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# Factors associated with comorbidity for depression, anxiety, and stress screening in a sample of university's community during the COVID-19 pandemic

## *Fatores associados à comorbidade para depressão, ansiedade e estresse em amostra de comunidade universitária durante a pandemia de COVID-19*

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## Abstract

### Objective
This study presents the prevalence and factors associated with comorbidity in screening for depression, anxiety, and stress during the COVID-19 pandemic.

### Methods
A cross-sectional descriptive/exploratory study used self-reported DASS-21 to screen for mental health.

### Results
In an online sample, 14.48% (*n* = 260), 12.42% (*n* = 223), and 31.12% (*n* = 559) illegible of participants were screened, respectively, positive for only one, for only two and for all the three outcomes. Being student, having children, using substances, reporting COVID-19 symptoms, reporting worsened emotional state, and previous mental disorders were associated with comorbidity for depression, anxiety, and stress.

### Conclusion
Individuals from the studied university's community experienced psychological disorders, as measured by levels of anxiety, depression, and stress and comorbidity for these outcomes, probably as Covid-19's initial psychological impact.

**Keywords:** Anxiety; Comorbidity; COVID-19 pandemic; Depression; Stress.

## Resumo

***Objetivo***

*Este estudo apresenta a prevalência e os fatores associados à comorbidade no rastreamento para depressão, ansiedade e estresse durante a pandemia de* COVID-19.

***Métodos***

*Trata-se de estudo transversal descritivo/exploratório que utilizou a DASS-21 para triagem de saúde mental.*

***Resultados***

*Em uma amostra baseada na internet, 14,48% (n = 260), 12,42% (n = 223) e 31,12% (n = 559) dos participantes apresentaram resultado positivo para somente um, para somente dois e para todos os três sintomas, respectivamente. Ser estudante, ter filhos, usar drogas, relatar sintomas de COVID-19, reportar piora do estado emocional e transtornos mentais prévios estiveram associados à comorbidade para depressão, ansiedade e estresse.*

***Conclusão***

*Indivíduos da comunidade universitária estudada apresentaram distúrbios psicológicos, medidos pelos níveis de ansiedade, depressão e estresse e comorbidade para esses desfechos, provavelmente como o impacto psicológico inicial da pandemia de* COVID-19.


***Palavras-chave:*** *Ansiedade; Comorbidade; Pandemia de COVID-19; Depressão; Estresse.*

Mental health was already recognized as a major public health challenge even before the Coronavirus Disease 2019 (COVID-19) pandemic (Vindegaard & Benros, 2020). The pandemic itself and the quarantine and physical/social distancing/isolation measures adopted to combat it can negatively affect the mental health of many healthy individuals, with a range of stressors including longer quarantine duration, fears of COVID-19, boredom, inadequate information, and financial loss (Brooks et al., 2020; Silva et al., 2018).

Studies using both web-based surveys (Huang & Zhao, 2020; Moghanibashi-Mansourieh, 2020; Verma & Mishra, 2020) and Depression, Anxiety and Stress Scale (DASS-21) (Marijanović et al., 2021; Mishra et al., 2023; Ozamiz-Etxebarria et al., 2020) to screen for common mental disorders during pandemic in the general population and subgroups, such as students and Healthcare Workers (HCW), are being published more frequently. Additionally, symptoms of mental conditions were widely screened using self-report tools, even in Brazil (De Boni et al., 2020), where DASS-21 was validated (Vignola & Tucci, 2014).

In China, 29.0 and 37.1 prevalence of anxiety and depression, respectively, were reported among the general population during COVID-19 outbreak (Ahmed et al., 2020); other study estimated rates to be at 27.9% for depression, 31.6% for anxiety, and 24.4% for stress (Shi et al., 2020). In the same country, the prevalence of depression and anxiety were found to be at 12.7 and 20.1, respectively, among HCW (Du et al., 2020), and among students was 34.9, 21.1, and 11.0 for stress, depression, and anxiety, respectively.

During the pandemic, in countries like China, Denmark, Italy, Iran, Nepal, Spain, Turkey, and the United States of America, relatively high rates of people suffering from symptoms of anxiety (6.33% to 50.9%), depression (14.6% to 48.3%), and stress (8.1% to 81.9%) are reported in the general population (Xiong et al., 2020). Among university students, 43.3%, 37.2%, and 30.9% showed some degrees of depression, anxiety, and stress, respectively, in Saudi Arabia (Alsolais et al., 2021), and 18.6% were depressed, 47.8% were anxious, and 44.6% were stressed, in Indonesia (Natalia & Syakurah, 2021).

A systematic review highlighted an increase in depression/depressive symptoms, anxiety, psychological distress in HCW during the COVID-19 pandemic in China. At the same time, in the general population, studies revealed higher scores of anxiety and depression compared to before pandemic (Vindegaard & Benros, 2020). These findings should not differ from those found in other subpopulations, such as university students, staff, and professors. Data from before and during the COVID-19 pandemic could reveal different levels of depression, anxiety and stress. For example, the frequency of depression among United States' undergraduate students were higher in May 2020 compared to October 2019 (Kim et al., 2022).

A systematic review comparing psychiatric comorbidities between the Severe Acute Respiratory Syndrome (SARS) and Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) outbreaks highlighted that psychiatric comorbidities were common in different subpopulations (Zhao et al., 2021). Among the Malaysian urban population, 19.9% presented depression with comorbid anxiety (Leong Bin Abdullah et al., 2021). So, some people may be affected by more than one mental conditions, as observed by Gorrochategi et al. (2020) in Northern Spain, where a small proportion of people experienced co-occurrence of stress, anxiety, and depression. Thus, this study aims to describe the prevalence of comorbidity in screening for depression, anxiety, and stress, as well as determinants of comorbidity during the initial stage of COVID-19 pandemic in Mild-West Brazil.

## Method

### Participants

In March 2020, we started a cross-sectional descriptive and exploratory study at a Federal University located in the Mid-West of Brazil. The study was started less than a month after the implementation of the remote work and remote classes, so-called Emergency Remote Learning (ERL - online-only learning), to measure the university's mental health in the initial stage of the pandemic that could allow future comparisons with subsequent scenarios of the progress of the pandemic, as published elsewhere (Baptista & Martins, 2022). Physical distancing and social isolation measures and ERL were abruptly imposed to a population of 22,873 university students due to the COVID-19 pandemic. We surveyed students since they are in large numbers and have long lasting link with the University that facilitate carrying out subsequent surveys with them.

### Procedures

Given the pandemic and lockdown scenario, it was difficult to implement probabilistic sampling technics; consequently, we recruited an online convenience sample. We built a self-applied questionnaire in Google Forms and have made it available via a link in the user area of the Academic Management System and the Virtual Learning Environment of the University. Participants were requested to participate via social media and the weekly newsletter of the University. Eligibility criteria were: (a) being a student enrolled in any undergraduate or graduate courses of the University, (b) aged at least 18 years old, (c) agree voluntarily to participate in the study and (d) register an online-Informed Voluntary Consent Form.

Participants who agreed to participate in the study answered to a self-applied internet-based questionnaire between April 10 and May 25, 2020. The first step of the questionnaire had questions related to participant's characterization, adherence to social/physical distancing measures, and perceptions, attitudes and difficulties regarding the pandemic.

The second step was related to mental health assessment over the last week using DASS-21, a 21-item self-reported questionnaire. Corresponding answers and respective constructs of the DASS-21 are detailed in Table 1. The responses for each item is based on a 4-point Likert scale ranging from 0 ('did not apply to me at all') to 3 ('applied to me very much or most of the time'), from a version validated in Brazil (Vignola & Tucci, 2014).

**Table 1**
*Items of the Depression, Anxiety and Stress Scale (DASS – 21)*

| Item | Question | Construct or Subscale |
|---|---|---|
| 1 | I found it difficult to calm myself. | Stress |
| 2 | My mouth felt dry. | Anxiety |
| 3 | I didn't experience any positive feelings. | Depression |
| 4 | I had difficulty breathing at times (such as wheezing and breathlessness without having made any physical effort). | Anxiety |
| 5 | It was hard for me to have the initiatives to do things. | Depression |
| 6 | I intended to exaggerate when I reacted to situations. | Stress |
| 7 | I felt shaky (for example, in my hands). | Anxiety |
| 8 | I felt I was always nervous. | Stress |
| 9 | I got worried about situations in which I could have panicked and looked ridiculous. | Anxiety |
| 10 | I felt I had no desire for anything. | Depression |
| 11 | I felt restless. | Stress |
| 12 | I found it difficult to relax. | Stress |
| 13 | I felt depressed and had no motivation. | Depression |
| 14 | I was intolerant of the things that kept me from continuing to do what I had been doing. | Stress |
| 15 | I felt like I was going to panic. | Anxiety |
| 16 | I didn't feel enthusiastic about anything. | Depression |
| 17 | I felt like I was worthless as a person. | Depression |
| 18 | I felt like I was being a little too emotional/sensitive. | Stress |
| 19 | I knew my heartbeat had changed even though I hadn't done anything physically rigorous (e.g. increased heart rate, irregular heartbeat). | Anxiety |
| 20 | I felt afraid for no reason. | Anxiety |
| 21 | I felt there was no meaning to life. | Depression |

Source: Vignola and Tucci (2014).
Note: The original DASS-21 was translated to Brazilian Portuguese and is validated in Brazilian culture by Vignola & Tucci (2014). It consists in 21 items corresponding to three seven-items subscales. One subscale of the scale assesses depression, other assesses anxiety and the last one assesses stress in the last one week before the survey. The score of each subscale are obtained adding the subscale items and then multilying it by two. The levels of symptoms for each subscale range from 'Normal' to 'Extremely severe'.

## Study Outcomes

Three primary outcomes were anxiety, depression, and stress levels assessed using DASS-21. In this study, each outcome was dichotomized in 'Screened Negative' for those who scored Normal or Mild and 'Screened Positive' for those participants who scored Moderate, Severe or Extremely severe in DASS-21. Subsequently, one polytomous composite outcome variable was created with four categories: 'Negative for all outcomes', 'Positive for one outcome', 'Positive for two outcomes', and 'Positive for all three outcomes'. Screening positive for more than one outcome was considered comorbidity. The DASS-21's internal reliability was considered good under Cronbach's alpha coefficients: anxiety = 0.85, stress = 0.90, and depression = 0.92. In addition, the correlation between the three outcomes' scores were: anxiety and depression ($r$ = 0.74), anxiety and stress ($r$ = 0.81), and depression and stress ($r$ = 0.80), showing that they are close with positive and strong relationship.

## Independent Variables

Variables included sociodemographic, such as biological sex (female/male), age (18-29; 30-49; 50-68), with cut points based on the shape of the histogram and other studies). Race/skin color (black and mixed race/white/native American and asian), education level (primary or secondary/

university degree/master or PhD), marital status (single/married or with partner), having children (Yes/No), relationship with the University (student/staff/professor), and cohabitation (alone/with family or partner/with fiends or roommates). Computer and household internet access (Yes/No), facing financial/material hardship during social and physical distancing measures (Yes/No), previous diagnostic of mental disorders before the COVID-19 pandemic (Yes/No), and belonging to high-risk group for COVID-19 severe illness (Yes/No). People who have chronic diseases (e.g. diabetes, hypertension, cancer, obesity, older than 60 years, etc.) are considered COVID-19 risk groups for severe illness if infected by SARS-CoV-2. Categorization of each variable is presented in Table 2.

### Data Analysis

For data imputation of missing data, MICE package was adopted, this package uses multiple imputation with conditional specification. The following independent categorical variables were imputed: 'healthcare worker' ($n$ = 2), 'sex' ($n$ = 8), 'previous diagnostic of mental disorders' ($n$ = 2), and 'educational level' ($n$ = 104).

Independent variables were described by outcome levels and the proportions were compared with Chi-squared test (two-tailed alpha < 0.05). Initial exploratory bivariate analysis aimed to identify factors associated with comorbidity, taking as reference group 'Negative for all outcomes'. Given the number of covariates in consideration and the complexity of multiple potential association between the covariates itself and covariates with the outcome, we did preliminary feature selection using Boruta algorithm. This algorithm uses a wrapper approach built around a random forest classification algorithm and uses $Z$ scores as the importance measure with respect to an outcome, taking into account the fluctuations of the mean accuracy loss – the Mean Decrease Accuracy (Kursa & Rudnicki, 2010). Consequently, the variables that was not important for the hypothetical model were excluded for subsequent multivariable regression.

Subsequently, to reach a parsimonious model, the subset of selected variables was used to fit a multinomial logistic regression. Models were built separately for each construct of the DASS-21 and were tested for multicollinearity. The variable 'religion' was excluded due to multicollinearity. Adjusted odds ratios (Adj-OR) with respective 95% confidence intervals (95% CI) were estimated using nnet package in R software, version 4.0.0 for Windows. The model fitness was evaluated using the Hosmer-Lemeshow test and the Pearson Chi-squared test.

The study was anonymous and was approved by the *Comissão Nacional de Ética em Pesquisa* - Brazil. Participants read and checked an internet based Informed Consent Form confirming their interest in participating before filling the questionnaire.

## Results

### Sample characteristics

Overall, 2,469 people accessed the form and 2,322 of whom agreed to participate, filled and submitted the questionnaire, accomplishing participation rate of 94.05%. The final sample consisted of 2,166 (87.7%) after excluding repeated participations, respondents aged less than 18 years old, and those with Informed Consent Form not checked. Of those, 1,796 answered to the DASS-21 and were included in this analysis. The majority of the sample were students (78.84%), women (65.53%), single (71.33%), and aged 18-29 years (67.26%). Most participants self-identified as white (54.18%), referred household internet access (85.63%). Around one quarter (24.61%) was high-risk group for COVID-19 and 5.9% were HCW (Table 2).

**Table 2**

*Sociodemographic characteristics and prevalence of positive screening for anxiety, depression, and stress for recruited participants in a Brazilian public University during physical/social distancing/isolation measures during the COVID-19 pandemic, April-May, 2020*

1 of 2

| Characteristic | *n* (%) (Total = 1,796) | Prevalence of morbidities (depression, anxiety, and stress) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Positive for 1 outcome *n* = 260 (14.48%) | *p*-value | Positive for 2 outcomes *n* = 223 (12.42%) | *p*-value | Positive for all 3 outcomes *n* = 559 (31.12%) | *p*-value |
| Sex | | | | | | | |
| Male | 619 (34.47) | 16.16 | 0.143 | 9.85 | 0.017 | 22.46 | < 0.001 |
| Female | 1,177 (65.53) | 13.59 | | 13.76 | | 35.68 | |
| Age group (mean: 28.3 ± 10.1 years) | | | | | | | |
| 18 - 29 years | 1,208 (67.26) | 15.73 | 0.007 | 14.07 | 0.003 | 37.25 | < 0.001 |
| 30 - 49 years | 495 (27.56) | 13.33 | | 9.90 | | 20.20 | |
| 50 - 68 years | 93 (5.18) | 4.30 | | 4.30 | | 9.68 | |
| Race/skin color | | | | | | | |
| White | 973 (54.18) | 14.90 | 0.835 | 12.74 | 0.425 | 30.22 | 0.662 |
| Black/Pardo | 735 (40.92) | 13.88 | | 12.52 | | 32.24 | |
| Indigenous/Yellow | 88 (4.90) | 14.77 | | 7.95 | | 31.82 | |
| Educational level | | | | | | | |
| Master/PhD | 230 (12.81) | 11.74 | 0.258 | 9.57 | 0.349 | 16.09 | < 0.001 |
| University degree | 909 (50.61) | 14.08 | | 13.09 | | 31.35 | |
| Primary/Secondary | 657 (36.58) | 15.98 | | 12.48 | | 36.07 | |
| Relationship with the University | | | | | | | |
| Professor | 104 (5.79) | 6.73 | 0.042 | 7.69 | < 0.001 | 14.42 | < 0.001 |
| Staff | 276 (15.37) | 13.04 | | 6.16 | | 14.49 | |
| Student | 1,416 (78.84) | 15.32 | | 13.98 | | 35.59 | |
| Marital status | | | | | | | |
| Married/With partner | 515 (28.67) | 12.43 | 0.118 | 10.87 | 0.209 | 20.58 | < 0.001 |
| Single | 1,281 (71.33) | 15.30 | | 13.04 | | 35.36 | |
| Children | | | | | | | |
| No | 413 (23.00) | 15.62 | 0.012 | 13.52 | 0.009 | 35.21 | < 0.001 |
| Yes | 1,383 (77.00) | 10.65 | | 8.72 | | 17.43 | |
| Risk group for CoVID-19 | | | | | | | |
| No | 1,354 (75.39) | 15.36 | 0.062 | 13.00 | 0.1905 | 27.33 | < 0.001 |
| Yes | 442 (24.61) | 11.76 | | 10.63 | | 42.76 | |
| Substance use (alcohol, tabacco, illicit drugs, etc) | | | | | | | |
| No | 921 (51.30) | 14.01 | 0.561 | 11.29 | 0.138 | 26.93 | < 0.001 |
| Yes | 875 (48.70) | 14.97 | | 13.60 | | 35.54 | |
| Cohabits? | | | | | | | |
| Family/Partner | 1,312 (73.05) | 13.80 | 0.391 | 12.58 | 0.544 | 29.34 | < 0.001 |
| Friends/Roommates | 146 (8.13) | 15.75 | | 9.59 | | 48.63 | |
| No, lives alone | 338 (18.82) | 16.57 | | 13.02 | | 30.47 | |
| Computer and household internet access | | | | | | | |
| Yes | 1,538 (85.63) | 14.76 | 0.406 | 12.22 | 0.545 | 29.26 | < 0.001 |
| No | 258 (14.37) | 12.79 | | 13.57 | | 42.25 | |
| Feeling that keeping remote activities helps to lessen oneself' sensation of social isolation/distancing (loneliness) | | | | | | | |
| No | 959 (53.40) | 13.45 | 0.186 | 13.45 | 0.155 | 37.33 | < 0.001 |
| Yes | 837 (46.60) | 15.65 | | 11.23 | | 24.01 | |
| Signs/symptoms suggesting COVID-19 infection during social/physical isolation/ distancing | | | | | | | |
| No | 1,518 (84.52) | 14.43 | 0.889 | 11.86 | 0.093 | 27.54 | < 0.001 |
| Yes | 278 (15.48) | 14.75 | | 15.47 | | 50.72 | |
| Financial/material hardship during physical/ social isolation | | | | | | | |
| No | 1,365 (76.00) | 14.29 | 0.682 | 12.31 | 0.803 | 25.86 | < 0.001 |
| Yes | 431 (24.00) | 15.08 | | 12.76 | | 47.80 | |
| Fear of being infected with SARS-CoV-2 | | | | | | | |
| No fear | 114 (6.35) | 15.79 | 0.846 | 13.16 | 0.693 | 15.79 | < 0.001 |
| Little fear | 918 (51.11) | 14.71 | | 11.76 | | 24.73 | |
| Very scared | 764 (42.54) | 14.01 | | 13.09 | | 41.10 | |

**Table 2**
*Sociodemographic characteristics and prevalence of positive screening for anxiety, depression, and stress for recruited participants in a Brazilian public University during physical/social distancing/isolation measures during the COVID-19 pandemic, April-May, 2020*



| Characteristic | *n* (%) (Total = 1,796) | Prevalence of morbidities (depression, anxiety, and stress) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Positive for 1 outcome *n* = 260 (14.48%) | *p*-value | Positive for 2 outcomes *n* = 223 (12.42%) | *p*-value | Positive for all 3 outcomes *n* = 559 (31.12%) | *p*-value |
| Feeling well informed about the pandemic and the reasons for social/physical isolation/ distancing | | | | | | | |
| No | 1,587 (88.36) | 14.87 | 0.191 | 12.73 | 0.269 | 28.86 | < 0.001 |
| Yes | 209 (11.64) | 11.48 | | 10.05 | | 48.33 | |
| Self-rated emotional state during social/ physical isolation/distancing | | | | | | | |
| Remained the same | 548 (30.51) | 13.87 | 0.873 | 6.02 | | 11.31 | < 0.001 |
| Got better | 124 (6.90) | 15.32 | | 13.71 | < 0.001 | 25.00 | |
| Got worse | 1,124 (62.58) | 14.68 | | 15.39 | | 41.46 | |
| Previous diagnostic of mental disorders before the COVID-19 pandemic | | | | | | | |
| No | 1,101 (61.30) | 15.71 | 0.061 | 10.54 | 0.002 | 17.26 | < 0.001 |
| Yes | 695 (38.70) | 12.52 | | 15.40 | | 53.09 | |

The number and prevalence of participants who did not score above the cut-off points (no symptoms) are not shown in the tables, but other each categories indicates detailed numbers and rates (Figure 1). The screenings' prevalence was 41.98% (***n*** = 754) 'Negative for all outcomes', 14.48% (***n*** = 260) 'Positive for one outcome', 12.42% (***n*** = 223) 'Positive for two outcomes', and 31.12% (***n*** = 559) 'Positive for all three outcomes (head of Table 2).

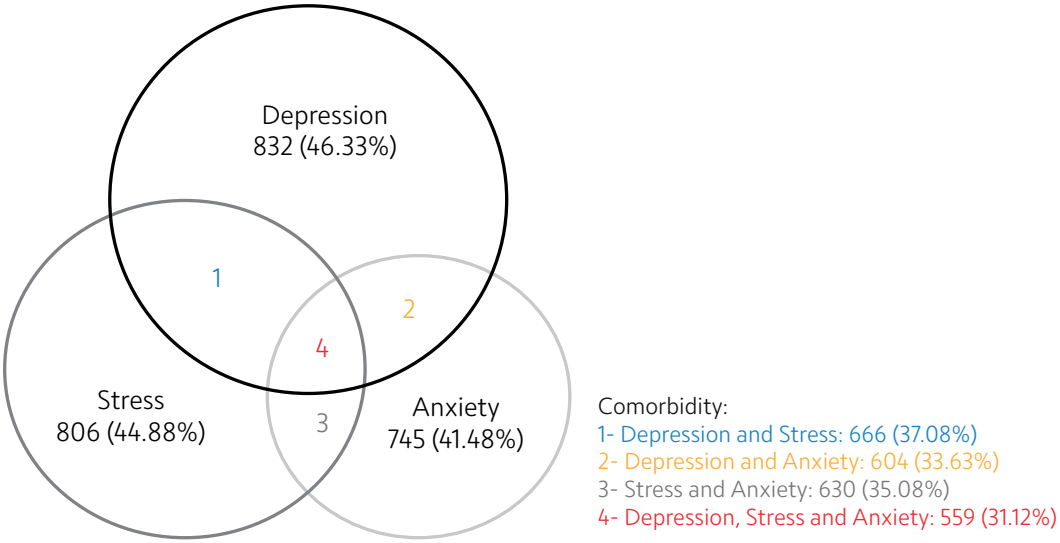
## Factors associated with being screened 'Positive for 1 outcome'

In the multinomial analysis, 18-29 years (95% CI: 1.12-11.28), student (95% CI: 1.33-10.32), and reporting financial/material hardship during physical/social distancing/isolation (95% CI: 1.13-2.43) were associated with presenting at least one mental condition. The likelihood of presenting at least one mental disorder was increased by presenting symptoms suggesting COVID-19 (95% CI: 1.06-2.67), using psychoactive substances (95% CI: 1.06-1.95), self-reporting worsening of emotional state during physical/social distancing/isolation (95% CI: 1.36-2.63), and previous diagnostic of mental disorders (95% CI: 1.59-3.18). Interestingly, having children (95% CI: 0.38-0.97) was apparently protective for being 'Positive for 1 outcome' (Table 3 - column 3).

## Factors associated with being screened 'Positive for 2 outcomes'

Female (95% CI: 1.07-2.21), student (95% CI: 1.74-15.59), using psychoactive substances (95% CI: 1.22-2.38), and symptoms suggesting COVID-19 (95% CI: 1.26-3.28) were associated with presenting 2 outcomes. In the same way, self-rating emotional state as 'got better' (95% CI: 1.43-5.66) and as 'got worsened' (95% CI: 2.62-6.15) during physical/social distancing/isolation, and previous diagnostic of mental disorders (95% CI: 2.80-5.76) were associated with positivity for two outcomes. Interestingly, 'Primary/Secondary' education (95% CI: 0.17-0.89), having children (95%CI: 0.33-0.96), and no computer and household internet access (95% CI: 0.37-0.99) decreased the likelihood of screening positive for two outcomes (Table 3 - column 5).

**Figure 1**
*Comorbidity for depression, anxiety, and stress among 1,796 participants during physical and social distancing measures during the COVID-19 pandemic, April-May, 2020*




## Factors associated with being screened 'Positive for all 3 outcomes'

Another time, female (95% CI: 1.17-2.15), student (95% CI: 1.28-8.55), high-risk group for COVID-19 (95% CI: 1.46-2.90), using psychoactive substances (95% CI: 1.26-2.23), and symptoms of COVID-19 (95% CI: 1.49-3.37) were associated with higher likelihood of presenting all three outcomes. Reporting financial/material hardship during physical/social distancing/isolation (95% CI: 1.45-2.92), feeling very scared of being infected with SARS-CoV-2 (95% CI: 1.46-5.55), feeling well-informed about the pandemic and the reasons for social isolation (95% CI: 1.05-2.49), got better (95% CI: 1.24-4.15) and got worse (95% CI: 2.96-6.02) in self-rated emotional state, and previous diagnostic of mental problems (95% CI: 5.74-10.66) were associated with comorbidity for all three outcomes in reference to neither outcome. While having children (95% CI: 0.28-0.70), living alone (95% CI: 0.44-0.94), having no computer and household internet access (95% CI: 0.34-0.77), and feeling that keeping remote activities helps to lessen the sensation of social isolation/loneliness (95% CI: 0.53-0.94) were potentially protective for being screened positive for three outcomes (Table 3 - column 7).

**Table 3**
*Multinomial analysis for factors associated with comorbidity for depression, anxiety, and stress among university's community during physical and social distancing measures during the COVID-19 pandemic, April-May, 2020*

1 of 2

| Characteristic | Number of morbidities (depression, anxiety, and stress) | | | | | |
|---|---|---|---|---|---|---|
| | Positive for 1 outcome *OR* [95% CI] | *p*-value | Positive for 2 outcomes *OR* [95% CI] | *p*-value | Positive for all 3 outcomes *OR* [95% CI] | *p*-value |
| Sex | | | | | | |
| Male | - | | - | | - | |
| Female | 1.02 [0.74-1.38] | 0.943 | 1.54 [1.07-2.21] | 0.019 | 1.58 [1.17-2.15] | 0.003 |
| Age group | | | | | | |
| 18 - 29 years | 3.59 [1.13-11.38] | 0.030 | 2.16 [0.64-7.36] | 0.218 | 2.16 [0.81-5.79] | 0.123 |
| 30 - 49 years | 2.93 [0.99-8.71] | | 1.80 [0.58-5.64] | | 1.71 [0.69-4.22] | |
| 50 - 68 years | - | | - | | - | |
| Educational level | | | | | | |
| Master/PhD | - | | - | | - | |
| University degree | 0.73 [0.39-1.37] | 0.328 | 0.53 [0.24-1.13] | 0.098 | 0.73 [0.38-1.41] | 0.343 |
| Primary/Secondary | 0.73 [0.37-1.44] | 0.358 | 0.40 [0.17-0.89] | 0.026 | 0.63 [0.31-1.28] | 0.201 |

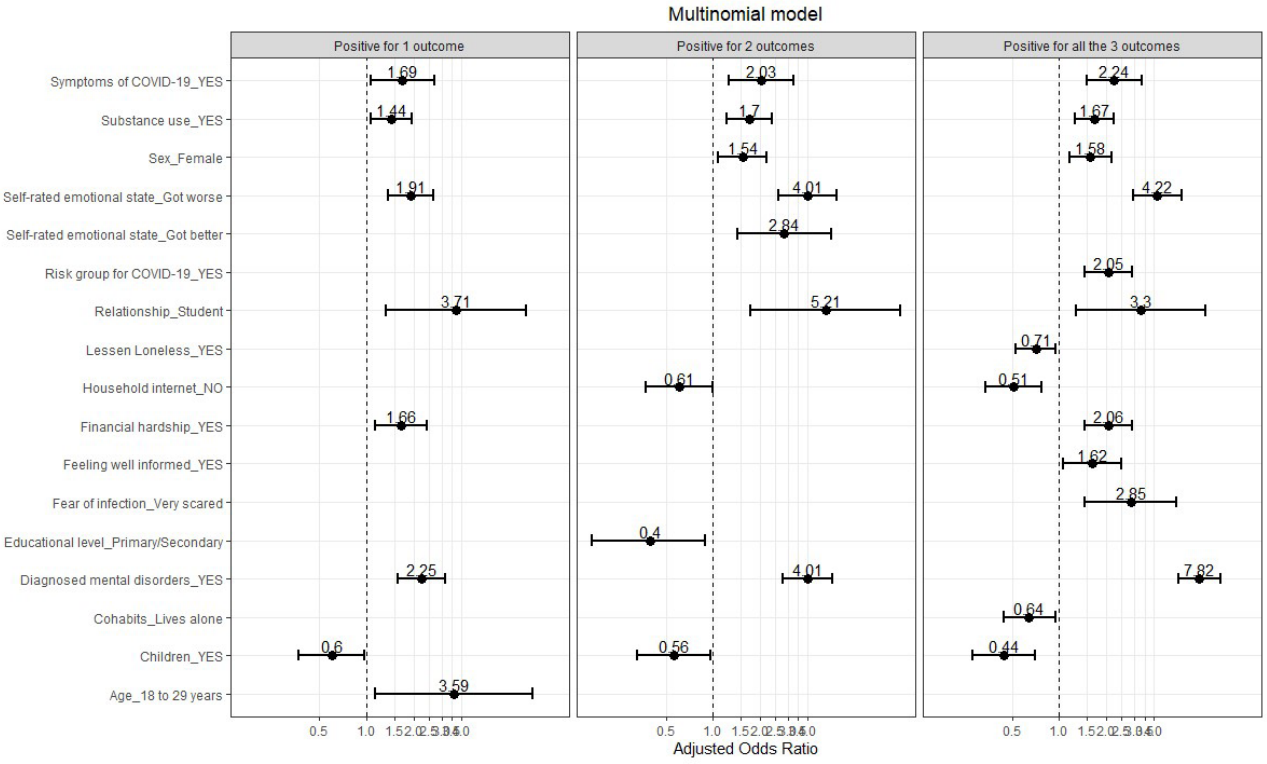
**Table 3**
*Multinomial analysis for factors associated with comorbidity for depression, anxiety, and stress among university's community during physical and social distancing measures during the COVID-19 pandemic, April-May, 2020*



| Characteristic | Number of morbidities (depression, anxiety, and stress) | | | | | |
|---|---|---|---|---|---|---|
| | Positive for 1 outcome *OR* [95% CI] | *p*-value | Positive for 2 outcomes *OR* [95% CI] | *p*-value | Positive for all 3 outcomes *OR* [95% CI] | *p*-value |
| Relationship with the University | | | | | | |
| Professor | - | | - | | - | |
| Staff | 2.25 [0.88-5.77] | 0.012 | 1.14 [0.42-3.10] | 0.003 | 1.18 [0.50-2.78] | 0.014 |
| Student | 3.71 [1.33-10.35] | | 5.21 [1.74-15.59] | | 3.30 [1.28-8.55] | |
| Marital state | | | | | | |
| Married/With partner | - | | - | | - | |
| Single | 0.97 [0.64-1.48] | 0.903 | 0.87 [0.55-1.38] | 0.547 | 1.75 [0.79-1.76] | 0.431 |
| Children | | | | | | |
| No | - | | - | | - | |
| Yes | 0.60 [0.37-0.96] | 0.034 | 0.56 [0.33-0.96] | 0.036 | 0.44 [0.28-0.70] | < 0.001 |
| Risk group for COVID-19 | | | | | | |
| No | - | | - | | - | |
| Yes | 1.19 [0.80-1.76] | 0.385 | 1.20 [0.78-1.83] | 0.409 | 2.05 [1.46-2.90] | < 0.001 |
| Substance use (alcohol, tabacco, illicit drugs, etc) | | | | | | |
| No | - | | - | | - | |
| Yes | 1.44 [1.06-1.95] | 0.019 | 1.70 [1.22-2.38] | 0.002 | 1.67 [1.26-2.23] | < 0.001 |
| Cohabits? | | | | | | |
| Family/Partner | - | | - | | - | |
| Friends/Roommates | 1.14 [0.64-2.03] | 0.656 | 0.72 [0.37-1.43] | 0.351 | 1.44 [0.86-2.40] | 0.022 |
| No, lives alone | 1.05 [0.70-1.55] | | 0.82 [0.53-1.27] | | 0.64 [0.44-0.94] | |
| Computer and household internet access | | | | | | |
| Yes | - | | - | | - | |
| No | 0.86 [0.54-1.39] | 0.541 | 0.61 [0.37-0.99] | 0.048 | 0.51 [0.34-0.77] | 0.002 |
| Feeling that keeping remote activities helps to lessen oneself' sensation of social isolation/distancing (loneliness) | | | | | | |
| No | - | | - | | - | |
| Yes | 1.08 [0.80-1.47] | 0.600 | 0.86 [0.62-1.20] | 0.380 | 0.71 [0.53-0.94] | 0.017 |
| Signs/symptoms suggesting COVID-19 infection during social/physical isolation/distancing | | | | | | |
| No | - | | - | | - | |
| Yes | 1.69 [1.07-2.69] | 0.025 | 2.03 [1.26-3.28] | 0.004 | 2.24 [1.49-3.37] | < 0.001 |
| Financial/material hardship during social/physical isolation/ distancing | | | | | | |
| No | - | | - | | - | |
| Yes | 1.66 [1.13-2.43] | 0.010 | 1.38 [0.91-2.10] | 0.134 | 2.06 [1.45-2.92] | < 0.001 |
| Luck of medical assistance during social/physical isolation/ distancing | | | | | | |
| No | - | | - | | - | |
| Yes | 1.05 [0.69-1.59] | 0.836 | 0.88 [0.56-1.39] | 0.595 | 1.42 [0.99-2.04] | 0.059 |
| Fear of being infected with SARS-CoV-2 | | | | | | |
| No fear | - | | - | | - | |
| Little fear | 0.98 [0.55-1.78] | 0.959 | 0.98 [0.50-1.90] | 0.946 | 1.67 [0.86-3.24] | 0.002 |
| Very scared | 1.27 [0.69-2.33] | | 1.34 [0.68-2. 64] | | 2.85 [1.46-5.55] | |
| Feeling well informed about the pandemic and the reasons for social/physical isolation/distancing | | | | | | |
| No | - | | - | | - | |
| Yes | 0.87 [0.52-1.46] | 0.604 | 0.86 [0.49-1.50] | 0.593 | 1.62 [1.05-2.49] | 0.028 |
| Self-rated emotional state during social/physical isolation/ distancing | | | | | | |
| Remained the same | - | | - | | - | |
| Got better | 1.40 [0.77-2.55] | < 0.001 | 2.84 [1.43-5.66] | 0.003 | 2.27 [1.24-4.15] | 0.008 |
| Got worse | 1.91 [1.37-2.66] | | 4.01 [2.62-6.15] | | 4.22 [2.96-6.02] | |
| Previous diagnostic of mental disorders before the COVID-19 pandemic | | | | | | |
| No | - | | - | | - | |
| Yes | 2.25 [1.59-3.18] | < 0.001 | 4.01 [2.80-5.76] | < 0.001 | 7.82 [5.74-10.66] | < 0.001 |

Note: Hosmer-Lemeshow test (multinomial model): $\chi$-squared = 11.301; ***df*** = 24; ***p***-value = 0.9867. OR: Odds Ratio.

**Figure 2**
*Factors associated with comorbidity for depression, anxiety, and stress among university's community during physical and social distancing measures during the CoVID-19 pandemic, April-May, 2020*




## Discussion

Given the pandemic, a number of studies turned to the internet to screen the general population, for example students, essential workforce, for common mental disorders and well-being (Marijanović et al., 2021; Mishra et al., 2023; Moghanibashi-Mansourieh, 2020; Ozamiz-Etxebarria et al., 2020; Verma & Mishra, 2020).

To the best of our knowledge, our study was the first web-based survey assessing psychological distress and its relationship in a public university's community during the early stage of the COVID-19 pandemic and early quarantine measures in Mid-West Brazil. We used DASS-21 and found 14.48% of participants screened positive for one, 12.42% for two, and 31.12% for three of the primary outcomes, whilst 41.98% were screened negative for all conditions. Whereas we found one in eight participants with co-occurrence of two psychological morbidities, Leong Bin Abdullah et al. (2021) estimated at 19.9% the prevalence of two outcomes (depression and anxiety) in several urban communities in Malaysia and Gao et al. (2020) reported 19.4% prevalence of both depression and anxiety in Chinese adults during the COVID-19 pandemic. In a study among 746,217 Chinese college/university students, 6.3% presented all three morbidities (depression, anxiety and stress), 5.5% were detected with two conditions (stress and depression), 3.3% with two outcomes (depression and anxiety) and 0.9% with two outcomes (stress and anxiety) (Ma et al., 2020).

Being female was associated with higher odds of positivity for both two and three outcomes. Other studies highlighted similar relationship (Mazza et al., 2020; Özdin & Bayrak Özdin, 2020). For exemple, De Boni et al. (2020) showed that female frontline workers in Brazil and Spain had a

higher likelihood of having depression and anxiety. In addition, having no computer and household internet access were associated with lower odds of screening positive for both two and three outcomes in this study.

Interestingly, student, children, psychoactive substances, symptoms suggesting COVID-19, worsened emotional state, and previous diagnostic of mental disorders were not only associated with screening positive for one condition, although it all were associated with higher odds of screening positive for both two and three outcomes (Figure 2).

Wang et al. (2020) found that being student was associated with higher levels of stress, anxiety, and depression, as well as in this study. Students may be facing a variety of determinants of psychological outcomes as the impact of the COVID-19 outbreak, which may be related to the higher likelihoods of screening positive for more than one mental conditions, as observed in the present study. For example, experiencing high levels of fear of SARS-CoV-2, adapting to new educational methods/tools, high-performance pressure, meeting the deadlines/targets, and fear of failing may be of concern, making students more anxious, stressed and depressed. In addition, concentration to study at home regarding learning environment may be challenging for some students.

Parallel to our results, presenting previous diagnostic of or treatment for mental disorders increased the odds of current depression, anxiety, and/or stress. Being diagnosed with or treated for mental health disorders in the last year was risky for having both depression and anxiety (De Boni et al., 2020). Among a large sample of college/university students (Ma et al., 2020) and of the general population (Shi et al., 2020) in China, prior mental problems increased odds of depressive, anxiety or/and acute stress symptoms.

Interestingly, getting better but also getting worse in self-rated emotional state during physical/social distancing/isolation were all associated with comorbidity for both two and three outcomes in our study. Likewise, reporting a reduction in self-rated health was found to be a predictor of both depression and anxiety (De Boni et al., 2020) and predictor of higher levels of stress, anxiety, and depression (Wang et al., 2020), suggesting reliability of self-rated health/mental well-being in measuring general health outcomes and health determinants. Nonetheless, participants with preexisting mental disorders prior to COVID-19 pandemic may report more frequently worsening of psychological symptoms during pandemic (Vindegaard & Benros, 2020).

In our sample, living alone during physical/social distancing/isolation was protective for being screened positive for three outcomes under study than their counterparts, contrary to what was revealed by Cao et al. (2020) among college students in China. Having children was protective for comorbidity even for having only one outcome in this study. However, a study with the Italian general population evidenced that not having a child was associated with depression (Mazza et al., 2020), while having two or more children predicted depression, anxiety and stress (Li et al., 2020).

For instance, family income stability were found to be protective against anxiety during the pandemic (Cao et al., 2020), whereas reporting financial problems was associated with depression and anxiety (Ruengorn et al., 2021). We found that experiencing financial distress during physical/social distancing/isolation increased the likelihood of one and three conditions. This interpretation is in line with a recent evidence that generalized anxiety disorder and depression were associated with loss of income due to the COVID-19 pandemic in the general population of Ireland (Hyland et al., 2020). Although in the United States of America, running out of money for basic needs predicted thoughts of suicide/self-harm (Elbogen et al., 2021), highlighting the effects of stressful economic situations on mental health (Silva et al., 2018; Uutela, 2010).

As far as is known, emotional and stress responses plays a role in motivation to drink alcoholic beverages, so people exposed to a sort of stressors in recent lifetime tended to drink more (Keyes et al., 2012), and the COVID-19 pandemic may be acting as a potential stressor which can be related to subsequent alcohol consumption. Empirical psychiatric and epidemiological data evidenced that having either psychological disorders or problems with alcohol one may elevates the prospective likelihood for developing the other one (Anker & Kushner, 2019). Accordingly, current substance use was associated with higher risk of being screened positive for all three outcomes under analysis. Smoking and alcohol drinking was associated with higher risk of depression (Mamun et al., 2021), and substance use may affect mental health (Lees et al., 2020), but also strong mood problems may trigger the urge to substance use, what can lead to psychological effects (Anthenelli, 2012; Sinha, 2012). In a population-based study in Bangladesh (Mamun et al., 2021) and among nurse students in Saudi Arabia (Alsolais et al., 2021), fear of COVID-19 predicted participants' mental conditions. The same pattern was found in this study. Feeling very scared of being infected with SARS-CoV-2 was associated with comorbidity for all three outcomes under analysis. In Ireland, higher levels of perceived risk of COVID-19 infection in the population was predictor of positive screening for generalized anxiety disorder or depression during the pandemic (Hyland et al., 2020) and anxiety about being infected was risky for mental outcomes in Israel (Mosheva et al., 2021).

Of notice is that people self-rated as well-informed about the pandemic and about the reasons for physical/social distancing/isolation measures were more likely to screen positive for all three outcomes under analysis. On the other hand, the lack of knowledge of the pandemic increased the risk of elevated anxiety (Du et al., 2020), and dissatisfaction with the available amount of health information about COVID-19 was related to stress during the initial stage of the COVID-19 pandemic among the general population in China (Wang et al., 2020).

Surprisingly, ethnicity/race, which may be associated with higher social and mental health vulnerabilities, was not included in the multinomial model due to the low importance level at feature selection stage. Studies on university students and/or university community's mental health in Latin America during the COVID-19 pandemic is limited. The most studied group was healthcare workers, regarded as a highly exposed group with a higher risk of psychological/psychiatric symptoms during the pandemic (De Boni et al., 2020; Du et al., 2020; Li et al., 2020). These surveys were predominantly conducted in Asia, with a variety of methodologies and screening tools, so equiparable data with university communities from Latin America is scarce, what limits the current comparability.

Additionally, using screening self-report measures can lead to higher rates estimates compared to clinical diagnostic interviews (Thombs et al., 2018) and differences in used screening tools and cut-off points may be considered. This study was web-based, therefore the sample is not probabilistic, and may not represent the entire population of the university. Gender bias can be considered, as females were overrepresented in this and many other web-based studies undergone during the pandemic (Kim et al., 2022; Mishra et al., 2023; Ruengorn et al., 2021). Also the 2019's Brazilian rate of households' internet access, taken to be at 82.70% (Ministério das Comunicações, 2021), may be taken in account. So, individuals without Internet access or unwilling to use Information and Communication Technologies could not be represented in this study. Finally, cross-sectional study design has no power to clarify the temporal association between outcome and determinants.

## Conclusion

Individuals from the studied university's community are experiencing psychological disorders, as measured by levels of anxiety, depression and stress and comorbidity for these outcomes, probably as COVID-19's initial psychological impact. The pandemic resulted in situations that adversely affect people's mental health from numerous perspectives. Given the variables found to affect the manifestation of psychological symptoms, there is need to worry about incidence of post-traumatic disorders after the pandemic. This study showed that females, students, psychoactive substances, symptoms suggesting COVID-19, worsened emotional state and previous diagnostic of mental disorders were associated with a greater risk for mental comorbidity. Besides our results calls for more research on determinants of psychological comorbidity during the pandemic, it could add to a set of evidence for formulating relevant support to better address mental problems during and after crisis.

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