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Associations of academic environment, lifestyle, sense of coherence and social support with self-reported mental health status among dental students at a university in Brazil: a cross-sectional study

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ABSTRACT

Objectives The study evaluated the association of academic environment, lifestyle, sense of coherence (SOC) and social support with self-reported mental health status among dental students.

Design Secondary analysis of data from a cross-sectional, questionnaire-based survey conducted from August to October 2018.

Setting Dental school of a public-funded university in the south-eastern region of Brazil.

Participants 233 undergraduate dental students recruited across all years of the course.

Outcome measures Socioeconomic and demographic characteristics, city of origin and student's academic semester were obtained through self-completed questionnaires. Perception of the academic environment (Dundee Ready Education Environment Measure (DREEM)), individual lifestyle (Individual Lifestyle Profile Questionnaire (ILPQ)), SOC (SOC Scale (SOC-13)), social support (Medical Outcomes Study Scale (MOS)), and depression, anxiety and stress (Depression, Anxiety and Stress Scale-21 (DASS-21)) were assessed using validated instruments. The relationships between variables were investigated through multivariable negative binomial regression to obtain the rate ratios (RRs) and 95% CIs.

Results Female sex was associated with greater scores of anxiety (RR 1.74, 95% CI 1.10 to 1.97) and stress (RR 1.52, 95% CI 1.12 to 2.06). Students who perceived a better academic environment and those reporting a greater SOC had a lower probability of depression, anxiety and stress. Furthermore, a favourable lifestyle was associated with lower depression scores (RR 0.99, 95% CI 0.97 to 0.99). Social support did not remain associated with depression, anxiety and stress after adjustment.

Conclusions The present findings suggest that self-reported mental health status is associated with students' sex, academic environment, SOC and lifestyle. Enhancing the educational environment and SOC, and promoting a healthy lifestyle may improve the psychological health of dental students.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The study comprehensively examined the predictors of mental health among undergraduate dental students, considering the role of demographics, perception of the academic environment, lifestyle and protective psychosocial factors using valid questionnaires.
⇒ This study focuses on the protective factors of dental students' mental health in a developing country setting.
⇒ The study used a representative sample of dental students with a high response rate (90.3%).
⇒ Our findings should not be generalised to dental students attending private dental schools who pay tuition fees or take student loans to cover such costs.
⇒ Other possible predictors of the mental health status among dental students, including bullying, pre-existing mental health problems, and family history of mental illnesses, were not assessed.

INTRODUCTION

During academic life, undergraduates may experience emotional, psychological, social and financial challenges that may affect their mental health. Of these, anxiety, stress and depression are common emotional disorders among university students in several countries.[1 2] Undergraduate students may experience higher levels of anxiety, depression and stress compared with the general population.[1] Psychological distress among students has been shown to influence their physical health and academic performance.[3] Alcohol misuse, substance abuse and social isolation have also been related to psychological distress among undergraduate students.[4 5]

The impact of the challenges experienced during the course on students' mental health depends on different aspects related to the

academic environment as well as individual characteristics.[6 7] Individual risk factors of poor mental health among university students may include female sex,[1 8 9] ethnicity,[1] low family income,[7] city of origin distinct from the city of the university,[10] low consumption of healthy foods[11] and low levels of physical activity.[12]

Anxiety and stress symptoms in undergraduate students enrolled in health-related courses were higher than those enrolled in other courses.[13] In addition, dental courses are considered more demanding and stressful than other health-related courses.[1] Dental students' primary sources of stress include the demanding nature of the course, the large amount of work to be learnt and examinations, the competitive environment, heavy laboratorial and clinical workload, and fear of failing.[14] Studies have also confirmed the importance of the student's perception of the academic environment on psychological distress.[1 14]

The academic environment is the general atmosphere of the education process, encompassing the different intellectual, social, emotional and physical aspects that can aid the learning experience or distract from it.[15] The first years of the undergraduate dental curriculum demand a substantial amount of time involving theoretical subjects and preclinical (laboratory) activities. Over the years, the dental curriculum has also included clinical training that requires commitment and responsibility for patient dental care through carrying out complex dental procedures and the completion of clinical prerequisites and exams. Thus, dental course demands students' intellectual, manual, psychosocial and interpersonal skills to succeed during the course and in their future careers.[14]

Recently, the role played by protective psychosocial factors in undergraduate students' mental health has been investigated. Studies have highlighted the importance of a sense of coherence (SOC) and social support on students' psychological well-being.[8 14] The salutogenic theory's main construct is SOC (salute=health; genesis=origin), which represents a global orientation towards perceiving life as organised, manageable and emotionally meaningful.[16] People with a higher SOC are more likely to effectively deal with life's difficulties and therefore maintain mental health.[16] Social support is a reciprocal process of formal and informal relations among people by which they feel cared for, cherished and part of a network of mutual commitments.[17] These relationships are commonly developed between people with similar everyday routines who establish enduring patterns of social ties.[17] SOC and social support seem to protect the mental health of university students.[10 18]

To date, few studies have assessed the complex associations of students' academic characteristics, psychosocial traits, and lifestyle with well-being among dental students, which prompted us to conduct a questionnaire-based survey to evaluate inter-relationships between the aforementioned predictors and quality of life and mental health. Our recent findings showed that better quality of life was associated with greater social support, higher SOC, lower anxiety and healthier lifestyle.[19] Since direct and indirect relationships between psychological suffering and students' quality of life were identified in our previous research,[19] it would be relevant to examine the determining factors of dental students' mental health. Moreover, there is a dearth of studies examining the influence of protective factors on dental students' mental health.[1 2 20] Considering the potential protective role played by psychosocial factors in and the relevance of academic factors to students' mental health, we undertook a secondary analysis of our previous survey[19] that aimed to evaluate the association of perception of the academic environment, lifestyle, SOC and social support with self-reported mental health status among dental students.

METHODS

Study design and participants

As previously reported,[19] a cross-sectional study was carried out involving dental students enrolled in the second semester of 2018 at the Dental School of Fluminense Federal University, Niterói *campus*. Fluminense Federal University is a public-funded university in the state of Rio de Janeiro, south-eastern Brazil where a dental degree is offered over a nine-semester course. Dental students aged 18 years or older attending the 2018 academic year in all semesters were invited. The Consensus-Based Checklist for Reporting of Survey Studies (CROSS)was used to report the study.

Recruitment and data collection procedures

Initially, the course coordinator provided the entire list of dental students enrolled in the course. Data collection was scheduled in advance with teachers of all academic semesters, without disrupting their academic activities. Data were collected in the dental school's classrooms, laboratories and dental clinics from August to October 2018. On the day scheduled for data collection, all students in the classroom were informed of the study objectives and received detailed instructions on how to respond to the questionnaire provided by one researcher. Any query about the research was clarified at this stage. Participants who met the inclusion requirements were invited to complete a structured questionnaire after receiving the appropriate instructions. At least three additional attempts were made to identify students who were absent on the scheduled day of data collection.

A self-administered questionnaire was used to collect data on socioeconomic and demographic characteristics, city of origin, student's academic semester, perception of the academic environment, lifestyle, psychosocial factors and mental health (online supplemental file 1). The scales used to assess lifestyle, perception of the academic environment, psychosocial factors and mental health were previously cross-culturally adapted for the Brazilian population.

The questionnaire was pretested in advance of the main study with 21 undergraduate nutrition students from the

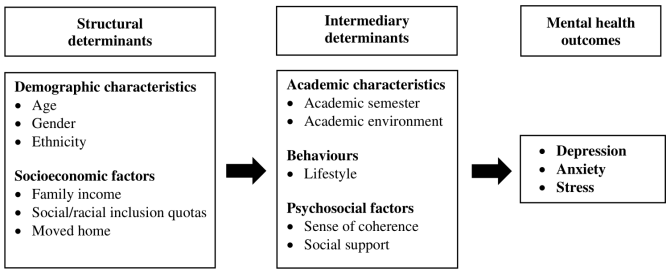

Figure 1 Theoretical model for the study of structural and intermediary determinants of mental health outcomes, adapted from the WHO Conceptual Framework on Social Determinants of Health [22]).

same university campus to evaluate the questionnaire's clarity and to estimate the response time to the items. The changes in the vocabulary of a few items were undertaken to ensure the participants' ability to understand the questionnaire, and the average time to fill out the questionnaire was 14 min.

Response rate and study power

In total, the dental school of the Fluminense Federal University had 258 undergraduate students enrolled in 2018. Of these, 246 students aged 18 years or older were identified during the recruitment period and data collection. One student declined to participate and 12 additional students were excluded from the analysis due to incomplete data. Therefore, the studied sample included 233 undergraduates, resulting in a response rate of 90.3%.

The final sample size of 233 participants would lend a power of 96% to detect statistically significant effects of 0.05 (small effect size), considering the 5% type I error probability and 11 independent variables in a multiple regression model.[21]

Theoretical model

The WHO Conceptual Framework for Action on Social Determinants of Health was adopted to investigate the determinants of self-reported mental health (figure 1).[22] According to this framework, the determinants of health are hierarchically organised into structural and intermediary factors. Structural determinants reflect the place within social hierarchies, which in turn affect intermediary determinants and health outcomes. The intermediary determinants refer to different direct exposures to physical and mental health problems. Demographic characteristics and socioeconomic factors were the structural determinants. Intermediary determinants included behaviours, academic characteristics and psychosocial factors, whereas depression, anxiety and stress were the mental health outcomes.

Mental health status

The mental health status of the participants was evaluated using the Depression, Anxiety and Stress Scale (DASS-21).[23] DASS-21 is composed of 21 items that evaluate the self-reported negative emotional states of depression, anxiety and stress. The scores of the depression, anxiety and stress subscales were recorded on a Likert scale ranging from 0 ('Strongly disagree') to 3 ('Totally agree'). The DASS-21 has seven items per subscale related to symptoms from the previous week. The scale used in the study was validated in Brazil by Vignola and Tucci.[24] The final scores of depression, anxiety and stress were obtained by adding up the scores of the items corresponding to each subscale and multiplying by two to evaluate the severity of each mental health status according to the cut-off points presented in table 1.[23] In this study, the categories 'Severe' and 'Extremely Severe' were merged for descriptive purposes.

Table 1 Degree of the severity of depression, anxiety and stress groups (DASS-21)[23]

Severity	Depression	Anxiety	Stress
Normal	0–9	0–7	0–14
Mild	10–13	8–9	15–18
Moderate	14–20	10–14	19–25
Severe/extremely severe	≥21	≥15	≥26

DASS-21, Depression, Anxiety and Stress Scale.

Structural determinants

The structural determinants were demographic characteristics and socioeconomic factors. The former included age, sex and ethnicity. Self-reported skin colour was used to assess ethnicity according to the following options: white, yellow, indigenous, brown and black. Monthly family income, social/racial inclusion quotas and student's city of origin were the socioeconomic factors. The monthly income was recorded in Brazilian reals (R$) and classified according to the number of Brazilian minimum wages (BMW) per family into <3 BMW, 3–6 BMW, >6–10 BMW and >10 BMW. University admission using social or racial quotas (no/yes) and information on whether the city of origin of the student was different from the city of the campus (no/yes) was also registered.

Intermediary determinants

The intermediary determinants included academic characteristics, and lifestyle and psychosocial factors. The academic characteristics were the current academic semester in which the student was enrolled and the perception of the academic environment. The current academic semester was originally registered ranging from 1 to 9 and then grouped as 1–3, 4–6 and 7–9, representing the initial, intermediate and advanced study periods of the course. Students' perception of the academic environment were assessed using the Dundee Ready Education Environment Measure (DREEM), validated for the Brazilian population.[25 26] The questionnaire is composed of 50 items followed by a 5-point Likert scale that is organised in five domains: 'learning' (12 items), 'teachers' (11 items), 'academic' (8 items), 'atmosphere' (12 items) and 'social' (7 items). DREEM scores may range from 0

to 200. Higher scores indicate a better perception of the teaching environment.

The student's individual lifestyle was measured using the Individual Lifestyle Profile Questionnaire (ILPQ) developed in Brazil.[27] The ILPQ has 15 items that are registered using a 4-point Likert scale and comprise five components: 'nutrition', 'physical activity', 'preventive behaviour', 'social relationship' and 'stress control'. The higher the ILPQ score, the more favourable the student's lifestyle.

The investigated psychosocial factors were SOC and social support. Student's SOC was collected using the Brazilian version of the SOC Scale (SOC-13 scale) proposed by Antonovsky.[16 28] SOC-13 is a 5-point Likert scale consisting of 13 items. The responses to the SOC code were summed to obtain the final score, which may vary from 13 to 65. The higher the SOC-13 Score, the stronger the SOC. Social support was assessed using the Medical Outcomes Study (MOS) Scale,[29] adapted and validated for Brazilian adults.[30] The MOS scale has 19 items involving the five dimensions of social support: 'material', 'affective', 'positive social interaction', 'emotional' and 'informational'. The participant should indicate how frequently they experience each type of support using a Likert scale. Higher MOS scores indicate greater perception of social support.

Instrument reliability

The internal consistency of the questionnaires was assessed through Cronbach's α coefficient. Instrument reliability based on Cronbach's α was considered as high (α>0.80), moderate (α=0.50–0.80) and low (α<0.50). The Cronbach α coefficients were: Depression DASS-21 ubscale=0.901, Anxiety DASS-21 subscale=0.843, Stress DASS-21 Subscale=0.891, DREEM=0.926, ILPQ=0.742, SOC=0.800 and social support=0.951.

Data analysis

Demographic characteristics, socioeconomic factors, lifestyle, academic characteristics and psychosocial factors were described according to the severity of depression, anxiety and stress through means (SD) and proportions.

The relationship of structural and intermediary determinants with each domain of DASS-21, namely the scores of depression, anxiety and stress, was evaluated using the rate ratio (RR), 95% CIs and *p* values. Initially, the association between each independent variable and mental health outcomes was assessed through unadjusted negative binomial regression. This regression analysis was used to account for overdispersed outcome variables, since the variance of the scores of depression, anxiety and stress exceeded the respective means. Statistical modelling using multivariate negative binomial regression was carried out to obtain adjusted estimates. The variables that presented p<0.10[31] in the unadjusted analysis were considered in the multivariable statistical models following the theoretical model (figure 1). The significance level established for the adjusted negative binomial regression models was 5% (p≤0.05). All analyses were performed using statistical software IBM SPSS Statistics V. 29 (IBM, Armonk, New York, USA).

Patient and public involvement

None.

RESULTS

The average age of the participants was 22.2 years and almost 83% of the sample were female university students. More than 50% of the sample had a monthly family income of less than six minimum wages and were from a different city than the city of the campus. The mean scores of DASS-21 subscales of depression, anxiety and stress were 7.39 (SD=5.72), 6.96 (SD=5.49) and 11.43 (SD=5.60), respectively. The sociodemographic and academic characteristics, and lifestyle and psychosocial factors of the participants are presented according to the severity categories of depression, anxiety and stress (online supplemental file 2). The mean age of the participants was 22.2 (SD=3.7) years, and most participants were female (82.8%), had white skin colour (59.4%), and family income between 3 BMWs and 6 BMWs (33.6%). Most students were not admitted through social quotas (57.9%) and moved from their city of origin to attend the dental course (54.5%).

The unadjusted analysis revealed that favourable student lifestyle, better perception of the academic environment, greater SOC and greater social support were statistically associated with lower levels of self-reported depression, anxiety and stress. In addition, female sex was associated with higher anxiety and stress levels (table 2).

Table 3 reports the multivariate negative binomial regression on the association of sex, academic environment, student lifestyle, SOC and social support with self-reported depression, anxiety and stress. Female students were expected to have anxiety and stress mean scores of 47% (95% CI 1.10 to 1.97) and 52% (95% CI 1.12 to 2.06) higher than male students. Better perception of the academic environment decreased the likelihood of depression (RR 0.99, 95% CI 0.98 to 0.99), anxiety (RR 0.99, 95% CI 0.98 to 0.99) and stress (RR 0.99, 95% CI 0.98 to 0.99). Greater SOC was associated with lower scores of depression (RR 0.94, 95% CI 0.92 to 0.95), anxiety (RR 0.96, 95% CI 0.95 to 0.98) and stress (RR 0.96, 95% CI 0.95 to 0.98). Students with a more favourable lifestyle were less likely to have greater scores of depression (RR 0.99, 95% CI 0.97 to 0.99).

DISCUSSION

Dental undergraduate students face several challenges during the course of study that can influence their mental health. Of these, academic work overload, laboratorial and clinical training, peer competition, and patient responsibility can possibly affect their mental well-being. In this study, dental students reported high levels

Table 2 Crude negative binomial regression on the relationship of socioeconomic factors, student characteristics, and lifestyle and psychosocial factors with depression, anxiety and stress

	Depression			Anxiety			Stress		
	RR	95% CI	P value	RR	95% CI	P value	RR	95% CI	P value
Age	0.99	0.96 to 1.03	0.710	1.02	0.98 to 1.06	0.425	1.00	0.98 to 1.02	0.863
Sex									
Male	1			1			1		
Female	1.33	0.98 to 1.79	0.068	1.76	1.27 to 2.44	0.001	1.35	1.11 to 1.63	0.002
Ethnicity									
White	1			1			1		
Yellow	0.55	0.22 to 1.39	0.550	0.70	0.27 to 1.82	0.462	0.69	0.40 to 1.24	0.693
Indigenous	0.44	0.11 to 1.70	0.234	–	–	–	0.45	0.18 to 1.09	0.177
Brown	1.26	0.94 to 1.55	0.139	1.05	0.81 to 1.37	0.713	1.01	0.87 to 1.19	0.866
Black	1.18	0.73 to 1.82	0.451	1.07	0.67 to 1.71	0.765	1.23	0.94 to 1.61	0.128
Family income									
>10 BMW	1			1			1		
>6 a 10 BMW	0.90	0.64 to 1.28	0.564	1.27	0.87 to 1.84	0.217	1.11	0.89 to 1.38	0.365
>3 a 6 BMW	0.92	0.67 to 1.26	0.588	1.21	0.85 to 1.71	0.291	1.03	0.84 to 1.26	0.808
<3 BMW	1.00	0.64 to 1.28	0.979	1.33	0.91 to 1.92	0.139	1.12	0.90 to 1.40	0.293
Social quota									
No	1			1			1		
Yes	0.84	0.67 to 1.05	0.124	0.97	0.76 to 1.24	0.831	0.97	0.84 to 1.12	0.706
City of origin is different from the city of the campus									
No	1			1			1		
Yes	0.86	0.68 to 1.07	0.173	0.90	0.70 to 1.15	0.385	0.93	0.80 to 1.07	0.296
Period of the course									
1–3	1			1			1		
4–6	1.16	0.87 to 1.55	0.234	0.90	0.68 to 1.19	0.461	1.04	0.88 to 1.23	0.628
7–9	1.15	0.89 to 1.50	0.285	1.34	0.90 to 1.82	0.059	1.12	0.93 to 1.34	0.228
Academic environment	0.98	0.97 to 0.99	< 0.001	0.98	0.98 to 0.00	< 0.001	0.99	0.98 to 0.99	< 0.001
Lifestyle	0.96	0.94 to 0.98	< 0.001	0.97	0.95 to 0.99	< 0.001	0.97	0.96 to 0.98	< 0.001
Sense of coherence	0.92	0.91 to 0.93	< 0.001	0.95	0.93 to 0.96	< 0.001	0.96	0.95 to 0.97	< 0.001
Social support	0.97	0.97 to 0.99	< 0.001	0.99	0.98 to 0.99	0.003	0.99	0.98 to 0.99	< 0.001

BMW, Brazilian minimum wages; RR, rate ratio.

of poor mental health status according to their scores of depression, anxiety and stress. Also, a better perception of the academic environment and greater levels of SOC were related to lower self-reported depression, anxiety and stress. In addition, a favourable student lifestyle was related to lower depression.

Previous research has shown that almost half of Brazilian dental students from another public university reported common mental disorders, including anxiety, depression and somatic symptoms.[32] High levels of stress, depression and anxiety among dental students have been found in many other countries.[1 9 14 33] Our findings are comparable to other studies that have used the DASS instrument to assess the mental health of dental students. The levels of anxiety symptoms in our study (43.0%) were similar to those found among dental students in Australia (50.2%),[34] while the frequency of stress symptoms (70.3%) was comparable to those reported by dental students in Saudi Arabia (70.8%)[7] and the USA (66.8%).[35] Saudi Arabian dental students exhibited higher levels of depression than those in the present study (56.1%).[13]

In this study, the period of the course was not associated with self-reported depression, anxiety or stress. This result is in accordance with a recent systematic review that concluded that scores of self-reported depression did not differ between dental students in different years of study.[9] Similar to our findings, the role of a poor academic environment on dental students' mental health has already

Table 3 Adjusted negative binomial regression on the relationship of socioeconomic factors, student characteristics, and lifestyle and psychosocial factors with depression, anxiety and stress

	Depression			Anxiety			Stress		
	RR	95% CI	P value	RR	95% CI	P value	RR	95% CI	P value
Sex									
Male	1			1			1		
Female	1.08	0.86 to 1.36	0.502	1.47	1.10 to 1.97	0.010	1.52	1.12 to 2.06	0.007
Period of the course									
1–3	–	–	–	1			–	–	–
4–6	–	–	–	0.88	0.69 to 1.12	0.284	–	–	–
7–9	–	–	–	1.25	0.96 to 1.63	0.097	–	–	–
Academic environment	0.99	0.98 to 0.99	< 0.001	0.99	0.98 to 0.99	0.003	0.99	0.98 to 0.99	0.003
Lifestyle	0.99	0.97 to 0.99	0.049	0.99	0.97 to 1.00	0.227	0.99	0.97 to 1.01	0.266
Sense of coherence	0.94	0.92 to 0.95	< 0.001	0.96	0.95 to 0.98	< 0.001	0.96	0.95 to 0.98	< 0.001
Social support	0.99	0.99 to 1.00	0.232	0.99	0.99 to 1.01	0.678	1.00	0.99 to 1.01	0.941

RR, rate ratio.

been reported. Student's negative perception of the academic environment has also been linked to greater levels of stress, depression and anxiety.[34] Several aspects related to the academic environment, such as academic work (exams, grades and workload), dental training, laboratory and clinical requirements, and low satisfaction with faculty and peer relationships are considered the main sources of stress and anxiety among dental students.[13 14] Previous findings showed that an unfavourable academic environment may negatively influence students' mental health.[1] Academic stressors, including high workload and development of technical skills, are relevant components of the dental learning environment that may have contributed to the poor mental health status of the participants in this study.[1 14]

Depressive symptoms were associated with the lifestyle of dental students in the present study. The heavy workload during dental undergraduate training possibly limits the time available for physical activity, relaxation and leisure, and social relationships, contributing to the development of depressive symptoms among students. Furthermore, smoking and substance abuse are common coping strategies adopted by dental students to relieve the stress and tensions generated by academic overload.[4 5] Thus, the challenging academic routine seems to contribute directly (by stressors) and indirectly (via poor lifestyle) to the development of depressive symptoms among dental students.

However, psychosocial factors, such as SOC, may mitigate the impact of challenging situations during dental training on psychological distress. In this study, higher SOC was associated with lower scores of anxiety, stress and depression. Previous studies have already demonstrated such a relationship among dental students.[18 36] SOC represents an individual psychosocial attribute that reflects the ability to deal with adversities using available material and symbolic resources to deal with challenging situations in a way that promotes health. Students with a higher SOC may develop the skills and abilities to cope with daily academic tensions using available resources from the social environment. SOC has been associated with positive reframing and active coping for dealing with stressful situations among dental students.[37] Thus, a greater SOC seems to protect students' mental health, decreasing symptoms of anxiety, stress and depression as reported in this study.

In this study, social support was not associated with self-reported depression, anxiety and stress in dental students. This result differs from previous research that reported that university students with greater social support showed lower levels of mental and psychological distress.[8 10] Possible explanations for such discrepancies may include sample characteristics, such as students from courses other than dentistry and from other countries, as well as the instrument used to assess social support. Additionally, social support was associated only with the three mental health outcomes in the unadjusted analysis. These relationships did not remain significant in the adjusted multivariable models. Thus, the lack of controlling for confounders in previous studies seems to be a solid explanation for the disparities between the present findings and previous studies.

According to our findings, female participants showed higher levels of stress and anxiety than male. Studies involving undergraduate students in different countries have reported similar results.[1 8 10] Women tend to be more expressive about their feelings and more emotionally vulnerable due to cultural and biological factors.[38] In the present study, there was a greater proportion of female students than of male. Even though this was expected, as the unbalanced distribution of sex is common in dental courses in Brazil,[32] the levels of poor mental health in the

studied sample would possibly have been lower if more male students had been included. However, this aspect did not affect the main findings once sex was included in all the adjusted regression models.

Most studies examining the factors associated with university students' mental health have been carried out in developed countries. Also, few studies on this topic have examined the role of protective psychosocial factors on students' mental health.[1 2] This study comprehensively assessed the predictors of dental students' mental health in a developing country, including demographic aspects, perception of the academic environment, lifestyle, social support and SOC. All instruments used in the present study were validated.

The following limitations of the present study should be acknowledged. The cross-sectional nature prevents causal inference between independent variables and mental health problems. Only dental students enrolled in a public university in Brazil, which is free of charge, were recruited. In addition, the study was conducted in only one dental school in south-eastern Brazil, which is considered the wealthiest region of the country. Therefore, our findings should not be generalised to dental students attending private dental schools who pay tuition fees or obtain student loans to cover such costs, as well as those enrolled in public universities located in other regions of Brazil. A small number of participants were of yellow and indigenous skin colour, which affected the precision of the estimates obtained in the regression models. Furthermore, other possible predictors of mental health status among dental students, including bullying, pre-existing mental health problems and a family history of mental illnesses, were not evaluated. Future longitudinal studies should be conducted to assess the aforementioned predictors of students' mental health throughout the course. In addition, intervention studies should be developed to investigate possible strategies to improve the academic environment and consequently promote students' mental health.

Improving the academic environment can possibly contribute to the reduction of depression, stress and anxiety among dental students. Many academic factors can be modified, including the adoption of educational strategies that reinforce the student's SOC, resilience, autonomy, self-esteem, sense of belonging and empowerment.[39 40] This is particularly relevant to reducing mental health inequalities in universities where students are from different socioeconomic backgrounds, such as the university where this research was conducted. Instead of being a risk factor for students' poor mental health, the university environment should support the academic community to thrive, flourish and achieve psychological well-being.[40] Other promising initiatives to improve student mental health may include the adoption of individual academic tutors to support students in developing strategies for stress management throughout the course, such as life coaching programmes,[41] mindfulness-based stress reduction and deep breathing exercises.[42]

In addition, screening for psychological distress at the beginning of the dental course can be useful in identifying the most vulnerable students and in directing strategies to promote their mental health and the ability to cope with adversity. Furthermore, early identification of dental students with depressive symptoms is especially relevant, as it can contribute to the development of healthier lifestyle habits. Therefore, psychological support services are needed for undergraduate dental students.

CONCLUSION

The present study showed that a poor academic environment and lower SOC were associated with self-reported depression, anxiety and stress among undergraduate dental students. Furthermore, female students were more likely to report greater anxiety and stress than male students. The favourable lifestyle of the student was also associated with lower depression. The educational environment, SOC and lifestyle are potential areas of intervention to improve the psychological health of dental students.

Contributors Conceptualisation, Silva AN da and MVV; methodology, Silva AN da and MVV; formal analysis, Silva AN da and MVV; investigation, Silva AN da; data curation, Silva AN da and MVV; writing—original draft preparation, Silva AN da and MVV; writing—review and editing, Silva AN da and MVV; project administration, Silva AN da. All authors have read and agreed to the published version of the manuscriptSilva AN da and MVV are responsible for the overall content as guarantors.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study involves human participants and was approved by the Committee of Ethics and Research of the Fluminense Federal University, Niterói, RJ (Protocol number 4.132.396). Participants gave informed consent to participate in the study before taking part.

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