Received: 9 February 2022 | Revised: 21 July 2022 | Accepted: 15 September 2022

DOI: 10.1111/eje.12858

ORIGINAL ARTICLE

WILEY

Stress, anxiety and depression in dental students: Impact of severe acute respiratory syndrome-coronavirus 2 pandemic

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Abstract

Introduction: With the emergence of COVID-19, dental medicine students were faced with a new reality, as a modification of the learning methods in Dentistry colleges happened. The aim of this study was to characterise the possible effects of Covid-19 pandemic in terms of anxiety, depression, and stress among students of dentistry.

Matherials and Methods: This cross-sectional study was conducted between October 2020 and May 2021. A total of 1115 participants from a total of approximately 3000 students from the seven university institutions that teach the master's degree in dentistry in Portugal, agreed to participate. An online self-reported questionnaire was applied through Google Forms® platform. The questionnaire was divided in three sections: the students' sociodemographic characterisation, pedagogical aspects, and questions about anxiety, depression, and stress using the Depression, Anxiety, and Stress-21 Scale.

Results: Normal levels of anxiety, depression, and stress, were found in 41%, 36.7%, and 22.7% of the participants, respectively. Being female was the most significant and strong predictor of anxiety and stress, and for depression, not feeling fulfilled in the course they were in was the most significant variable.

Conclusion: The participants presented high values of anxiety, depression, and stress, during the pandemic state. Gender and not feeling fulfilled in the course were important predictors.

KEYWORDS
anxiety, DASS-21, dental student, depression, SARS-CoV-2, stress

1 | INTRODUCTION

On 11 March 2020, the World Health Organization declared a Pandemic state resulting from the disease caused by the new coronavirus 2019 (SARS-CoV-2 – severe acute respiratory syndrome-coronavirus 2). This virus was first detected at the end of 2019 in Wuhan, capital of Hubei province in China, and has become a worldwide health problem since then.[1,2] On 2 March 2020, the first case of COVID-19 was confirmed in Portugal by the Ministry of Health, and several restrictive measures were implemented to contain the outbreak of SarsCov-2 infection. These measures included border closures and a nationwide lockdown until the first days of May.

University campuses, including dental schools, were closed, and face-to-face/in-person teaching was disrupted. In May, only the 5th year students, the dental course final year, resumed clinical activity using personal protection equipment. This allowed students to have the necessary clinical practice to complete their degree. Moreover, to carry out planned activities, some semesters were extended at the expense of holidays.

The virus spreads mainly, through person-to-person contact, or through respiratory droplets, which are currently considered the major routes of transmission. The contaminated respiratory droplets and secretions are transmission vehicles, propagated or by direct transmission, resulting from involuntary reflex acts such as sneezing, coughing, and breathing, or transmission by contact with the oral, nasal, and ocular membranes or with their respective secretions.[3]

Considering the way COVID-19 spreads, dental professionals are in a permanent state of alert, given the high susceptibility of contracting the disease. Within this group are the dentists, one of the professions with a very high risk of contagion,[4,5] due to the physical proximity with patients.[1,4] Exposure to occupational aerosols arising from certain materials and intrinsic to some procedures, originate and propagate droplets (originating from saliva) from the patient's oral cavity, directly to the dentist, and, indirectly, to the surrounding physical environment.[6] Thus, dentists may face psychological distress and anxiety, and fear falling sick and spreading the disease to their closest contacts, triggering a chain of infection.[1,7] This happens, in a similar way, in dental students, who face even more stresses, such as the closing of the universities, all around the world, during the first months of the pandemic, a situation which undoubtedly changed academic life. Teaching methods were also changed, and a new reality was forced upon students, with the theoretical and practical classes transferred to online learning using online meeting platforms. If, on one hand, this methodology allowed to acquire the necessary theoretical knowledge, clinical and pre-clinical practices were severely penalised, as nothing can be compared with clinical and laboratory practices.[8] In this way, it is fair to assume that students can demonstrate discouragement, anxiety, and fear of not being able to acquire enough practice to complete their training with the necessary skills.

Additionally, when students move from a face-to-face context to a virtual approach, feelings of discouragement can accentuate, and negative feelings can intensify. These feelings include frustration, lack of motivation and numerous worries, such as how will they be able to reconcile all their current fears with the dedication, responsibility, and objectives imposed by the course, since dentistry has been associated with high levels of stress for having a demand level considered high.[9] With the onset of the pandemic and the underlying changes implemented, namely the clinical activity reduction, changes in study methods, or the interpersonal contact reduction, negative factors such as anxiety, depression, and stress in students may have arisen.

These negative factors can be measured by a self-reported questionnaire (DASS-21), that measures depression, anxiety, and stress in a single and comprehensive scale and has been used to assess these negative emotional states in undergraduate students, including dental students.[10–17]

This study aimed to evaluate if sociodemographic factors and the new realities experienced during the pandemic period may be related to anxiety, depression, and stress experienced by students of dentistry.

2 | MATERIALS AND METHODS

This cross-sectional study was conducted between October 2020 and May 2021. All undergraduate dental students from the seven university institutions that teach dental medicine in Portugal were eligible to participate. The sample size was estimated to be 341 participants, using a confidence level of 95% within a 5% margin of error. However, due to the non-randomised sampling technique applied, we decided to include all the questionnaires received resulting in a final sample of 1115 participants out of a total of approximately 3000 students (response rate 38%).

Ethical approval was obtained from the Ethics Committee of the Faculty of Dental Medicine, Porto University (NO: 21/2020).

A three-part questionnaire was developed using the Google Forms Platform. The online link to the questionnaire was posted in every Facebook page of each curricular year of every participant institution. The first section included the sociodemographic characterisation, namely gender, academic year, whether they lived alone or accompanied, the effect of the pandemic state on their income, and finally a question about the feeling of accomplishment in the course they were in. Regarding the second section, referring to the pedagogical aspects, the participants were asked about whether they were satisfied with their performance at a pedagogical level, if they felt affected for not having had practical/laboratory/pre-clinical classes/clinics and, if they experienced aggrieved feelings for not having had the clinical benefit they were expecting. Finally, they were asked whether they felt discouraged throughout the day, as most of their time was spent in front of a computer. In the third section, the questions aimed to characterise anxiety, depression, and stress using the Depression, Anxiety and Stress Scale – 21, DASS-21[10,18] which is an abbreviated version of the Depression, Anxiety and Stress Scale – 42 (DASS-42), developed by Lovibond and Lovibond. The DASS-21 includes three self-reported scales designed to measure anxiety, depression, and stress. The anxiety subscale items focused on psychological restlessness and fear. The depression subscale items focused on bad mood, low self-esteem, and a negative outlook on the future, while the stress subscale items focused on constant thoughts and high tension. Each scale has seven items scored on a Likert scale from 0–3 (0 = Did not apply to me; 1 = Applied to me a few times, 2 = Applied to me many times, 3 = Applied to me most of the time).

The scale provides four scores, one for each subscale, where the total score ranges from 0 to 21. The 21 items of DASS-21 were selected so that it can be converted into the full 42-item scale scores by multiplying thus the result of each subscale by two.[18] Each scale was evaluated by summing the response to each item. The anxiety

scale score was categorised as normal from 0 to 6, mild anxiety from 7 to 9, moderate anxiety from 10 to 14, severe anxiety from 15 to 19, and extremely severe anxiety from 20 to 42.[13] The depression scale score was divided into normal from 0 to 9, mild depression from 10 to 12, moderate depression from 13 to 20, severe depression from 21 to 27, and extremely severe depression from 28 to 42.[13] The stress scale score was characterised as normal from 0 to 10, mild stress from 11 to 18, moderate stress from 19 to 26, severe stress from 27 to 34, and extremely severe stress from 35 to 42.[13]

2.1 | Statistical analysis

Data analysis was performed using version 25 from Statistical Package for Social Science (SPSS-IBM Corporation).

Categorical variables were described using absolute and relative frequencies. A multiple linear regression model was used to test whether anxiety, depression, and stress could be predicted by sociodemographic factors and different pedagogical aspects presented in the questionnaire. In all analyses, a significance level of 5% was used.

3 | RESULTS

In Table 1 are shown the participants' sociodemographic characteristics. The majority was female and resided with others (78.2% and 87.9%, respectively). Most (83.3%) declared feeling accomplished in their course, and 61.5% reported feeling a negative financial impact during the pandemic.

TABLE 1 Characterisation of the participants' sociodemographic data ($n = 1115$)

	%
Gender	
Male	21.8
Female	78.2
School year	
1°	10.9
2°	13.7
3°	18.5
4°	22.6
5°	34.3
Do you feel accomplished in the course you are in?	
Yes	83.3
No	16.7
During the school year, did you live alone or accompanied?	
Alone	12.1
Accompanied	87.9
Has the pandemic affected your financial income?	
Yes	61.5
No	38.5

Table 2 shows the results of the pandemic impact on the participants' pedagogical performance. Most students (78.2%) reported feeling a negative impact on their pedagogical performance, with 69.4% declaring the fact they spent many hours on the computer as a negative factor. Most participants (78.4%) felt upset due to dissatisfaction in their clinical performance and to have felt affected by the lack of the practical component (86.4%).

Table 3 depicts the participants' results on anxiety, depression, and stress. Abnormal levels of anxiety, depression, and stress were observed in 59.1%, 63.3%, and 77.3% of the participants, respectively. Extremely severe scores for anxiety, depression, and stress were reported in 26.1%, 16.0%, and 11.7%, respectively.

The predictive values of anxiety, depression, and stress in students of dentistry during the SARS-CoV-2 pandemic are depicted in Table 4. Regarding anxiety, being female ($B = 4.077$, $t = 5.641$, $p < .001$) and the feeling of non-fulfilment with the course ($B = 3.170$, $t = 4.125$, $p < .001$), were the predictive factors of increased levels of anxiety. Living alone or accompanied during the pandemic state did not significantly alter the levels of anxiety ($B = 1.561$, $t = 1.768$, $p = .077$).

Predictors of increase of depression were the feeling of non-fulfilment in the course ($B = 5.773$, $t = 7.345$, $p < .001$), and the fact that students do not feel they had the same educational performance ($B = 4.029$, $t = 5.308$, $p < .001$). Living alone or accompanied during the pandemic state had no statistical significance for the increase in depression levels ($B = 0.474$, $t = 0.527$, $p = .598$).

Predictive factors of increased stress levels were to be female ($B = 5.237$, $t = 7.186$, $p < .001$), and not feeling they had the same educational performance ($B = 2.825$, $t = 3.762$, $p < .001$).

4 | DISCUSSION

This study aimed to evaluate how the conditions enforced by the pandemic affected the levels of anxiety, depression, and stress in students of dental medicine.

A high level of anxiety, depression, and stress are natural responses to any type of unnatural situation.[11] As stress is the result of certain physical and psychological factors that affect an individual well-being, it is associated with the manifestation of other disorders, such as anxiety and depression.[10,18] Anxiety can be defined as an emotion characterised by feelings of tension, disturbing thoughts, and physical changes; depression is defined as a common mental disorder, characterised by sadness, loss of interest or pleasure, substantially impairing a person's ability to respond in the context of their work, education, or dealing with daily life. Both anxiety and depression are emotional states that must be considered, primarily in the current pandemic scenario, to minimise the psychological suffering.[6,10,18]

It has been described that students of dental medicine had higher levels of anxiety, depression, and stress than students from other areas.[10] The instabilities and challenges that the COVID-19 pandemic brought, from the reformulation of learning methods, the lack of interpersonal contact, the resumption of the practical part for the course, and the risk of infection, may have intensified these negative

TABLE 2 Characterisation of the impact of COVID-19 pandemics on pedagogical aspects ($N = 1115$)

	%
Did you feel that you managed to have the same educational performance?	
Yes	21.8
No	78.2
Did you feel anxious about spending most of the day in front of a computer?	
Yes	69.4
No	30.6
Did you feel disadvantaged for not having had practical/laboratory/pre-clinical/clinical classes?	
Yes	86.4
No	13.6
Did you feel anxious about not having had the clinical benefit you had hoped for?	
Yes	78.4
No	21.6

TABLE 3 Participants' anxiety, depression, and stress levels ($N = 1115$)

	Anxiety	Depression	Stress
	%	%	%
Normal	41.0	36.7	22.7
Mild	7.3	13.6	23.9
Moderate	16.9	22.6	23.9
Severe	8.8	11.1	17.8
Extremely severe	26.1	16.0	11.7

emotions, resulting in greater psychological distress. In our study, mild to extremely severe levels of anxiety, depression, and stress were identified in 59%, 63.3%, and 77.3%, respectively. These data were consistent with other studies.[6,11,13,19–21] In contrast, German dental students showed an overall normal or mild psychological impact of the pandemic on anxiety, stress, and depression.[17] Also, one study showed a low prevalence of anxiety (7.3%), depression (11.9%) and stress (0.9%) during the pandemic COVID-19 in dental studens.[14] Different measures applied to contain the pandemic may have contributed to the students' different responses to the development of these negative feelings. It may also be due to cultural differences.

It has been reported that while infection with SARS-CoV-2 seems to be more severe for men, the mental health effects appear to disproportionately affect women.[22,23] Women had higher percentages for all DASS-21 subscales than men, which agrees with other studies.[9,13,20,24] Our results are similar to those found by Mekhemar et al.[17] and Loset et al.,[25] in which female students were at higher risk of stress, anxiety, and depression. This may be due to the females' greater psychological predisposition to better express their feelings and thoughts. So, females may display a greater vulnerability in self-report questionnaires.[24]

In this study, similar to other authors[13,20] we found that as students progress through their academic path, anxiety, depression, and stress decrease, and the first-year students had higher levels of anxiety, depression, and stress. This may be due to the entry into the academic world, unknown for them until then, adding up to the pandemic, that prevents them from developing interpersonal relationships, extremely important in the beginning and through all academic life. Such results can also be justified by the fact that students, as they proceed through the course, learn to better manage their emotional states, to cope with the demands imposed by the course and, currently, with the current pandemic scenario. However, throughout the course, due to the increase in clinical responsibilities and to the thought of being about to be working autonomously, one would expect higher levels of anxiety, depression, and stress in 4th- and 5th-grade students, as Jowkar et al.[24] and Akinkugbe et al.[26] evidenced in their research. Yet, such results were not seen in our research.

In this study, one of the conditioning factors that stood out significantly in the expression of the emotional states mentioned above was the fact that students did not feel fulfilled in the Dentistry course which was a variable that favoured the significant increase in levels of anxiety, depression, and stress. No previous studies were found addressing this. However, it is something that we are aware of, and should be investigated. In fact, the emotional states' levels increase may be caused by a pre-existing dissatisfaction, due to a lack of interest in the course, possibly leading to the exacerbation of these emotions with the pandemic. In fact, Basudan et al.[10] argued that students' degree of satisfaction with their learning experience influenced their levels of anxiety, depression, and stress. This variable may be indirectly related to the increase in the levels of these emotional states when students are asked if they feel fulfilled in the course they are in, which goes against the results of our investigation.

In the present study, increased levels of anxiety and depression were observed when the students lived accompanied, although not statistically significant. However, this variable was significant in the increase in stress levels, probably because of a greater interpersonal interaction. This could increase the negative emotional states levels, mainly in the lockdown periods imposed, where people were forced to spend most of their daily time in the same space. Conversely, living with someone might have helped to reduce levels of anxiety, depression, and stress, as they did not feel alone to face the adversities encountered during this period, as observed in the study by Hakami et al.[20]

TABLE 4 Multiple linear regression model predictive of anxiety, depression, and stress in dental students during the SARS-COV-2 pandemic

		Unstandardised coefficients		Standardised coefficients					Colinearity statistics	
Predictor	Scale	*B*	SE	β	*t*	*p*	IC 95%		Tolerance	VIF
Constant	A	14.810	1.495		9.904	**<.001**	11.875	17.744		
	D	15.452	1.525		10.134	**<.001**	12.460	18.444		
	S	20.035	.729		13.286	**<.001**	17.077	22.994		
Sex (reference = male)	A	4.077	.723	.158	5.641	**<.001**	2.659	5.495	.924	1.082
	D	2.679	.737	.102	3.636	**<.001**	1.233	4.125	.924	1.082
	S	5.237	.729	.191	7.186	**<.001**	3.807	6.667	.924	1.082
School year	A	−1.476	.219	−.189	−6.734	**<.001**	−1.906	−1.046	.921	1.086
	D	−1.230	.223	−.155	−5.504	**<.001**	−1.669	−.792	.921	1.086
	S	−1.330	.221	−.160	−6.017	**<.001**	−1.763	−.896	.921	1.086
Do you feel accomplished in the course (reference = yes)	A	3.179	.771	.111	4.125	**<.001**	1.667	4.692	.996	1.004
	D	5.773	.786	.199	7.345	**<.001**	4.231	7.315	.996	1.004
	S	3.571	.777	.118	4.595	**<.001**	2.046	5.097	.996	1.004
During the school year lives alone or accompanied? (Reference = alone)	A	1.561	.883	.048	1.768	.077	−.172	3.293	.991	1.009
	D	.474	.900	.014	.527	.598	−1.292	2.241	.991	1.009
	S	2.373	.890	.069	2.665	**0.008**	.626	4.120	.991	1.009
Did the pandemic affect financial income? (reference = yes)	A	−3.083	.610	−.141	−5.054	**<.001**	−4.280	−1.886	.934	1.071
	D	−2.836	.622	−.127	−4.559	**<.001**	−4.056	−1.615	.934	1.071
	S	−3.212	.615	−.138	−5.222	**<.001**	−4.419	−2.005	.934	1.071
Did you feel that you managed to have the same educational performance? (reference = yes)	A	.969	.745	.038	1.302	.193	−.492	2.430	.871	1.149
	D	4.029	.759	.154	5.308	**<.001**	2.540	5.519	.871	1.149
	S	2.825	.751	.103	3.762	**<.001**	1.352	4.298	.871	1.149
Did you feel disadvantaged for not having practical/laboratory/pre-clinical/clinical classes? (reference = yes)	A	1.240	1.018	.040	1.218	.223	−.757	3.237	.674	1.483
	D	−.775	1.038	−.025	−.746	.456	−2.811	1.262	.674	1.483
	S	.953	1.027	.029	.928	.353	−1.061	2.967	.674	1.483
Have you felt discouraged by being in front of a computer most of the day? (reference = yes)	A	−4.042	.669	−.175	−6.042	**<.001**	−5.355	−2.729	.866	1.155
	D	−2.914	.682	−.124	−4.272	**<.001**	−4.253	−1.576	.866	1.155
	S	−5.89	.675	−.241	−8.742	**<.001**	−7.222	−4.574	.866	1.155
Did you feel aggrieved that you did not get the clinical uptake you expected? (reference = yes)	A	−4.412	.879	−.170	−5.019	**<.001**	−6.137	−2.687	.628	1.592
	D	−2.882	.896	−.110	−3.215	**.001**	−4.641	−1.124	.628	1.592
	S	−4.416	.887	−.161	−4.892	**<.001**	−6.156	−2.677	.628	1.592

Note: All values in bold are statistically significant.

Abbreviations: A, Anxiety; CI, Confidence Interval; D, Depression; LL, Lower Limit; S, Stress; SE, Standard Error; UL, Upper Limit; VIF, Variance Inflation Factor.

p = significant predictor ($p < .05$).

With the pandemic, there were changes in professional dynamics as well, which may have led, in many cases, to a decrease in financial income due to the interruption, for indefinite periods, of the work activity. Workers who were dependent on these incomes to support themselves and their families faced periods of financial instability, which may have triggered an increase in levels of stress and anxiety. Most students who needed their employment to continue their studies, or those who supported themselves financially, were affected. This led to a significant increase in levels of anxiety, depression, and stress. These data are similar to those obtained by Hung et al.[21] and by Khan et al.[11]

It should be noted that the COVID-19 pandemic significantly changed the pedagogical strategies of the dental medicine course. Although the theoretical part was ensured with online classes using platforms, such as Zoom and Moodle, among others,[16] thus enabling the acquisition of the necessary and essential theoretical knowledge, this option was seen by the participants of the study as an alternative, but not the preferred choices when compared to face-to-face methods, and a pedagogical level downgrade was referred. This can be explained by many factors, such as the imposition of students spending most of their time in front of a computer, being more difficult to maintain concentration for long periods of time, problems in the internet or in their equipment,[16] thus generating discouragement and frustration, revealing increased levels of anxiety, depression, and stress, as Amir et al.[19] report in their research. In contrast, studies carried out in Jordan, one by Al-Balas et al.[27] and another carried out by Al-Azzamet et al.[28] We reported that learning through the virtual method was considered by students to be an effective method and, to a certain extent, described by some, as being effectively better than the face-to-face method, due to greater time savings, flexibility between classes and, consequently, better academic performance. It is noteworthy that, in our study, students feeling that they have learned less was one of the predictive variables of the increase in the levels of depression and stress.

Temporary interruption of clinical practice led to anxiety, depression, and stress increased levels in students of dental medicine, who felt jeopardised. This was because they dealt with increased clinical demand in the progression of the course, as well as the need for the indispensable pre-clinical and clinical training. Therefore, students may be aware that practical skills cannot be learnt similarly with the visualisation of clinical procedures during online classes, this being the only alternative means when the classroom is interrupted. This perspective goes against studies performed previously.[21,29] In this study, the absence of the clinical part was a significant predictor of the increase in the level of depression, deserving its due emphasis.

This study may indicate that some academic factors contributed to the increase in levels of anxiety, depression, and stress in students of dentistry. This may be due to the current pandemic state that has mostly affected learning methods. Concomitantly, these factors were the main concern of students, although human relationships were also strongly affected. However, the impact on learning methods did not act in the same way in a study carried out by Basudan et al.[10] where, contrary to what our study shows, interpersonal factors were the most significant predictors of psychological impact on dental students. It is relevant to note that it is not possible to make a real comparison of both studies, since the study found in the literature was carried out before the pandemic state.

4.1 | Limitations of the study

Limitations of this study include its cross-sectional design and relatively low response rate (37.1%), meaning that the full range of impacts relating to the COVID-19 outbreak may not have been captured. Also being a cross-sectional study does not allow the assessment of changes in the psychological state over time, and it is impossible to quantify over the pandemic scenario whether there was a permanence, increase, or decrease in levels of anxiety, depression, and stress. Additionally, there were no studies carried out prior to the COVID-19 pandemic that had evaluated the same parameters in Portuguese dental students to compare with the present one.

It should be noted that the convenience sample used here may not be fully representative of the Portuguese dental student population. The data were collected via on-line questionnaire rather than face-to-face interview, but considering the number of possible participants and the pandemic, an online survey was the most convenient form of data collection.

This study was also limited by the fact that students who receive or received any type of psychological treatment (cognitive and behavioural therapy, medication, or a combination of both) were not excluded, and their responses may have been biased, because of the psychological treatment.

5 | CONCLUSION

This study provides that information about the impact that the COVID-19 pandemic brought to undergraduate Portuguese dental students in terms of anxiety, depression, and stress.

During the pandemic state, regarding anxiety, depression, and stress in students of dentistry, it was possible to conclude that the participants had high values for these psychological states. The disruption in the clinical experience and the change in the teaching methods in combination with personal factors led to a significantly negative impact for students.

In short, given the obstacles faced during the pandemic and in view of the possibility of distance learning being interspersed with face-to-face teaching, it is imperative that the dental school courses be adapted and personalised among students, to achieve this with appropriate auxiliary tools, to get the theoretical and practical skills essential for dentistry teaching while ensuring the mental health of students. Therefore, in addition to investing in teaching strategies to mitigate the effect of possible pandemics, there should be a social and psychological support network, and above all, this network should be able to detect the most vulnerable students. We suggest that dental schools should provide training courses and support in mental health, to help students create

strategies to deal with stressful situations and to recognise the need to seek help when needed.

ACKNOWLEDGEMENTS

The authors are grateful to all the students for participating in the study.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author.

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How to cite this article: Braz-José C, Morais Caldas I, de Azevedo Á, Pereira ML. Stress, anxiety and depression in dental students: Impact of severe acute respiratory syndrome-coronavirus 2 pandemic. *Eur J Dent Educ*. 2023;27:700-706. doi: 10.1111/eje.12858