. These findings may indicate a need to investigate the medical student's mental health during the pandemic period.

Besides mental health, it is also important to assess how medical students are coping with this psychological distress during the COVID-19 pandemic context. The coping term is defined as "cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person"[11]. One coping strategy is not inherently better or worse than another, because people can use strategies in a complementary way to move away from the stressor using avoidance strategies, manage emotions using emotion-focused strategies, and face the

situation using problem-focused strategies[11]. However, some studies have identified some strategies as dysfunctional, due to their association with low resilience, worse well-being, and the presence of symptoms of mental disorders[12–14]. Apart from that, other studies showed a significant association between coping strategies and medical students' mental health[15,16].

In light of all of this, in our study we aimed to investigate the prevalence of depression, anxiety, and stress symptoms in Brazilian undergraduate medical students, the associated factors, and the relationship between coping strategies and psychological symptoms during the COVID-19 pandemic.

METHOD

We used the "Strengthening the Reporting of Observational Studies in Epidemiology" (STROBE)[17] principles to carry out this study.

Study design and participants

This is a cross-sectional study with undergraduate medical students enrolled in a public medical school in the northeast region of the state of Minas Gerais, Brazil. The non-probabilistic convenience sampling was adopted, and the inclusion criterion was age ≥18 years and being regularly enrolled in the medical course. All students enrolled in the medical course were invited to answer the questionnaire (n = 333).

Settings

During the survey period, the Brazilian situation with the COVID-19 pandemic reached 10,455,630 confirmed cases and 252,835 deaths by the end of February 2021[18]. There was no national or regional lockdown during the research period, but only recommendations to maintain social distancing, cancellation of mass gatherings, and isolation for those who may have been exposed to people infected with COVID-19. The Brazilian government has been criticized by the scientific community for their denial of scientific facts and failure to coordinate and promote public health measures[19,20].

As for the classes, the Brazilian Ministry of Education authorized since March 2020 the replacement of in-person classes by remote ones using digital media for the duration of the pandemic situation[7]. Specifically for medical education, the substitution applied only to cognitive-theoretical subjects from the first to the fourth year of the course[21]. The particular university evaluated in this research suspended all in-person classes in their campuses in March 2020 and held all its classes virtually in response to the COVID-19 pandemic only from September 2020 onwards. Thus, the assessed students were having online classes, but only students attending medical clerkship were involved in clinical activities.

Procedures

Data were collected from December 1, 2020, to February 28, 2021, using the Google Form platform. An e-mail was sent to all 333 medical students with the link to access the questionnaire.

Ethical Considerations

The students were told about the objectives of the research, its voluntary characteristic, and the confidentiality of information, whose results would be demonstrated globally, without individual identification. Students were informed that they could receive a report on their performance and psychological support if they wanted. The Term of Free and Informed Consent (TFIC) was available online. Those who agreed to participate marked the "yes" option in the online form. The study was approved by the Ethics Committee of Universidade Federal dos Vales do Jequitinhonha e Mucuri (UFVJM), under Protocol N. 4.420.682.

Instruments

Sociodemographic questionnaire

The questionnaire was created based on the literature review and developed specifically for this research. The questionnaire included baseline and mental health characteristics such as age, gender, marital status, skin color/race, family income, close person (relative, friend, boyfriend/girlfriend, etc.) with COVID-19, year of the course, history of psychological/psychiatry treatment, and aspects related to the academic context during the pandemic, such as study routine, attending classes online, practicing social distancing, and self-rated mental health.

Brief Coping Orientation to Problems Experienced inventory (Brief COPE)

The inventory was created by Carver[22] and it is a reduced version of the COPE Inventory (Coping Orientation for Problem Experiences). The Brief COPE is available in a Brazilian Portuguese version and has been validated[23]. The questionnaire has a brief introduction, in which people are asked to respond on how they deal with life's problems. The Brief COPE has 28 items distributed in 14 scales (2 items each) which are based on previous studies[12,14,15,24] and were categorized into 3 categories: problem-focused (planning, active coping and instrumental support), emotion-focused (acceptance, emotional support, religion, positive reframing, and humor), and avoidance coping (self-distraction, venting, self-blame, behavioral disengagement, denial and substance use). The inventory is evaluated by an ordinal scale ranging from 1 ("I haven't been doing this at all") to 4 ("I've been doing this a lot"). The result is obtained by adding the item scores for each subscale, and the higher the obtained score, the greater the use of a given coping strategy[23].

Depression, Anxiety, and Stress Scale (DASS-21)

The Depression, Anxiety and Stress Scale (DASS-21) was adapted and validated for Brazilian Portuguese by Vignola[25], based on the original version by Lovibond and Lovibond [26]. Each DASS-21 subscale has seven items to assess emotional states of depression, anxiety, and stress. There are four possible answers in terms of severity or frequency, organized on a Likert-type scale from "I totally disagree" (whose score is zero) to "I totally agree" (whose score is three). To calculate the final score, total scores for each subscale were multiplied by two. For DASS-21, the respondent is required to indicate the presence of a symptom during the past week. Total scores on the depression, anxiety, and stress domains were categorized into normal, mild, moderate, severe, and extremely severe. For the statistical analysis, these categories were then divided into clinically irrelevant (normal-mild) and clinically relevant (moderate-extreme severe). It was decided to join mild symptoms with the normal level, as mild means that the person is above the population mean, but still well below the typical severity of people who are seeking help[27]. This method was also used by others studies with medical students and different professions during the COVID-19 pandemic[16,28].

Data Analysis

Completed questionnaires were extracted from Google Forms as an Excel spreadsheet and were then incorporated into Jamovi (version 1.6.23.0) for data analysis. The normality of data was first tested with Shapiro-Wilk test, which showed that the data did not have a normal distribution ($p<0.05$) and, therefore, non-parametric statistics were employed. Data were expressed as mean (M), and standard deviation (SD) for continuous variables and as number and percentage for categorical variables.

The reliability analysis of the instruments was assessed with Cronbach's Alpha (α) following a common recommendation that alpha values ranging from 0.70 to 0.95 are acceptable for good internal consistency[29].

Pearson's chi-square test was used to assess the association between categorical variables and depression,

anxiety, and stress. The effect size was calculated for the significant results with Cramer's V using the following references: for 1 degree of freedom (small: 0.10; medium: 0.30; and large: 0.50), for 2 degrees of freedom (small: 0.07; medium: 0.21; and large: 0.35); for 3 degrees of freedom (small: 0.06; medium: 0.17; and large: 0.29)[30].

Poisson regression with robust variance was used to build a multivariate regression model using the hierarchical input. After calculating the prevalence ratio (PR) and the respective 95% confidence intervals (95%CI), the independent variables that had a significance level with p<0.20 in the bivariate analysis were included in the final multivariate regression model.

Spearman's correlation test was used to assess the correlation between coping strategies and depression, anxiety, and stress scores. For Spearman's Correlation, the following references were used: weak (0.1-0.3), moderate (0.4-0.6), and strong (>0.7)[31]. Fisher's r-to-z transformation test was used to assess whether there were significant differences between the correlations[32].

The p-value ≤0.05 was considered significant for all statistical analyses and all tests were 2-tailed.

RESULTS

Sociodemographic characteristics

A total of 141 medical students aged 18 to 53 years old (M = 24.9; SD = 5.01) completed the questionnaire (42.3% of response rate) and there were no missing data to be computed. Demographic data showed that most students were 18 to 24 years old (86; 61%); female (84; 59.6%); single (132; 93.6%), of brown/black ethnicity (73; 51.8%); with a family income less than or equal to 5 minimum wages (78; 55.3%) and had some close person (relative, friend, boyfriend, etc.) diagnosed with COVID-19 (96; 68.1%). About the academic variables, most students were in their first years of medical training (79; 53.9%), rarely managed to maintain a regular study routine during the pandemic (58; 41.1%) and were attending classes online (99; 70.2%). Most students were practicing social distancing, going out only for essential and/or unavoidable activities (105; 74.5%). Regarding their mental health, most students had a history of psychological/psychiatric treatment (72; 51.1%) and self-rated that their mental health got worse compared with the period before the pandemic (93; 66%).

Depression, anxiety and stress in medical students

The reliability analysis with Cronbach's Alpha in our study showed good internal consistency for all three DASS-21 subscales: Depression (α = 0.90), Anxiety (α = 0.90), and Stress (α = 0.91). The mean score of stress was the highest (M = 23; SD = 11.8), followed by depression (M = 17.1; SD = 11.9) and anxiety (M = 12.7; SD = 12.1).

Depression, anxiety, and stress symptoms were analyzed according to their prevalence and severity (Table 1). It was verified that 55.3% of the students suffered from a moderate to an extremely severe degree of depression (moderate 22%, severe 11.3%, and extremely severe 22%). Also, 50.4% of students suffered from a moderate to an extremely severe degree of anxiety (moderate 11.3%, severe 10.6%, and extremely severe 28.3%). Moreover, 61% suffered from a moderate to an extremely severe degree of stress (moderate 14.9%, severe 22%, and extremely severe 24.1%).

Regarding the demographic characteristics and their association with depression, anxiety, and stress (Table 2), age had no statistical significance with any disorder. Skin color/race had a small association with depression (χ^2 (1) = 5.03; p = 0.025; Cramer's V = 0.18), and stress (χ^2 (1) = 6.67; p = 0.010; Cramer's V = 0.21). The higher prevalence rates were found in brown/black students, with 64.4% for depression and 71.2% for stress. The medical school year had a small association with stress only (χ^2 (1) = 5.30; p = 0.021; Cramer's V = 0.19) with 69.7% of prevalence in the students in the first years of the medical training. Study routine had a marginally significant medium association with depression (χ^2 (3) = 7.21; p = 0.066; Cramer's V = 0.22) with the highest prevalence being found in students that never managed to maintain a regular study routine during the researched pandemic period (72%). A history of psychological/psychiatric treatment had a small association with anxiety (χ^2 (1) = 8.68; p = 0.003; Cramer's V = 0.24) and stress (χ^2 (1) = 5.99; p = 0.014; Cramer's V = 0.20), with a prevalence rate of 62.5% for anxiety and 70.8% for stress in students who had undergone psychological/psychiatric treatment. Self-rated mental health had a small to medium association with depression (χ^2 (2) = 13.3; p = 0.001; Cramer's V = 0.30), anxiety (χ^2 (2) = 13.7; p = 0.001; Cramer's V = 0.31) and stress (χ^2 (1) = 11.5; p = 0.003; Cramer's V = 0.28). Students who considered that their mental health got worse during the pandemic had higher prevalence rates for depression (64.5%), anxiety (60.2%) and stress (69.9%).

Table 1. Prevalence and severity of depression, anxiety and stress in the respondents attending a public medical school from December 1, 2020 to February 28, 2021, Minas Gerais, Brazil, 2021 (N=141).

Category	Depression n	Depression % (95%CI)	Anxiety n	Anxiety % (95%CI)	Stress n	Stress % (95%CI)
Normal-Mild	63	44.7 (36.7-52.9)	70	49.6 (41.5-57.8)	55	39 (31.3-47.2)
Moderate-Extremely severe	78	55.3 (47.1-63.3)	71	50.4 (42.2-58.5)	86	61 (52.8-68.7)
Level						
Normal	44	31.2 (24.1-39.3)	61	43.2 (3.35-51.5)	39	27.7 (20.9-35.6)
Mild	19	13.5 (8.8-20.1)	9	6.3 (3.3-11.7)	16	11.3 (7.1-17.6)
Moderate	31	22 (15.9-29.5)	16	11.3 (7.1-17.6)	21	14.9 (9.9-21.7)
Severe	16	11.3 (7.1-17.6)	15	10.6 (6.5-16.8)	31	22 (15.9-29.5)
Extremely severe	31	22 (15.9-29.5)	40	28.3 (21.5-36.3)	34	24.1 (17.8-31.8)

Source: prepared by the authors.

Table 2. Association between demographic variables and depression, anxiety and stress in the respondents attending a public medical school from December 1, 2020 to February 28, 2021, Minas Gerais, Brazil, 2021 (N=141).

Variables	Depression Normal-Mild N (%)	Depression Moderate-Extremely Severe N (%)	p	Anxiety Normal-Mild N (%)	Anxiety Moderate-Extremely Severe N (%)	p	Stress Normal-Mild N (%)	Stress Moderate-Extremely Severe N (%)	p
Age									
18-24	40 (46.5)	46 (53.5)	0.585	44 (51.2)	42 (48.8)	0.652	35 (40.7)	51 (59.3)	0.607
Over 24	23 (41.8)	32 (58.2)		26 (47.3)	29 (52.7)		20 (36.4)	35 (63.6)	
Gender									
Female	37 (44)	47 (56)	0.854	40 (47.6)	44 (52.4)	0.559	33 (39.3)	51 (60.7)	0.934
Male	26 (45.6)	31 (54.4)		30 (52.6)	27 (47.4)		22 (38.6)	35 (61.4)	
Skin color/race									
Brown/black	26 (35.6)	47 (64.4)	0.025	31 (42.5)	42 (57.5)	0.077	21 (28.8)	52 (71.2)	0.010
White	37 (54.4)	31 (45.6)		39 (57.4)	29 (42.6)		34 (50)	34 (50)	
Family income									
≤ 5 MWa	35 (44.9)	43 (55.1)		38 (48.7)	40 (51.3)		29 (37.2)	49 (62.8)	
> 5 to 10 MW	22 (44.9)	27 (55.1)	0.990	25 (51)	24 (49)	0.968	19 (38.8)	30 (61.2)	0.663
>10 MW	6 (42.9)	8 (57.1)		7 (50)	7 (50)		7 (50)	7 (50)	

Table 2. Continuation

Variables	Depression			Anxiety			Stress		
	Normal-Mild	Moderate-Extremely Severe	p	Normal-Mild	Moderate-Extremely Severe	p	Normal-Mild	Moderate-Extremely Severe	p
	N (%)	N (%)		N (%)	N (%)		N (%)	N (%)	
Close person (relative, friend, boyfriend, etc.) with COVID-19									
Yes	46 (47.9)	50 (52.1)	0.259	46 (47.9)	50 (52.1)	0.549	38 (39.6)	58 (60.4)	0.838
No	17 (37.8)	28 (62.2)		24 (53.3)	21 (46.7)		17 (37.8)	28 (62.2)	
Year at medical school									
First years	32 (42.1)	44 (57.9)	0.506	37 (48.7)	39 (51.3)	0.805	23 (30.3)	53 (69.7)	0.021
Final years	31 (47.7)	34 (52.3)		33 (50.8)	32 (49.2)		32 (49.2)	33 (50.8)	
Attended classes online									
Yes	41 (41.4)	58 (58.6)	0.231	48 (48.5)	51 (51.5)	0.672	35 (35.4)	64 (64.6)	0.172
No	22 (52.4)	20 (47.6)		22 (52.4)	20 (47.6)		20 (47.6)	22 (52.4)	
Study routine									
Never	6 (24)	19 (76)	0.066	9 (36)	16 (64)	0.266	7 (28)	18 (72)	0.342
Rarely	25 (43.1)	33 (56.9)		32 (55.2)	26 (44.8)		22 (37.9)	36 (62.1)	
Occasionally	24 (57.1)	18 (42.9)		19 (45.2)	23 (54.8)		17 (40.5)	25 (59.5)	
Frequently	8 (50)	8 (50)		10 (62.5)	6 (37.5)		9 (56.3)	7 (43.8)	
Social distancing									
Yes	51 (48.6)	54 (51.4)	0.113	52 (49.5)	53 (50.5)	0.961	44 (41.9)	61 (58.1)	0.228
No	12 (33.3)	24 (66.7)		18 (50)	18 (50)		11 (30.6)	25 (69.4)	
History of psychological/psychiatric treatment									
Yes	28 (38.9)	35 (50.7)	0.158	27 (37.5)	45 (62.5)	0.003	21 (29.2)	51 (70.8)	0.014
No	44 (61.1)	34 (49.3)		43 (62.3)	26 (37.7)		34 (49.3)	35 (50.7)	
Self-rated mental health									
Worse	33 (35.5)	60 (64.5)	0.001	37 (39.8)	56 (60.2)	0.001	28 (30.1)	65 (69.9)	0.003
Neither worse nor better	26 (70.3)	11 (29.7)		28 (75.7)	9 (24.3)		23 (62.2)	14 (37.8)	
Better	4 (36.4)	7 (63.6)		5 (45.5)	6 (54.5)		4 (36.4)	7 (63.6)	

[a]MW: Minimum Wage per month (BRL $1.100.00 or approximately US$ 197.11).
Source: prepared by the authors.

The multivariate Poisson regression (Table 3) showed that, compared to white students, brown/black students had 1.46 times higher prevalence of depression (Adj. PR = 1.46, 95%CI: 1.07-2.01, p = 0.019) and 1.43 times higher prevalence of stress (Adj. PR = 1.42; 95%CI: 1.08-1.89, p = 0.013). Students that occasionally maintained a regular study routine had lower prevalence of depression (Adj. PR = 0.54; 95%CI: 0.34-0.84, p = 0.008) compared with students that never managed to maintain a regular study routine during the researched pandemic period. Students that had a history of psychological/psychiatric treatments had 73% higher prevalence of anxiety (Adj. PR = 1.73; 95%CI: 1.23-2.46, p = 0.002) and 44% higher prevalence of stress (Adj. PR = 1.44; 95%CI: 1.09-1.91, p = 0.011) compared with those that did not have any history. Finally, students who self-rated that their mental health neither worsened nor improved during the pandemic period had a significantly lower prevalence of depression (Adj. PR = 0.48; 95%CI: 0.30-0.74, p = 0.002), anxiety (Adj. PR = 0.43; 95%CI: 0.25-0.69, p = 0.001), and stress (Adj. PR = 0.58; 95%CI: 0.39-0.83, p = 0.005) compared with those students that considered that their mental health got worse.

Coping strategies

The reliability analysis with Cronbach's Alpha in our study showed good internal consistency for all three coping categories: Problem-focused (α = 0.75), Emotion-focused (α = 0.70), and Avoidance (α = 0.82).

The most common coping strategies used by the students were planning in the problem-focused category (M = 6.09; SD = 1.40), acceptance in the emotion-focused category (M = 6.16; SD = 1.55) and self-distraction in the avoidance category (M = 6.10; SD = 1.57) (Table 4). Overall, the coping strategies in the avoidance category was the most frequently used by the students (M = 26.5; SD = 6.47), especially by those in the moderate-extreme severe level of depression (M = 29.8; SD = 6.16), anxiety (M = 29.8; SD = 6.19) and stress (M = 29.3; SD = 6.11).

Regarding the relationship between coping strategies and depression, anxiety and stress symptoms (Table 5), problem-focused strategies had no significant correlation with depression, anxiety or stress. Emotion-focused strategies had a weak negative correlation with depression only [r_s = -0.29 (95%CI: -0.43 – -0.13), p < 0.001]. Avoidance had a moderate positive correlation with depression [r_s = 0.68 (95%CI: 0.58 – 0.75), p < 0.001], anxiety [r_s = 0.56 (95%CI: 0.43 – 0.66), p < 0.001], and stress [r_s = 0.66 (95%CI: 0.55 – 0.74), p < 0.001]. Fisher's r-to-z transformation test showed that avoidance was more strongly associated with depression than with anxiety (z = 2.291; p = 0.011). There was no significant difference in relation to stress (z = 0.472; p = 0.318).

DISCUSSION

Key findings

We found high prevalence rates of depression, anxiety, and stress symptoms in the undergraduate medical students during the pandemic period. Stress symptoms were the most prevalent ones and anxiety symptoms had higher severity.

Regarding the demographic characteristics and their association with depression, anxiety, and stress, skin color/race showed an association with depression and stress, with the higher prevalence in brown/black students. The medical school year was associated with stress only, with the highest prevalence found in the students attending the first years of medical training. Study routine had a marginally-significant association with depression, with the higher prevalence found in students that never managed to maintain a regular study routine during the researched pandemic period. A history of psychological/psychiatric treatment showed an association with anxiety and stress, with higher prevalence in students who had undergone psychological/psychiatric treatment. The self-rated mental health showed an association with depression, anxiety, and stress, with higher prevalence in students who considered their mental health had worsened.

As for coping strategies, problem-focused strategies had no significant correlations with depression, anxiety, or stress. Emotion-focused strategies had a weak negative correlation with depression and avoidance strategies had a moderate positive correlation with depression, anxiety, and stress.

Table 3. Multivariate Poisson regression between sociodemographic variables and depression, anxiety and stress in the respondents attending a public medical school from December 1, 2020 to February 28, 2021, Minas Gerais, Brazil, 2021 (N=141).

Variable	Depression		Anxiety		Stress	
	PRa (95%CI)	Adj. PRb (95%CI)	PR (95%CI)	Adj. PR (95%CI)	PR (95%CI)	Adj. PR (95%CI)
Age	0.55 (0.47-0.63)		0.97 (0.93-1.0)	0.96 (0.92-1.00)	0.96 (0.93-0.99)*	0.96 (0.92-0.99)

Continues...

Table 3. Continuation

Variable	Depression		Anxiety		Stress	
	PRa (95%CI)	Adj. PRb (95%CI)	PR (95%CI)	Adj. PR (95%CI)	PR (95%CI)	Adj. PR (95%CI)
Gender						
Female	1.02 (0.76-1.40		1.10 (0.79-1.56)		0.98 (0.75-1.30)	
Male	1		1		1	
Skin color/race						
White	1	1	1	1	1	1
Brown/black	1.41 (1.04-1.92)*	1.46 (1.07-2.01)*	1.39 (0.96-1.89)	1.31 (0.93-1.85)	1.42 (1.08-1.87)*	1.43 (1.08-1.89)*
Family income						
≤ 5 MWc	1		1		1	
> 5 to 10 MW	1.0 (0.71-1.37)		0.95 (0.66-1.36)		0.97 (0.72-1.29)	
> 10 MW	1.03 (0.60 -1.68)		0.97 (0.52-1.66)		0.79 (0.46-1.27)	
Close person (relative, friend, boyfriend, etc.) with COVID-19						
Yes	1		1		1	
No	1.19 (0.87-1.62)		0.89 (0.61-1.27)		1.03 (0.77-1.36)	
Year at medical school						
First years	1		1		1	1
Final years	0.90 (0.66-1.22)		0.95 (0.68-1.33)		0.72 (055-0.95)*	0.87 (0.64-1.17)
Attended classes online						
Yes	1.23 (0.88-1.75)		1.08 (0.75-1.57)		1.23 (0.91-1.68)	1.17 (0.84-1.63)
No	1		1		1	1
Study Routine						
Never	1	1	1	1	1	1
Rarely	0.74 (0.51-1.10)	0.78 (0.52-1.16)	0.70 (0.45-1.10)	0.74 (0.47-1.17)	0.86 (0.60-1.24)	0.90 (0.61-1.32)
Occasionally	0.56 (0.36-0.87)*	0.54 (0.34-0.84)**	0.85 (0.54-1.36)	0.76 (0.48-1.22)	0.82 (0.56-1.22)	0.74 (0.49-1.11)
Frequently	0.65 (0.36-1.13)	0.68 (0.37-1.19)	0.58 (0.28-1.11)	0.59 (0.29-1.13)	0.60 (0.34-1.03)	0.60 (0.33-1.05)
Social distancing						
Yes	0.77 (0.56-1.07)	0.82 (0.59-1.16)	1.01 (0.69-1.49)		0.83 (0.62-1.12)	
No	1	1	1		1	
History of psychological/psychiatric treatment						
Yes	1.24 (0.91-1.68)	1.30 (0.95-1.77)	1.65 (1.18-2.35)**	1.73 (1.23-2.46)**	1.39 (1.06-1.83)*	1.44 (1.09-1.91)*
No	1	1	1	1	1	1

Table 3. Continuation

Variable	Depression		Anxiety		Stress	
	PRa (95%CI)	Adj. PRb (95%CI)	PR (95%CI)	Adj. PR (95%CI)	PR (95%CI)	Adj. PR (95%CI)
Self-rated mental health						
Worse	1	1	1		1	1
Neither worse nor better	0.46 (0.29-0.69)***	0.48 (0.30-0.74)**	0.40 (0.23-0.64)**	0.43 (0.25-0.69)**	0.54 (0.37-0.76)**	0.58 (0.39-0.83)*
Better	0.98 (0.55-1.61)	0.95 (0.52-1.62)	0.90 (0.47-1.58)	0.92 (0.47-1.64)	0.91 (0.53-1.44)	1.03 (0.60-1.68)

Note: *p<0,05, **p<0,01, ***p<0,001.
aPR: Prevalence Ratio
bAdj. PR: Adjusted Prevalence Ratio
cMW: Minimum Wage per month (BRL $1.100,00 or approximately US$ 197,11).
Source: prepared by the authors.

Table 4. Coping strategies and depression, anxiety and stress in the respondents attending a public medical school from December 1, 2020 to February 28, 2021, Minas Gerais, Brazil, 2022 (N=141).

Coping strategies	Overall M (SD)	Depression M (SD)	Anxiety M (SD)	Stress M (SD)
Problem-focused	**16.5 (3.69)**	**16.4 (3.95)**	**16.8 (3.78)**	**16.7 (3.95)**
Planning	6.09 (1.40)	6.12 (1.49)	6.08 (1.46)	6.17 (1.46)
Active coping	5.66 (1.60)	5.32 (1.67)	5.61 (1.57)	5.53 (1.61)
Instrumental support	4.74 (1.72)	4.92 (1.79)	5.14 (1.80)	5.03 (1.79)
Emotion-focused	**25.2 (5.19)**	**24 (5.43)**	**24.9 (6.09)**	**24.7 (5.72)**
Acceptance	6.16 (1.55)	5.68 (1.63)	5.70 (1.66)	5.81 (1.63)
Emotional support	5.47 (1.73)	5.35 (1.70)	5.39 (1.84(	5.47 (1.79)
Positive reframing	5.40 (1.95)	5.10 (1.94)	5.58 (1.95)	5.31 (2.02)
Religion	4.95 (2.26)	4.49 (2.16)	4.87 (2.25)	4.69 (2.27)
Humor	3.24 (1.50)	3.43 (1.72)	3.34 (1.67)	3.44 (1.72)
Avoidance	**26.5 (6.47)**	**29.8 (6.16)**	**29.8 (6.19)**	**29.3 (6.11)**
Self-distraction	6.10 (1.57)	6.01 (1.70)	6.07 (1.68)	6.17 (1.64)
Venting	4.96 (1.62)	5.19 (1.52)	5.32 (1.57)	5.35 (1.58)
Self-blame	4.88 (1.83)	5.85 (1.67)	5.58 (1.74)	5.53 (1.70)
Behavioral Disengagement	4.18 (2.02)	5.17 (1.96)	5.21 (2.03)	4.84 (2.03)
Denial	2.91 (1.63)	3.36 (1.98)	3.44 (1.96	3.30 (1.92)
Substance use	3.50 (2.14)	4.18 (2.34)	4.20 (2.38)	4.09 (2.34)

Source: prepared by the authors.

Table 5. Correlation between coping strategies and depression, anxiety and stress in the respondents attending a public medical school from December 1, 2020 to February 28, 2021, Minas Gerais, Brazil, 2022 (N=141).

Coping strategies	Depression r_s (95%CI)	Anxiety r_s (95%CI)	Stress r_s (95%CI)
Problem-focused	-0.08 (-0.24-0.08)	0.05 (-0.11-0.21)	0.05 (-0.11-0.21)
p-value	0.305	0.502	0.526
Emotion-focused	-0.29 (-0.43 - -0.13)	-0.12 (-0.27-0.04)	-0.15 (-0.30-0.01)
p-value	<0.001	0.130	0.068
Avoidance	0.68 (0.58-0.75)	0.56 (0.43-0.66)	0.66 (0.55-0.74)
p-value	<0.001	<0.001	<0.001

Source: prepared by the authors.

Interpretation of results

Compared with previous studies about mental health problems among medical students in Brazil[2,33], and with other studies during the COVID-19 pandemic[34–36], the medical students who participated in our study show higher prevalence of depression, anxiety, and stress symptoms. The pandemic context seems to contribute to an increase in the overall prevalence of depression and anxiety in undergraduate medical students[10]. Compared with the Brazilian general population[37] and with Brazilian undergraduate students from other courses[38,39] the medical students in this study had much higher prevalence rates of depression, anxiety, and stress symptoms.

In our study, stress and anxiety had high severity ratings. This may occur due to the uncertainty and the fear about the pandemic and the suspension of in-person classes. A similar study states that an elevated level of stress has had a negative impact on medical students and raised concerns regarding graduation, fears about self-isolation, and uncertainty about returning to normal life[40].

Female gender is generally associated with mental problems among medical students[2,41]. Nonetheless, during the COVID-19 outbreak context, we did not find any significant differences regarding gender. Others studies, however, have found that the prevalence of depression, anxiety, and stress in women was significantly higher than in men[3,42,43].

Regarding skin color/race, medical students in Brazil are more frequently white, wealthy, and upper-middle-class[44], which contributed to the existence of racial inequality[45]. Before the pandemic period, non-white medical students had higher prevalence of depression symptoms and were also associated with poorer mental health and quality of life[33,46]. In the pandemic period, we confirmed a high prevalence rate of depression and stress symptoms in brown/black medical students. This result may be explained by the fact that racial disparities increased in the pandemic period[47]. Additionally, in the general population,

brown skin was a risk factor for severe/extreme anxiety and depression during the social distancing measures[37]. Another study found that black Brazilians had an increased risk of death by COVID-19 when compared to white ones[48].

As for mental health, having a history of psychiatric/ psychological treatment was an associated factor before the pandemic[49]. In the COVID-19 period, students with a previous diagnosis of mental disorders and higher baseline levels of depression, anxiety, and stress were found to be more likely to have mental problems[10,50]. In addition to a history of mental disorders, another study found that 81.4% of medical students reported having observed some psychological or behavioral change in themselves during the social distancing period[50]. We found similar results, as students who considered that their mental health got worse during the pandemic period had higher prevalence rates of depression, anxiety, and stress.

About the coping strategies, our study supports evidence from a previous observation related to medical students with depression, anxiety, and stress using more avoidance strategies during the pandemic[35]. Additionally, a prior study with Chinese medical students showed that depression and anxiety negatively correlated with positive coping and positively correlated with negative coping[51]. As with medical students in our study, other studies in Brazil showed that undergraduate students from other courses[38] and graduate students[39] with depression, anxiety, and stress were also using more avoidance strategies. Interestingly, both Brazilian medical students and the Brazilian general population were using more avoidance coping strategies during the pandemic period[52].

Regarding positive coping strategies, medical students in our study used planning and acceptance, which is similar to a study from Pakistan with students from other courses[53]. In addition to these strategies, other studies with medical students found they used different positive strategies, such as video chats and social media apps, mindfulness, meditation,

fitness, music, reading, watching movies, playing video games, and online fun with family and friends[40,43].

Overall, our results confirm the significant association between coping strategies and the presence of psychological disorders in medical students during the COVID-19 pandemic. Possible mental health problems in these students may occur due to the greater use of avoidance strategies, since it showed a greater association with negative outcomes.

Strengths and limitations

The present research, to the best of our knowledge, appears to be one of the first studies to thoroughly assess Brazilian medical students' mental health and coping strategies during the COVID-19 pandemic outbreak. Some limitations of the present study should be taken into account. In addition to being a cross-sectional investigation, it is impossible to establish a causal relationship between the variables. The information on the study variables was obtained via an online self-administered questionnaire. We also have to consider that other aspect of the students' lives that were not assessed in this research may contribute to their mental health, such as economic problems, changes in family dynamics, students that moved to or returned home and students who worked from home helping other family members. Moreover, we did not focus on other causes for depression and anxiety, such as personality traits. The generalizability of the findings of this study to other medical students should be done with caution.

CONCLUSION

We identified a high prevalence of depression, anxiety, and stress symptoms in the Brazilian undergraduate medical students surveyed during the COVID-19 pandemic. We also found a moderate positive correlation between these psychological disorders and the use of coping strategies in the avoidance category, such as self-blame and behavioral disengagement. Additional studies may further evaluate evidence-based interventions to help students use more functional coping strategies.

AUTHORS'S CONTRIBUTION

Tâmaro Chagas Mendes: contributed to all phases of the research and prepared the final version of the manuscript. Ana Catarina Perez Dias: was in charge of research orientation and reviewed the final version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest related to this research.

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