

# Prevalence and Associations between Anxiety, Depression, and Stress among Peruvian University Students during the COVID-19 Pandemic

Prevalencia y asociaciones de ansiedad, depresión y estrés en estudiantes universitarios peruanos durante la pandemia de COVID-19

Prevalência e associações de ansiedade, depressão e estresse em estudantes universitários peruanos durante a pandemia de COVID-19

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## Abstract

**Introduction:** The pandemic has brought about social changes, which may have affected mental health. The purpose of this study was to determine the prevalence of and associations between anxiety, depression, and stress among Peruvian university students during the COVID-19 pandemic. **Materials and Methods:** This was an analytical, multi-centered, cross-sectional study conducted with 2,572 university students from 16 Peruvian cities. Depression, anxiety, and stress diagnoses were obtained with the DASS-21 scale (stress alpha: 0.85; anxiety alpha: 0.84; and depression alpha: 0.87). The values were crossed with significant social and educational variables. **Results:** Anxiety was the most common condition (extremely severe in 4%, severe in 3%, and moderate in 10%). Whereas stress and depression were not associated with the course of studies ( $p > 0.330$  and  $p > 0.440$ , respectively), anxiety was lower among students pursuing health-related degrees ( $p = 0.011$ ). Women showed higher levels of stress ( $p = 0.040$ ) and anxiety ( $p = 0.017$ ). Older participants had relatively lower stress ( $p = 0.002$ ), depression ( $p = 0.006$ ), and anxiety ( $p = 0.044$ ) levels. Third-year students had higher depression levels than first-year students ( $p = 0.011$ ). **Conclusions:** Significant prevalence levels and associations were identified for the three conditions, which should be monitored to determine their current status, given the possible future occurrence of panic attacks or post-traumatic stress, among other complications.

**Keywords:** Coronavirus; pandemic; mental health; students; Peru.

## Resumen

**Introducción:** la pandemia vivida obligó a cambios sociales que pudieron influir en la salud mental. El objetivo fue determinar la prevalencia y asociaciones de ansiedad, depresión y estrés en estudiantes universitarios peruanos durante la pandemia por COVID-19. **Materiales y métodos:** estudio transversal analítico y multicéntrico, en 2572 estudiantes universitarios de 16 ciudades de Perú. Los diagnósticos de depresión, ansiedad y estrés se obtuvieron con la escala DASS-21 (alfa estrés: 0.85; alfa ansiedad: 0.84 y alfa depresión: 0.87). A estos se los cruzó con importantes variables socioeducativas. **Resultados:** la ansiedad

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fue la patología más frecuente (4% de forma extrema severa, 3% de forma severa y 10% de forma moderada); el estrés y la depresión no tienen asociación con la carrera profesional ( $p > 0.330$  y  $p > 0.440$ , respectivamente); en cambio, la ansiedad fue menor en los estudiantes de carreras de salud ( $p = 0.011$ ). Las mujeres tuvieron más estrés ( $p = 0.040$ ) y ansiedad ( $p = 0.017$ ). A mayor edad, hubo menos estrés ( $p = 0.002$ ), depresión ( $p = 0.006$ ) y ansiedad ( $p = 0.044$ ). Los de tercer año tuvieron más depresión en comparación con los de primer año ( $p = 0.011$ ). *Conclusiones:* existen importantes prevalencias y asociaciones de las tres patologías evaluadas, lo que debe ser monitorizado según como están actualmente. Esto por las posibles futuras manifestaciones de crisis de pánico, estrés postraumático, entre otras.

**Palabras clave:** coronavirus; pandemia; salud mental; estudiantes; Perú.

## Resumo

*Introdução:* a pandemia que estamos vivenciando forçou mudanças sociais, que podem influenciar na saúde mental. O objetivo do estudo é determinar a prevalência e associações de ansiedade, depressão e estresse em estudantes universitários peruanos durante a pandemia de COVID-19. *Materiais e métodos:* estudo transversal analítico e multicêntrico, com 2572 estudantes universitários provenientes de 16 cidades do Peru. Os diagnósticos de depressão, ansiedade e estresse foram obtidos com a escala DASS-21 (Alpha para estresse: 0,85; Alpha para ansiedade: 0,84 e Alpha para depressão: 0,87), estes foram cruzados com importantes variáveis socioeducativas. *Resultados:* a ansiedade foi a patologia mais frequente (4% em sua forma extremamente grave, 3% forma grave e 10% forma moderada); estresse e depressão não foram associados à carreira profissional ( $p > 0,330$  e  $p > 0,440$ , respectivamente); por outro lado, a ansiedade foi menor nos estudantes da carreira da saúde ( $p = 0,011$ ). As mulheres apresentaram mais estresse ( $p = 0,040$ ) e ansiedade ( $p = 0,017$ ); quanto maior a idade houve menos estresse ( $p = 0,002$ ), depressão ( $p = 0,006$ ) e ansiedade ( $p = 0,044$ ). Estudantes do 3º ano apresentaram mais depressão em comparação aos do 1º ano ( $p = 0,011$ ). *Conclusões:* existem prevalências e associações importantes entre as três patologias avaliadas, que devem ser monitoradas de acordo com a forma como se encontram atualmente. Isso se deve às possíveis manifestações futuras de ataques de pânico, estresse pós-traumático, entre outras complicações.

**Palavras-chave:** coronavírus; pandemia; saúde mental; estudantes; Peru.

## Introduction

The COVID-19 pandemic triggered mental disorders that altered individual's cognitive function, especially since a general mental health deterioration had been reported before the pandemic (1,2); this deterioration has been more significant in certain groups (3–5). Furthermore, this was enhanced by the psychological impact of the lockdown which is why the pandemic should be regarded as a possible public health concern (6,7). This issue needs to be assessed in students, especially among those with higher frustration levels caused by an inability to focus on their education, those living in populations with high risk of COVID-19 transmission, and those experiencing stress or other symptoms of depression (8). Together, these factors may have increased the prevalence of stress, anxiety, and depression, among others, affecting academic performance, professional development, and interpersonal relationships (9,10).

Furthermore, stress is known to highly affect university students because of the lack of adequate coping mechanisms, so they are prone to suffering emotional dysregulation issues, such as depression and anxiety, among others (8). Educational institutions should consider this in order to develop detection and aid programs for students, and to assess whether social distancing resulted in social stress, as well as in terms of depression and feelings of loneliness (11-13). Therefore, performing a situational analysis at the beginning of the crisis is essential. The purpose of this study was to determine the prevalence of and associations between anxiety, depression, and stress among Peruvian university students during the COVID-19 pandemic.

## Materials and methods

### Design and population

This was an analytical, multicenter, cross-sectional study with data collection, whose target population was students of different higher education degrees in the most important and largest cities of Peru, including Arequipa, Ayacucho, Cajamarca, Chiclayo, Chiclayo, Huancayo, Lima, Cerro de Pasco, Piura, Tacna, Trujillo, Ica, Cusco, Puno, Iquitos, and Huánuco.

University students pursuing a higher education degree during the pandemic and authorizing their participation were included. A total of 44 surveys were excluded since they were answered by technical education students, students that were not living in Peru, or students whose answers were incoherent; 29 surveys were excluded because the students did not agree to participate in the study; and 55 surveys were excluded because the participants did not have at least one of the mental health conditions. Snowball sampling was used by contacting the participants, who would then contact other groups of students and so on, until a minimum sampling size was achieved, consisting of 2,178 subjects (to obtain a minimum difference of 3% [48% vs. 51%], a 95% confidence interval, 80% potency, and a single sample size).

### Procedures and ethics

This project was initiated in the middle of the health emergency declared by the Peruvian government, which is why all information was collected during June and July of 2020 using a free-access virtual survey (Google forms). For this reason, and owing to the fact that data had to be reported, the ethical recommendations for research in these contexts were followed. The study was described to the participants, and they were free to participate in the surveys (in all cases, the survey ended immediately if participants refused to participate), which were completely anonymous (so that participants could answer safely). The project was approved by the Ethics Committee of Universidad Privada Antenor Orrego (no. 0207-2020-UPAO). Once

the surveys were conducted, the data were transferred to the general database (Microsoft Excel, 2016), and then filtered, cleared, and analyzed using Stata 11.1 software (StataCorp LP, College Station, TX, USA).

## Variables and statistical analysis

The main (dependent) variables were stress, anxiety, and depression. They were estimated using the DASS-21 questionnaire, consisting of 21 questions (7 questions for each screening diagnosis). For each participant, a Cronbach's alpha estimation yielded adequate scores (stress alpha: 0.85; anxiety alpha: 0.84; and depression alpha: 0.87; considering scores of 0.70–0.90 as adequate). Each condition was categorized into normal, low, moderate, severe, and extremely severe. For statistical analysis, each category was classified dichotomously (category of interest: moderate + severe + extremely severe and comparison category: normal + low).

Moreover, other variables were recorded, with the main variables being subject area of the academic degree (health, engineering, management, basic sciences, law, human sciences, and others [the latter was considered a comparator for the statistical analysis]), sex (male or female), age (years), academic year (quantitatively, taking the first year as a comparator for statistical analysis), and university of origin (according to each participating university).

A table was developed to describe the population, as well as a figure to show the percentages for each category of the three dependent variables. Then, statistical association values for the crossing of each independent variable versus the three dependent variables were obtained. Generalized linear models were used for that purpose, with the Poisson family, the log link function, and models for robust variances adjusted according to the university of origin. Based on this information, prevalence ratios (aPR), 95% confidence intervals (95% CI), and *p* values were obtained (values lower than 0.05 were considered statistically significant).

## Results

**O**f the 2,572 participants surveyed during the COVID-19 lockdown, 56.4% (1,438) pursued a degree associated with the health sciences, 54.8% (1,407) were women, the median age was 21 years (interquartile range, 20–23 years), and 23.9% (529) were in their third academic year (Table 1).

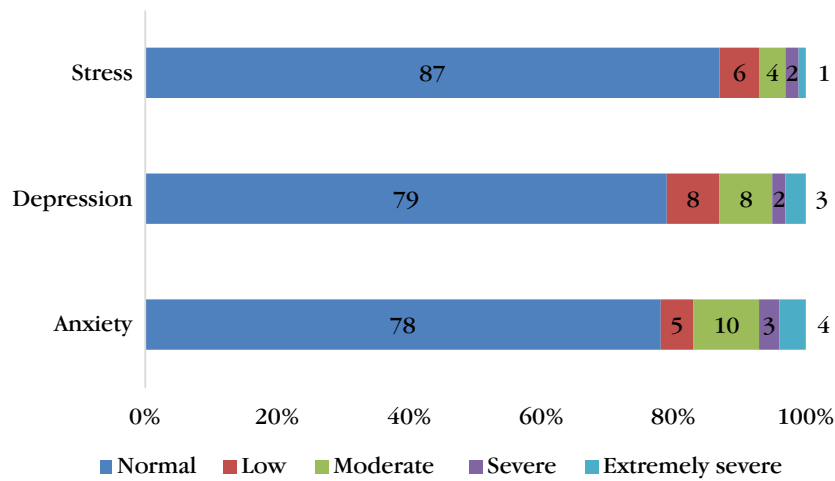
**Table 1.** Characteristics of the Peruvian university students surveyed during the COVID-19 pandemic

Variable	Frequency	Percentage
<b>Course of studies</b>		
Other	181	7.1
Health	1438	56.4
Engineering	374	14.7
Management	190	7.5
Basic sciences	165	6.5
Law	102	4.0
Human sciences	100	3.9
<b>Sex</b>		
Male	1161	45.2
Female	1407	54.8
Age (years)*	21	20–23
<b>Academic year</b>		
First year	104	4.7
Second year	380	17.2
Third year	529	23.9
Fourth year	413	18.7
Fifth year	519	23.4
Sixth year**	187	8.5
Seventh year**	80	3.6

\*This variable shows the median and interquartile range.

\*\* These categories were only for the degree in medicine.

Anxiety was the most frequent condition (extremely severe in 4 %, severe in 3 %, and moderate in 10 %), followed by depression (extremely severe in 3 %, severe in 2 %, and moderate in 8 %) and stress (extremely severe in 1 %, severe in 2 %, and moderate in 4 %) (Figure 1).



**Figure 1.** Categories of anxiety, depression and stress in university students in coronavirus quarantine in Peru

In the multivariate model, stress was not associated with the course of studies ( $p < 0.330$  in all cases) or study years ( $p > 0.160$  in all cases). However, women showed higher stress levels (aPR: 1.43; 95 % cr: 1.02–2.00;  $p = 0.040$ ) and being older was associated with lower stress levels (aPR: 0.89; 95 % cr: 0.83–0.96;  $p = 0.002$ ) (Table 2).

**Table 2.** Multivariate model of social and academic factors associated with stress during the COVID-19 lockdown among Peruvian university students

Variable	Prevalence ratio	95% confidence interval	p value
<b>Course of studies</b>			
Other	Comparison category versus others		
Health	1.08	Insignificant	0.773
Engineering	1.37	Insignificant	0.331
Management	1.12	Insignificant	0.770
Basic sciences	1.15	Insignificant	0.696
Law	0.56	Insignificant	0.407
Human sciences	1.01	Insignificant	0.989
Female	1.43	1.02–2.00	0.040
Age (years)	0.89	0.83–0.96	0.002
<b>Academic year</b>			
First year	Comparison category versus other years		
Second year	1.30	Insignificant	0.440
Third year	1.64	Insignificant	0.222
Fourth year	1.75	Insignificant	0.165
Fifth year	1.74	Insignificant	0.193

Sixth year*	1.28	Insignificant	0.598
Seventh year*	1.66	Insignificant	0.478

Note. Statistical values were obtained with generalized linear models, using the Poisson family, log link function, and models for robust variances adjusted according to the university of origin.

\* These categories were only for the degree in medicine.

In the multivariate model, depression was not associated with the course of studies ( $p > 0.440$  in all cases) or sex ( $p = 0.069$ ). However, being older was associated with lower depression levels (aPR: 0.92; 95 % CI: 0.87–0.98;  $p = 0.006$ ) and third-year students had higher depression levels than first-year students (aPR: 2.11; 95 % CI: 1.19–3.75;  $p$  value = 0.011) (Table 3).

**Table 3.** Multivariate model of social and academic factors associated with depression during the COVID-19 lockdown among Peruvian university students

Variable	Prevalence ratio	95 % confidence interval	p value
<b>Course of studies</b>			
Other	Comparison category versus others		
Health	0.86	Insignificant	0.443
Engineering	0.98	Insignificant	0.921
Management	0.95	Insignificant	0.858
Basic sciences	1.08	Insignificant	0.785
Law	0.82	Insignificant	0.624
Human sciences	1.07	Insignificant	0.794
Female	1.30	Insignificant	0.069
Age (years)	0.92	0.87–0.98	0.006
<b>Academic year</b>			
First year	Comparison category versus other years		
Second year	1.67	Insignificant	0.062
Third year	2.11	1.19–3.75	0.011
Fourth year	1.84	Insignificant	0.082
Fifth year	1.94	Insignificant	0.064
Sixth year*	1.65	Insignificant	0.225
Seventh year*	2.02	Insignificant	0.112

Note. Statistical values were obtained with generalized linear models, using the Poisson family, log link function, and models for robust variances adjusted according to the university of origin.

\* These categories were only for the degree in medicine.

In the multivariate model, anxiety was not associated with study years ( $p \geq 0.050$  in all cases). However, women showed higher anxiety levels (aPR: 1.43; 95 % CI: 1.07–1.92;  $p = 0.017$ )



and being older was associated with lower anxiety levels (a<sub>PR</sub>: 0.94; 95 % CI: 0.89–0.99;  $p = 0.044$ ), as well as studying medicine (a<sub>PR</sub>: 0.72; 95 % CI: 0.56–0.93;  $p = 0.011$ ) (Table 4).

**Table 4.** Multivariate model of social and academic factors associated with anxiety during the COVID-19 lockdown among Peruvian university students

Variable	Prevalence ratio	95% confidence interval	p value
<b>Course of studies</b>			
Other	Comparison category versus others		
Health	0.72	0.56–0.93	0.011
Engineering	1.02	Insignificant	0.918
Management	1.08	Insignificant	0.614
Basic sciences	0.64	Insignificant	0.095
Law	0.73	Insignificant	0.231
Human sciences	0.94	Insignificant	0.769
Female	1.43	1.07–1.92	0.017
Age (years)	0.94	0.89–0.99	0.044
<b>Academic year</b>			
First year	Comparison category versus other years		
Second year	1.55	Insignificant	0.103
Third year	1.79	Insignificant	0.050
Fourth year	1.45	Insignificant	0.153
Fifth year	1.37	Insignificant	0.279
Sixth year*	1.52	Insignificant	0.265
Seventh year*	1.34	Insignificant	0.478

Note. Statistical values were obtained with generalized linear models, using the Poisson family, log link function, and models for robust variances adjusted according to the university of origin.

\* These categories were only for the medicine degree.

## Discussion

In this study, we noted that anxiety (one in every six participants) and depression (one in every seven participants) were more frequently observed among students during the lockdown. Similarly, Porter et al. found that, in Peru, at least 41 % of subjects had mild anxiety or depression (14). A study conducted in a neighboring country determined the presence of psychological disorders among university students before the pandemic, and showed that 47 % had anxiety, 28 % had depression, and 44 % had stress (15). Moreover, Arabic countries such as Jordan have also reported a 23.8 % prevalence of depression and 13.1 % prevalence

of anxiety among university students during the COVID-19 pandemic, which is a triggering factor for prior manifestations (16). Finally, in Saragossa, levels of anxiety and depression of 23.5% and 18.6%, respectively, were measured with DASS-21, which may interfere with the lifestyles of students because of, for example, unhealthy alterations of their feeding patterns (17).

Unfortunately, our study instruments were only applied at one point, so it is unclear whether these conditions may have changed or worsened because of the pandemic (and its consequences). For this reason, we could not determine whether the normal values were increased or decreased, which is why educational institutions should measure these values and compare our results against subsequent findings.

This study evidenced that being older is associated with lower levels of depression, anxiety, and stress, which could be explained by the fact that older students have better emotional control. Wang conducted a study in China during the COVID-19 pandemic and showed that 54% of participants classified the psychological impact as moderate or severe, regardless their age, which could be due to their satisfaction with the measures taken by their government (18). Prior epidemics—such as the one that took place in 2003 due to severe acute respiratory syndrome (SARS)—have also changed student populations. In countries such as Malaysia, students in their first semesters showed higher anxiety levels than those in their last semesters, since the latter reported having a wider realistic perspective and increased maturity when facing their context (19). This situation was similar to the one described in our study.

Cao conducted a similar study with Chinese medicine students and showed that 25% had some level of anxiety. This was not associated with age, but with living in urban areas, living with their parents, and having a stable family income (all these were protective factors during the lockdown) (20). For this reason, a situational analysis should be conducted for each population according to the current context, since there could be considerable variations due to social, economic, and even cultural factors.

Moreover, Puthran et al. conducted a meta-analysis to determine the prevalence of depression among medical students in 2015, and found that first-year students showed the highest depression rates (34%), which decreased gradually and significantly until reaching 21% in fifth-year students (21). This was because of the difficulties with adaptation experienced by new students, which decrease as academic years go by and students learn to cope with any challenges they may face.

Our study showed that women were more likely to suffer from stress and depression. A study conducted in Pakistan reported that 27% of female medical students had moderate stress and 32% had extremely severe depression (22). In Germany, a study reported statistically significant and higher depression levels among female students (23). In closer countries, such as Cuba, the female sex has also been associated with moderate and high stress levels (90%) (24). This may be attributable to cultural differences associated with social prejudice

and gender inequality and, many times, coexistence with other conditions such as major depression, the consumption of harmful substances, and personality disorders (25,26). For this reason, further studies should focus on the relationship between social support, wellbeing, personality, social roles, and even sexism, as well as other aspects found in our population, in order to identify the factors that mostly determine the likelihood of suffering from depression, anxiety, and stress.

Our study shows that health sciences students had lower anxiety levels than other students. A study conducted in Australia found that graduate and undergraduate first-year students had normal values, within the DASS-21 limit, in the depression, anxiety, and stress subscales. However, being a woman and having financial problems increased the stress levels of graduate students (27).

Another study associated higher psychological impact with COVID-19 outbreak, and with dissatisfaction toward available information about the disease. Thus, access to updated and accurate data on this virus and the application of specific preventive measures were associated with lower levels of the three conditions studied (18). For this reason, educational methods should be available to students in order to avoid a negative academic impact and ensure the availability of adequate data about COVID-19.

In our study, students in their middle years showed higher depression levels than first-year students. This varies from study to study, given that some stated that depression was more frequent during the first academic years and others stated that it was more frequent during the last ones (28-31). Our findings may be explained by the fact that middle-year students feel more uncertainty and fear toward failing their academic semester, since they had already invested in their first study years as opposed to first-year students. They also showed more concern toward their graduation. Another factor is the changing rhythm of university life, which favors physical inactivity and bad sleep quality, affecting students' academic performance, and is associated with depression, anxiety, and stress (32).

The main limitation was that our results cannot be extrapolated to the entire Peruvian population, mainly due to the sampling method and the fact that the virtual survey had. However, these results can be considered as a baseline study, since it includes thousands of subjects from the most important cities of Peru. This way, each educational institution should follow-up their students (during the pandemic and after it), measure more variables, and even find a bigger sample size (which allows for higher statistical power to estimate smaller percentage differences).

Due to all of the above, we conclude that anxiety and depression were more frequently observed among university students during the pandemic. Older students had lower anxiety and stress levels, women had lower likelihood of suffering from stress and depression, health sciences students had lower anxiety levels than other students, and middle-year students had higher depression levels than first-year students.

## Authors' contributions

All authors participated in the development of the research and project idea, as well as in data collection and interpretation of the results. The final report was written and approved by all authors. Author Christian R. Mejia conducted the statistical analysis.

## Conflict of interests

None stated.

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