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# Anxiety, depression, and academic stress among medical students during the COVID-19 pandemic

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**Background:** The social distancing policies implemented by the health authorities during the COVID-19 pandemic in Mexico and elsewhere led to major changes in teaching strategies for college undergraduates. So far, there is limited data regarding the impact of the lockdown on the academic stress and mental health of these students.

**Objective:** To assess the occurrence of academic difficulties, anxiety, depression, and academic stressors resulting in somatization with subsequent coping strategies linked to the pandemic.

**Materials and methods:** A cross-sectional study was conducted with 728 medical students (years 1–5). A purposely designed questionnaire to assess academic difficulties associated with the pandemic was administered electronically. The validated Goldberg anxiety and depression scale was also used, as well as the SISCO-II inventory on academic stress.

**Results:** Screening for anxiety and depression led to a prevalence of 67.9 and 81.3%, respectively. Most relevant stressors, reported always or nearly always, included professors' evaluations (63.9%), and reading overload of academic papers (50.6%). Factorial analyses showed that women were more prone to stress than men ( $p < 0.001$ ). Somatization symptomatology included drowsiness or increased need of sleep, anxiety, anguish, desperation, chronic fatigue, and sleep disorders. Common coping strategies included practicing a hobby, done always or nearly always by 65% of students with high stress, and 34% of those with low stress ( $p < 0.001$ ).

**Conclusion:** There was a relevant impact of the mandatory lockdown during COVID-19 pandemic on the mental health of medical students reflected in the high prevalence rates of anxiety, depression, and stressors in the studied

population pointing to the need for designing and implementing preventive strategies to deal with the effects of lockdowns.

#### KEYWORDS

academic stress, anxiety, COVID-19, depression, medical students

## 1. Introduction

Coronavirus 2019 disease (COVID-19) is a viral infection that can lead to the potentially lethal severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It appeared in December 2019 in Wuhan, Hubei province of China, and since then it spread rapidly throughout the world (Hopkins, 2020; Yang and Wang, 2020; World Health Organization, 2022).

As to December 2022, the pandemic has caused more than 6.62 million deaths, and it has had a major economic impact coupled with a transformation of the daily life everywhere (World Health Organization, 2022). The social isolation that arose from the mandatory lockdown implemented by many countries has resulted in various psychological problems for the population (Wang et al., 2020). Recent reports show that COVID-19 lockdowns, including curfews, quarantines, and other societal restriction measures, are associated with symptoms of acute stress disorder (ASD) and posttraumatic stress disorder (PTSD), along with other issues such as emotional exhaustion, lack of interest, and mental disturbances including anxiety and depression (Brooks et al., 2020; Nelson et al., 2020).

Among students of medicine and other academic tracks, stress (i.e., the body's reaction to physical, mental, or emotional pressure) is an important concern (Behere et al., 2011), whereas the events responsible for its occurrence are called stressors. Yet, people can react differently to the same stressor; the response can be physical, emotional, or behavioral, and it is usually framed within the physical and social environment of the individual. Such response appears when the assessment of an event appears as a threat to the individual's wellbeing, and especially when he/she lacks the resources to face it and cope with it (Arribas Marín, 2013; Cohen et al., 2016).

Stress affects the lives of many people's around the world, and it is linked to the psychopathology of various health conditions, and to their inability to adapt to challenging social environments (Eisenbarth et al., 2019). Stressful life experiences and the individuals' psychological condition influence the clinical manifestations and course of many diseases (Straub and Cutolo, 2018). Back in 1948, Selye theorized that a stressor generally produces an acute response (alarm reaction stage) that can be adaptive (stage of resistance) and resolve or lead to an exhaustion stage with potentially chronic and irreversible physiological, psychological, and psychosocial consequences (Selye, 1948). A theoretical framework on the response to stress (i.e., allostasis) states that the allostatic load could accumulate

resulting in an overexposure to stress mediators (immunologic, endocrine, and neural) triggering adverse organic effects that can lead to illnesses (McEwen, 1998). The theory of cognitive activation of stress is centered on the coping response that seems to determine the outcome, potentially resulting in stress-related illnesses if coping strategies are insufficient or inadequate (Ursin and Eriksen, 2010). Continuous thinking about negative events, passed or future (i.e., perseverative cognition), manifested through worry, rumination and brooding, has also been linked to stress-related problems, including cardiovascular, endocrine, and immunologic (Brosschot et al., 2006; Segerstrom et al., 2008).

Additionally, many university students experience academic stress associated with educational activities (e.g., exams, assessments, study load, etc.) and financial difficulties that have an impact on their learning performance (Crego et al., 2016). Students can also develop psychophysiological manifestations including memory and concentration difficulties, mental blocks, chronic fatigue, drowsiness, and despair (Barraza Macías, 2008).

Medical students are particularly prone to high levels of stress and psychological disorders such as anxiety and depression (Guthrie et al., 1995; Toews et al., 1997; Moffat et al., 2004). Studies have shown that most medical students experience different forms of psychological distress (Dyrbye et al., 2005, 2006; Heinen et al., 2017; Zvauya et al., 2017), some of which can lead to a higher risk of suicidal ideation and thoughts about quitting medical studies (Dyrbye et al., 2011). Students under stress try to deal with stressors by means of physical, psychological, or social behavioral responses; these coping strategies attempt to overcome or at least attenuate stress situations.

The social distancing policies implemented by the government and health authorities during the COVID-19 pandemic in Mexico and many other countries led to major changes in teaching strategies, including those for medical students, with internet-based learning becoming the cornerstone of these efforts for more than a year. However, so far there is limited data on what has been the impact of the lockdown on the mental health and academic stress in these medical students. Therefore, this study was undertaken to assess the occurrence of academic difficulties, anxiety, depression, and academic stressors that resulted in somatization and coping strategies linked to the pandemic in medical students from a Mexican university. The study proposal was reviewed and approved by the Ethics and Research Committee at the Academic Unit of Human Medicine and Health Sciences of the Autonomous University of Zacatecas (approval ID: AMC/

CI/02-ORD/2020, CEICCL0121- ALGDEZA-03). All participant students provided signed informed consent.

## 2. Materials and methods

### 2.1. Study design and participants

This was a cross-sectional study conducted with 728 medical students out of the 928 registered at the Autonomous University of Zacatecas, in the homonymous State in the Central Northern region of Mexico. Male and female students from years 1 to 5 were surveyed. At the time of the survey (early Spring 2021), internet-based learning was the educational modality due to the compulsory lockdown.

### 2.2. Measuring instruments

#### 2.2.1. General questionnaire

This was a purposely designed tool that contained basic sociodemographic data and a number of questions assessing academic difficulties potentially linked to the COVID-19 pandemic.

#### 2.2.2. Goldberg anxiety and depression scale (GADS)

This screening tool consists of two subscales, one for anxiety and the other for depression, each with nine items with dichotomous responses (Goldberg et al., 1988). An independent score is totalized for each scale. Questions 1–9 relate to anxiety (e.g., Have you had difficulty relaxing?), and questions 10–19 relate to depression (e.g., Have you felt low energy?); the first four questions in each subscale are conditioning questions, so that two and one positive answers are needed to continue answering each subscale, respectively. The individual is questioned about whether he/she has presented any of the relevant symptoms; those lasting <2 weeks or are of mild intensity are not scored. The cut-off points for anxiety and depression used in this study was  $\geq 4$  and  $\geq 2$ , respectively. An adequate internal and external validity has been reported; correlation coefficient with the Hamilton Depression Scales is 0.74 (Holm et al., 2001). A total of 728 students completed this questionnaire.

The validity and reliability of the Goldberg anxiety and depression scale has been assessed in two Spanish speaking Latin American countries; one with a sample of 548 Cuban adults that showed a good diagnostic performance (AUC: anxiety 0.64, depression 0.68) (Martín-Carbonell et al., 2016), and another with a sample of 609 psychology students from the Catholic University of Cuenca, Ecuador, that showed a good reliability (Cronbach's alpha: anxiety 0.75, depression 0.80) (Reivan-Ortiz et al., 2019). In research studies, GADS has been previously used to assess depression symptoms among middle-aged Latin American women with severe menopausal symptoms and obesity (Blümel

et al., 2016), to assess anxiety and depression among Mexican patients with dystrophic epidermolysis bullosa (Fortuna et al., 2016), and more recently in two Mexican studies, one with type 2 diabetes patients (Gonzalez Heredia et al., 2021), and another with primary caregivers of patients in dialysis (Gonzalez Heredia et al., 2021).

#### 2.2.3. SISCO-II psychometric inventory on academic stress

This instrument contains eight questions that assess academic stressors (e.g., peer competition, homework overload, teachers' personality, etc.), and another 17 items that measure physical, psychological, and social behavior reactions (e.g., sleep disorders, chronic fatigue, headache, etc.) in response to academic stress (i.e., dimensions of somatization). An additional six questions measure coping strategies (e.g., ability to defend preferences without harming others, religious practice, information seeking about a situation, etc.) with five possible answers each using a Likert scale (never, seldom, sometimes, nearly always, always) were part of the instrument.

The SISCO-II inventory of academic stress has been considered valid and reliable scale for diagnostic use. It was designed and tested in Mexico showing good reliability (Cronbach's alpha: stressors 0.85, symptomatology 0.91, and coping 0.69) (Barraza, 2007). It has been validated in other Latin American countries such as Colombia (Malo et al., 2010), Perú (Manrique-Millones et al., 2020), and considered appropriate in these three countries. Thus, it has been considered a valid tool for use in Latin American students (Castillo-Navarrete et al., 2020). A total of 421 students completed this questionnaire.

### 2.3. Data collection

Students were sent a link where they could access the webpage to participate in the survey, which lasted between 15 and 20 min. Students were sent a reminder email one week after the first contact. All questionnaires were administered electronically using "Google forms." Participants had to provide informed consent in the first page of the survey to be able to continue. Data was collected anonymously in March 2021. Overall participation rate was 76.1% (728/956), but for the SISCO-II inventory it was 44% (421/956). No data were available for the reasons for not responding.

### 2.4. Statistical analysis

Percentages were used to describe issues and problems associated with the online teaching modality during the pandemic. Overall prevalence of anxiety and depression was also computed with results stratified by sex and age. Density analysis was used to graph the most frequent responses. An exploratory analysis relating anxiety and depression was done, as these psychiatric

illnesses are known to be highly comorbid with each other (Kalin, 2020).

Percentages were used to present the response level for the SISCO-II inventory. Clusters were produced to stratify the population based on the stressors assessed. Responses obtained for each stressor were assessed by K-means. Also, an exploratory factorial analysis was used to reduce the number of variables included in the instrument using various methods (e.g., Bentler, acceleration factor,  $R^2$ , VSS complexity 1, Velicer's MAP, TLI, RMSEA, optimal coordinates, parallel analysis, and Kaiser criterion); factors were used to assess whether there were significant differences between clusters based on symptomatology. Correlations between stressors were done using Kendall rank correlation coefficients; item dependency was considered statistically significant with  $p$  values below 0.05.

### 3. Results

From the 728 surveyed medical students from years 1 to 5, 301 (41.3%) were men and 427 women (58.7%). Most students (96%) were aged 18–24 years; differences in sex for grade was not significant ( $\chi^2 = 3.24$ , value of  $p = 0.52$ ; Table 1).

#### 3.1. Educational difficulties reported during COVID-19 pandemic

The main educational difficulties referred to by the students are presented in Figure 1A. The most common difficulty associated with the learning modality was “problems with internet connectivity,” reported by 30% of the students, followed by the “lack of clinical practice (hospital and/or laboratory)” with 20%. Students also reported “problems with the internet learning modality” (19%) and “problems with the faculty” (15%). “Lack of concentration and motivation” was also reported by 8% of the students each. As to students' academic performance in the pandemic, 92% reported being affected. Most frequent reasons given were “lack of motivation” (25.2%), “lack of concentration” (18.8%), “lack of clinical practice” (18.4%), “insufficient learning” (17.2%), and “stress” (14.6%; Figure 1B).

TABLE 1 Frequency distributions by sex and age according to grade level.

Degree course	<i>n</i>	Male	Female	Age (mean±SD)
1	122	49	73	18.72±0.92
2	106	43	63	20.13±1.94
3	142	52	90	20.93±0.92
4	172	71	101	21.97±1.01
5	186	86	100	23.11±1.33

#### 3.2. Prevalence of anxiety and depression

Overall, screening for anxiety and depression led to a prevalence of 67.9 and 81.3%, respectively. Women had significantly higher proportions of both, anxiety (73.3% vs. 60.4%;  $p < 0.001$ ) and depression (87.1% vs. 73%;  $p < 0.001$ ), but no statistical differences were seen by age (Table 2). However, those aged 19 years or less showed a notably lower prevalence of anxiety (nearly 10 percent points below the other ages), and yet a higher prevalence of depression (6–12 percent points above the other ages).

Density analysis and linear regression showed that most frequent responses for anxiety were between 4 and 9, and 4 to 8 for depression. Linear regression between both domains (anxiety as predictor of depression) showed a Pearson coefficient of 0.529 ( $p < 0.05$ ; Figure 2).

#### 3.3. SISCO-II inventory on academic stress

The most frequent stressor was the “evaluation of professors” where 40.6% of students reported that caused then stress nearly always, and 23.3% as always, followed by “overload of tasks and academic papers” with 38 and 12.6%, and by “participation in class” with 26.6 and 20.9%, respectively. In contrast, “type of work that professors request,” and “competition with others” were items that caused less stress (Table 3).

The optimization of the number of groups to classify students according to the stressors resulted in two clusters (Figure 3A). The cluster plot produced two separated groups, one with low stress ( $n = 216$ ), and another with high stress ( $n = 205$ ; Figure 3B).

Women were more prone to stress than men ( $p = 0.0003$ ), but no statistical differences were observed by mean age (Table 4).

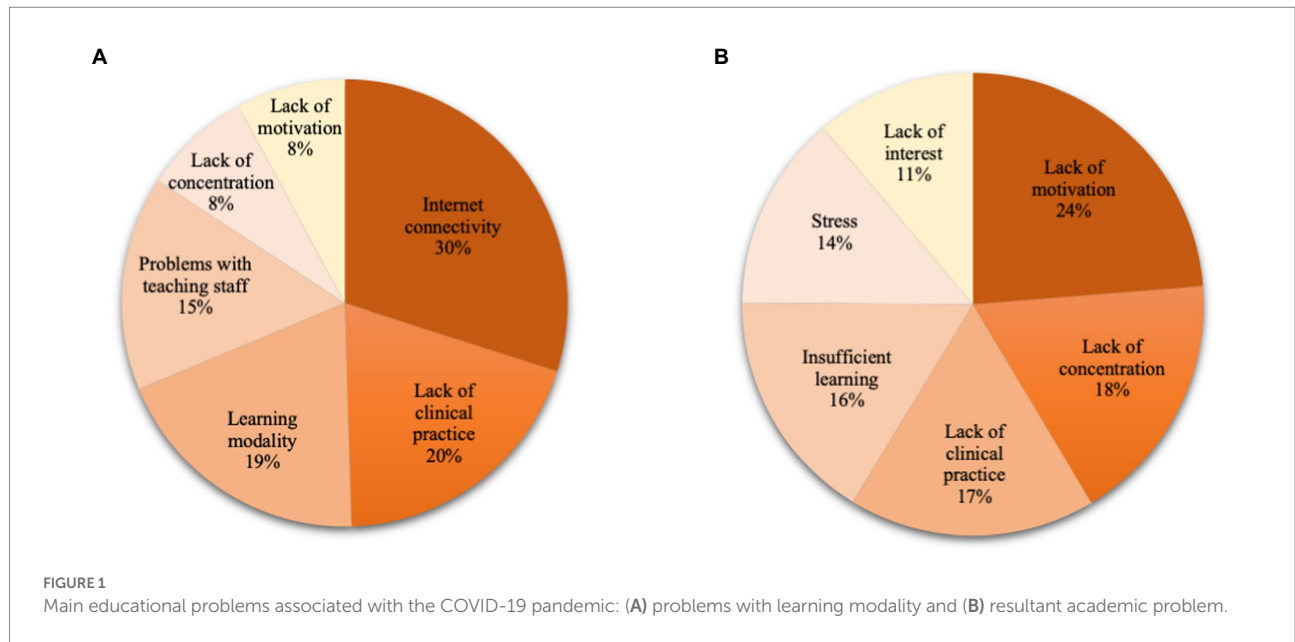
#### 3.4. Dimensions of somatization

The distribution of somatization variables (i.e., physical, psychological, and social behavior response) by response level in groups 1 (low stress) and 2 (high stress) is shown in Table 5. The proportion of responses with levels 4 (nearly always) and 5 (always) were notably higher in group 2 (high stress) compared with group 1 (low stress), especially for “drowsiness or increased need for sleep,” “anxiety, anguish, or desperation,” “chronic fatigue (permanent fatigue),” and “sleep disorders (insomnia or nightmares).”

According to sex, the distribution of response level in somatization, we found significant differences in most of the items ( $p < 0.01$ ), except for the cratching, nail biting, rubbing, etc. and Unwillingness to perform student duties items.

#### 3.5. Coping strategies

Table 6 compares the response level of coping strategies by stress group. Most frequent coping strategies include “practicing a



**TABLE 2** Prevalence of anxiety and depression according to the Goldberg scale by sex and age among medical students at the Autonomous University of Zacatecas, 2021.

Variable	Category	Frequency (%)					
		Anxiety <sup>1</sup>			Depression <sup>2</sup>		
		Negative	p-value*	Positive	Negative	p-value*	Positive
Sex	Male	119 (39.5)	<0.001	182 (60.4)	81 (26.9)	<0.001	220 (73.0)
	Female	114 (26.6)		313 (73.3)	55 (12.8)		372 (87.1)
Age (years)	≤19	33 (23.9)	0.17	105 (76.0)	16 (11.5)	0.10	122 (88.4)
	20	39 (34.8)		73 (65.1)	21 (18.7)		91 (81.2)
	21	53 (37.0)		90 (62.9)	30 (20.9)		113 (79.0)
	22	53 (33.3)		106 (66.6)	28 (17.6)		131 (82.3)
	≥23	55 (31.2)		121 (68.7)	41 (23.2)		135 (76.7)
Total	728	233 (32.0)		495 (67.9)	136 (18.6)		592 (81.3)

<sup>1</sup>Goldberg scale: ≥4 relevant symptoms (those lasting <2 weeks or of mild intensity did not score). <sup>2</sup>Goldberg scale: ≥2 relevant symptoms (those lasting <2 weeks or of mild intensity did not score). \*Pearson Chi-square tests were used.

hobby,” performed nearly always or always by 65% of students with high stress and by 34% of those with low stress ( $p < 0.001$ ), followed “getting company by a loved one” with 56 and 34% ( $p < 0.001$ ), respectively. No statistical differences in responses between groups 1 and 2 were seen for strategies such as “ventilation and confidences,” “complimenting oneself,” and “assertive ability.”

According to sex, the distribution of the level of response in the strategies, we did not find significant differences in any of the items.

### 4. Discussion

This study was carried out to assess the presence of academic difficulties, anxiety and depression, and academic stressors that

result in somatization and coping strategies linked to the COVID-19 pandemic in medical students in a Mexican university.

Stress, in general, is a complex multifactorial process that can result in somatic symptomatology, including gastrointestinal problems, insomnia, insulin resistance and overweight/obesity, as well as adaptative disorders, memory alterations, and depression, among others (Tafet and Nemeroff, 2016). When stress occurs in an educational context, it is known as academic stress (Putwain, 2007), which is characterized by physiological, emotional, cognitive, and behavioral stimuli that happens as consequence of a student’s inability to cope with difficulties in a school setting; stressors linked to school procedures can also trigger this reaction (Barraza Macías, 2008). Academic stress associated with poor coping strategies may affect academic performance, school homework, exams, and poor learning (Eva et al., 2015). Therefore,

timely identification of academic stressors is essential to prevent somatization and the development of more serious physical and/or mental illnesses (Zhai and Du, 2020).

Academic stress has been widely linked to several negative effects on academic performance, school homework, exams, and learning.

Nearly one out of three students reported difficulties with internet connectivity as the main problem linked to the learning modality, and one in five said that the lack of clinical practice was the main concern. Lack of motivation (24%), concentration (18%), and clinical practice (17%) were the most common academic performance concerns.

Research has shown disproportionately higher levels of stress, anxiety, and depression among medical students compared to nonmedical undergraduates (Alzahrani et al., 2020). The incidence of psychological dysregulation in medical students is often attributed to the competitive and stressful environment along with other academic and professional demands which often lead to emotional exhaustion and psychological distress (Abdel Wahed and Hassan, 2017).

Screening for anxiety and depression resulted in an overall prevalence of 68 and 81%, respectively. Results also showed sex differences for both anxiety and depression with higher proportions in women. These results come from data collected in March 2021, right after the second wave of the pandemic, when mortality was at its highest levels. During this period, strict social distancing measures were in place, leading to complete online teaching in all educational system. However, it is important to consider that even before the COVID-19 pandemic, medical students already had relatively high levels of stress and depression (Dyrbye et al., 2006). A meta-analysis from 2016 had revealed a

global prevalence of depression of 28% with first year medical students having the highest rate (Puthran et al., 2016), and with estimates ranging from 8% in American universities assessed with the Center For epidemiologic Studies-Depression scale (CES-D) to as high as 70% in medical schools of Pakistan using the Aga Khan University Anxiety and Depression Scale.

Whether the COVID-19 pandemic has resulted in higher incidence of anxiety and depression is still a contentious topic. For instance, a recent review concluded that the overall prevalence of anxiety in medical students did not increase with the outbreak, as high levels of resilience and healthy coping systems were put in place along with a reduction of academic load together with available family support (Lasheras et al., 2020). Conversely, another study reported that most medical students felt significantly more distressed about their studies due to COVID-19 (Loda et al., 2020). Previous research has shown that stress in preclinical medical students varies depending on the setting, ranging from 20.9% to more than 90% (Fares et al., 2016). In Mexico, before the pandemic, there is data associating high levels of academic stress in medical students with various psychological outcomes such as mental blocks, despair, feelings of depression and anxiety, restlessness, concentration and memory difficulties, and other physiological manifestations including chronic fatigue, drowsiness, headaches, insomnia, and muscle tremors (Pozos-Radillo et al., 2016).

Most relevant stressors, reported as always/nearly always, included professors' evaluations (63.9%), and reading overload of academic papers (50.6%). Other stressors previously reported include poor academic performance (Zeppa and Linn, 1984), excessive academic workload, high pressure to perform,

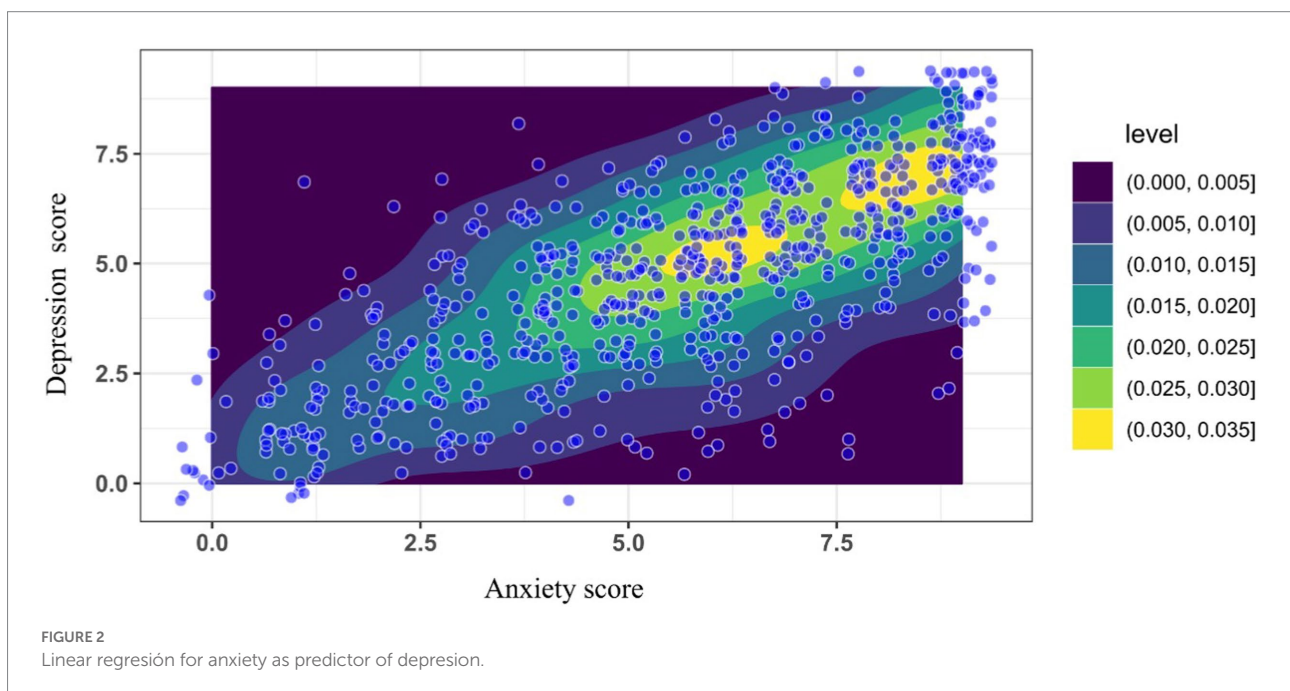


TABLE 3 Distribution of stressors by response level among medical students ( $n=728$ ).

Stressors	Response level* (%)				
	1	2	3	4	5
Overload of tasks and academic papers	0.7	4.0	44.7	38.0	12.6
Personality and character of professors	2.6	12.6	43.9	32.1	8.8
Evaluation of professors (exams, tests, research, etc.)	0.5	6.4	29.2	40.6	23.3
Type of work that professors request	3.3	28.0	41.8	20.2	6.7
Do not understand topics covered in class	2.1	15.2	41.8	29.0	11.9
Participation in class (e.g., response to questions)	3.3	17.8	31.4	26.6	20.9
Limited time to do work	4.0	22.3	35.2	25.9	12.6
Competition with others in the group	9.3	24.7	35.9	19.2	10.9

\*1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Nearly always, and 5 = Always.

learning difficulties, poor time management, conflicts in work-life balance, conflictive personal relationships, inadequate peer relations, as well as health and financial problems (Hill et al., 2018). Cluster and factorial analyses led to identification of two groups with low and high stress, showing that women were more prone to stress than men. This is consistent with previous research showing higher distress in female students when exposed to human suffering (Hill et al., 2018), along with other findings pointing to gender differences in stress vulnerability, manifested through medical and psychiatric symptoms (Nechita et al., 2014).

Somatization resulting from academic stress was higher in the group with high stress especially for drowsiness or increased need for sleep, anxiety, anguish, or desperation, chronic fatigue, and sleep disorders. An earlier study reported that early closure of academic institutions due to COVID-19 resulted in various psychological issues such as lack of sleep, need of emotional and mental support, and the search for social interactions (Nurunnabi et al., 2020).

Recent research on the psychological impact of the COVID-19 pandemic showed that individuals working in the

clinical field had higher stress scores (Alkhamees et al., 2020), yet less was known about its impact among medical students. There is also evidence that female medical students had higher levels of stress, anxiety, and depression (Wang et al., 2020). Another study has shown that 71% of college students reported an increase in stress, anxiety levels, and depressive thoughts linked to the COVID-19 pandemic, which appeared to be associated with fear and concern with their own health and that of their loved ones; concentration difficulties, sleep disturbances, decrease in social interactions due to social distancing, and concern about their academic performance were also observed (Son et al., 2020).

In many settings, including the Mexican, medical students usually live in a high-stress environment, due in part to a rigid system that promotes competition. Thus, the COVID-19 pandemic seemed to aggravate this situation by adding new stress factors, including the concern and fear to the infection to oneself and relatives, and by limiting the benefits to engage in activities such as exercise and social interactions that would have reduced the stress; as a result, the lockdown and social distancing measures have led to radical lifestyle changes that took place in a very short period of time (Brooks et al., 2020).

This study found that the most common coping strategies included practicing a hobby, done always/nearly always by 65% of those with high stress and 34% of those with low stress, followed by getting company of a loved one (56 and 34%, respectively). Previous research on coping strategies among preclinical medical students highlight personal engagement, positive reinterpretation and expression of emotion, support programs delivered by senior students and extracurricular activities (mostly musical and physical activities) as valuable mechanisms to reduce anxiety, stress, and burnout (Fares et al., 2016). Other evidence has shown that medical students who adopt active coping, including planning and reality acceptance rather than avoiding strategies such as denial, alcohol and drug intake, and behavioral disengagement have better outcomes (Abouammoh et al., 2020). It has been seen that adaptive coping improves mental health while maladaptive coping strategies, such as negation, are predictors of depression among young adults (Mahmoud et al., 2012). Finally, another study with medical students from King Saud University also reported that mindfulness was associated with lower depressive symptoms (Alzahrani et al., 2020).

## 5. Conclusion

The results presented here reflect the impact of the prolonged COVID-19 pandemic in terms of the academic performance, occurrence of anxiety and depression, and stressors among medical students potentially linked to the lockdown accompanied with internet-based learning modality. Therefore, it is important to design and implement preventive strategies to deal with the

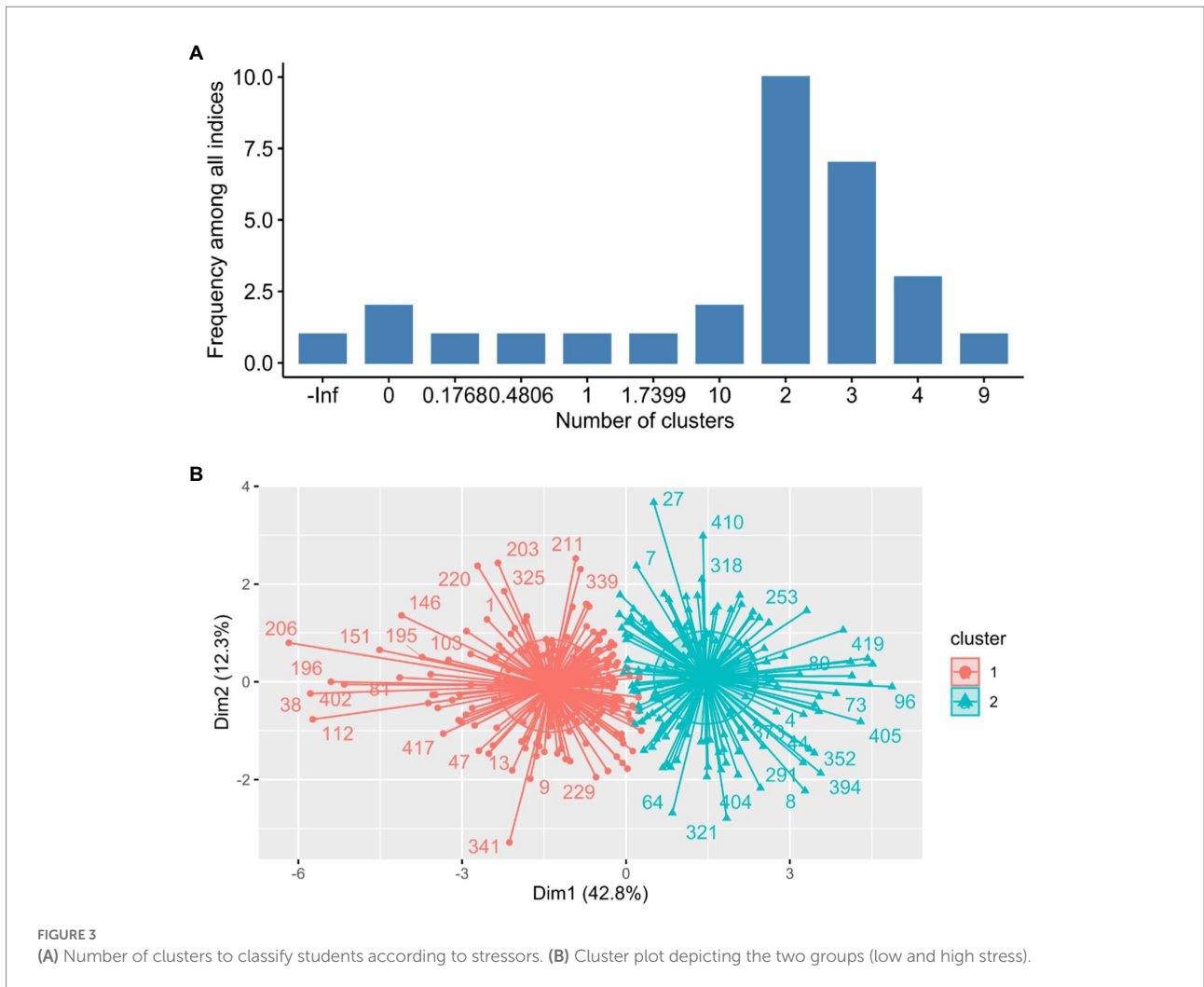


TABLE 4 Differences in academic stress (low vs. high) by sex and mean age in medical students at Zacatecas Autonomous University, 2021.

Variable	Category	Low stress <sup>1</sup>	p-value*	High stress <sup>1</sup>
Sex	Male, n (%)	100 (62.8)	0.0003	59 (37.2)
	Female, n (%)	116 (44.2)		146 (55.8)
Age	Mean	21.5	0.20	21.3

<sup>1</sup>Grouping cut-off was based on the cluster analysis. \*Pearson Chi-square test was used for nominal data, and student t-test for continuous data.

effects of the online learning modality used during the COVID-19 lockdown.

### 5.1. Limitations

An important limitation relates to the observational design used which makes it difficult to determine whether the COVID-19 pandemic could be indeed associated with the

observed outcomes. Another limitation was the use of a non-probabilistic sample, and the fact that even in this sample selection bias is still a potential issue, as response rate went down to 76.1% for the Goldberg scale and to 44% for the SISCO-II inventory. Since reasons for not responding were not obtained, it was not possible to run a non-response analysis to compare participants and non-participants to speculate on the possible direction of the bias.

### Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

### Ethics statement

Participation was voluntary. The questionnaire was administered via “Google forms.” Participants had to give



TABLE 5 Distribution of somatization variables by response level by stress groups.

Somatization variables	Response level* (%)				
	1	2	3	4	5
<b>Group 1 (low stress)<sup>1</sup></b>					
Sleep disorders (insomnia or nightmares)	14	29	27	24	6
Chronic fatigue (permanent fatigue)	6	24	37	26	6
Headaches or migraines	14	33	39	13	1
Digestive problems, abdominal pain, diarrhea	17	31	33	14	6
Scratching, nail biting, rubbing, etc.	19	25	23	22	11
Drowsiness or increased need for sleep	4	13	44	30	9
Muscle pain and/or contractures	21	28	30	16	5
Skin reactions (rash, peeling, etc.)	54	23	12	8	3
Restlessness (inability to relax and be calm)	8	25	38	24	5
Anxiety, anguish, or desperation	5	22	44	22	7
Increased or decreased food consumption	13	21	41	20	5
Feelings of depression and sadness (depressed)	9	24	43	20	4
Feelings of aggressiveness or increased irritability	12	29	38	18	4
Abrupt mood changes	19	29	30	17	4
Conflict or tendency to argue or debate	19	36	31	12	2
Isolation from others	17	28	38	15	3
Unwillingness to perform student duties	3	17	50	23	7
<b>Group 2 (high stress)<sup>1</sup></b>					
Sleep disorders (insomnia or nightmares)	3	14	26	27	30
Chronic fatigue (permanent fatigue)	1	7	24	36	31
Headaches or migraines	4	18	38	26	14
Digestive problems, abdominal pain, diarrhea	6	22	33	22	17
Scratching, nail biting, rubbing, etc.	13	15	21	25	26
Drowsiness or increased need for sleep	0	5	25	36	34
Muscle pain and/or contractures	7	18	32	29	15
Skin reactions (rash, peeling, etc.)	35	26	21	8	10
Restlessness (inability to relax and be calm)	1	4	31	37	26
Anxiety, anguish, or desperation	1	5	28	32	34
Increased or decreased food consumption	4	12	28	32	24
Feelings of depression and sadness (depressed)	3	4	34	32	26
Feelings of aggressiveness or increased irritability	2	19	35	26	18
Abrupt mood changes	3	21	34	26	16
Conflict or tendency to argue or debate	10	28	34	14	14
Isolation from others	5	19	33	27	16
Unwillingness to perform student duties	1	3	29	37	30

<sup>1</sup>Grouping cut-off was based on the cluster analysis. \*1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Nearly always, and 5 = Always.

informed consent in the first page of the questionnaire to be able to proceed with the survey. The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Unidad

Académica de Medicina Humana y C.S at Universidad Autónoma de Zacatecas (approval ID: AMC/CI/02-ORD/2020, CEICCL0121- ALGDEZA-03; approval date: November 6, 2020, and January 29, 2021).

TABLE 6 Comparison of coping strategies by response level between the two stress groups among medical students (n=728).

Strategies	Group <sup>1</sup>	Response level* (%)				
		1	2	3	4	5
Developing of a plan to perform tasks	1	8	27	42	15	8
	2	8	15	43	21	13
Complimenting oneself	1	16	36	31	13	4
	2	20	37	29	8	6
Ventilation and confidences (e.g., verbalization of concerned situation)	1	11	40	35	11	4
	2	11	38	33	12	6
Assertive ability (i.e., defend preferences or feelings without harming others)	1	5	24	34	29	9
	2	5	29	38	20	7
Practicing a hobby (e.g., exercise, reading, TV, social networking, etc.)	1	2	10	24	45	20
	2	3	23	40	21	13
Getting company by a loved one (e.g., family, friends, pets, etc.)	1	3	15	26	30	26
	2	6	23	37	17	17

<sup>1</sup>Grouping cut-off was based on the cluster analysis: 1 = low stress, 2 = high stress. \*1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Nearly always, 5 = Always.

## Author contributions

LA-C and MM-F conceptualization. LA-C and DD-A methodology. PV-E, SV-R, JS-G, and AM-G software. AR-L, JM-E, and IG-V validation. AR-L and JM-E formal analysis. AR-L and LA-C data curation and visualization. LA-C and DD-A writing—original draft preparation. JM-E, IG-V, JS-G, and MM-F writing—review and editing. All authors contributed to the article and approved the submitted version.

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