

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

Fatores associados à comorbidade na triagem para depressão, ansiedade e estresse em uma amostra de uma comunidade universitária brasileira durante a pandemia de Covid-19

Factores asociados con la comorbilidad en el cribado de depresión, ansiedad y estrés en una muestra de una comunidad universitaria brasileña durante la pandemia de Covid-19

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### Abstract

**Background:** Mental health is a major public health challenge worldwide and affected people may present more than one mental outcomes simultaneously. **Purpose:** To describe the prevalence of comorbidity in screening for depression, anxiety, and stress, as well as determinants of these comorbidity in a university's community in Mid-West Brazil during the Covid-19. **Methods:** A cross-sectional descriptive/exploratory study used self-report DASS-21 to screen for mental health. Data from a non-probabilistic sample was obtained online between April 10 and May 25, 2020. Multinomial model was used to identify factors associated with comorbidity. **Results:** The majority of the sample was students (78.84%), women (65.53%), white (54.18%), single (71.33%), aged 18-29 years old (67.26%), with an overall mean age of 28.3 years ( $sd = 10.1$ ), 85.63% referred household internet access. 14.48%, 12.42%, and 31.12% screened positive for one, two and all the 3 outcomes, respectively. Students, having children, substance use, presenting Covid-19's symptoms, worsened self-rated emotional state, and previous mental disorders were associated with comorbidity for depression, anxiety, and stress. **Conclusions:** 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

**Contexto:** A saúde mental é um grande desafio de saúde pública em todo o mundo e as pessoas afetadas podem apresentar mais de um desfecho mental simultaneamente. **Objetivo:** Descrever a prevalência de comorbidade no rastreamento para depressão, ansiedade e estresse, bem como os determinantes dessas comorbidades em uma comunidade universitária do Centro-Oeste do Brasil durante a pandemia de Covid-19. **Métodos:** Estudo transversal descritivo/exploratório que utilizou a DASS-21 para triagem de saúde mental. Dados de uma amostra não probabilística foram obtidos online entre 10 de abril e 25 de maio de 2020. Regressão multinomial foi utilizada para identificar fatores associados à comorbidade. **Resultados:** A maioria da amostra era composta por estudantes (78,84%), mulheres (65,53%), brancos (54,18%), solteiros (71,33%), com idade entre 18 e 29 anos (67,26%), com média geral de idade de 28,3 anos ( $dp = 10,1$ ), 85,63% referiram acesso domiciliar à internet. 14,48%, 12,42% e 31,12% foram rastreados como positivos para uma, para duas e para todas as 3 morbidades, respectivamente. Ser estudantes, ter filhos, uso drogas, apresentar sintomas de Covid-19, reportar piora do estado emocional autoavaliado e transtornos mentais prévios foram associados à comorbidade para depressão, ansiedade e estresse. **Conclusões:** Indivíduos da comunidade universitária estudada apresentaram distúrbios psicológicos, medidos pelos níveis de ansiedade, depressão e estresse e comorbidade para esses distúrbios, provavelmente como impacto psicológico inicial da pandemia de Covid-19.

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

### Resumen

**Antecedentes:** La salud mental es un desafío de salud pública importante en todo el mundo y las personas afectadas pueden presentar más de un resultado mental simultáneamente. **Propósito:** Describir la prevalencia de comorbilidad en el tamizaje de depresión, ansiedad y estrés, así como los determinantes de estas comorbidades en una comunidad universitaria del Centro-Oeste de Brasil durante la Covid-19. **Métodos:** Estudio transversal descriptivo/exploratorio

que utilizó el DASS-21 para el cribado de salud mental. Los datos de una muestra no probabilística se obtuvieron en línea entre el 10 de abril y el 25 de mayo de 2020. Se utilizó regresión multinomial para identificar los factores asociados con la comorbilidad. Resultados: La mayoría de la muestra eran estudiantes (78,84 %), mujeres (65,53 %), blancas (54,18 %), solteras (71,33 %), de 18 a 29 años (67,26 %), con una edad media de 28,3 años (dt = 10,1), el 85,63% refirió acceso a internet en el hogar. El 14,48 %, el 12,42 % y el 31,12 % dieron positivo en uno, dos y los 3 resultados, respectivamente. Ser estudiante, tener hijos, usar drogas, tener síntomas de Covid-19, reportar un empeoramiento del estado emocional autopercebido y trastornos mentales previos se asoció con comorbilidad para la depresión, la ansiedad y el estrés. Conclusiones: Los individuos de la comunidad universitaria estudiada presentaron trastornos psicológicos, medidos por niveles de ansiedad, depresión y estrés, y comorbilidad de estos trastornos, probablemente como un impacto psicológico inicial de la pandemia de Covid-19.

**Palabras clave:** Ansiedad; Comorbilidad; Depresión; Estrés; Pandemia Covid-19.

## 1. Introduction

Mental health was already recognized as a major public health challenge even before the 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 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., 2021; 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 screened using self-report tools widely, 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, 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 (USA), relatively high rates of people suffering with 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 increase in depression/depressive symptoms, anxiety, psychological distress in HCW during the Covid-19 pandemic in China, while in the general population, studies revealed higher scores of anxiety and depression compared to before pandemic (Vindegaard & Benros, 2020). These findings should not be different 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, frequencies of depression among United State's undergraduate students were higher in May 2020 compared to October 2019 (Kim et al., 2021).

A systematic review comparing psychiatric comorbidities between the SARS and 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 Mid-West Brazil.

## **2. Methods**

### **2.1 Study population and study design**

A cross-sectional descriptive/exploratory study started in the first month of physical/social distancing/isolation measures with remote classes and remote work due to the Covid-19 pandemic in a Federal University in Mid-West Brazil.

### **2.2 Recruitment strategy and Data collection**

Given the pandemic and lockdown scenario, it was difficult to implement probabilistic sampling techniques. Consequently, participants aged at least 18 years old who agreed to participate answered to a self-applied internet-based questionnaire between April 10 and May 25, 2020, less than a month after the implementation of the remote work and remote classes, so called Emergency Remote Learning (ERL). 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 using DASS-21, a 21-item self-reported questionnaire. 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). The questionnaire was available online at the homepage, social media, and weekly newsletter of the University.

### **2.3 Study Outcome**

Three primary outcomes were anxiety, depression and stress assessed using DASS-21. Each outcome was dichotomized in 'Screened Negative' for those scored Normal or Mild and 'Screened Positive' for those participants 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 1 outcome', 'Positive for 2 outcomes', and 'Positive for all the 3 outcomes' (De Boni et al., 2020). 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.

### **2.4 Independent Variables**

Sociodemographic characteristics, behaviors/attitudes, self-perceptions about social distancing measures and other variables were obtained. Categorization of each variable is presented in Table 1.

### **2.5 Data Analysis**

MICE package, which uses multiple imputation with fully conditional specification, was used to impute categorical missing data for the following independent variables: '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 analysis was run 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 preliminar 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 et al., 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 were used to fit a multinomial logistic regression. 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* (CONEP) – Brazil, CAAE: 30651820.4.0000.0008. Participants read and checked an internet based Informed Consent Form (ICF) confirming their interest in participating before filling the questionnaire.

### 3. Results

#### 3.1 Sample characteristics

Overall, 2,469 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 signed. 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 1).

**Table 1.** Sociodemographic characteristics and prevalence of positive screening for anxiety, depression, and stress for recruited participants in a Brazilian public University during physical and social distancing measures during the Covid-19 pandemic, April-May, 2020.

Characteristic	n (%) (Total=1,796)	Prevalence for number 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 the 3 outcomes n=559 (31.12%)	p-value
<b>Sex</b>							
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	
<b>Age group</b> (mean: 28.3 ± 10.1 years)							
18 - 29 years	1,208 (67.26)	15.73		14.07		37.25	
30 - 49 years	495 (27.56)	13.33	0.007	9.90	0.003	20.20	<0,001
50 - 68 years	93 (5.18)	4.30		4.30		9.68	

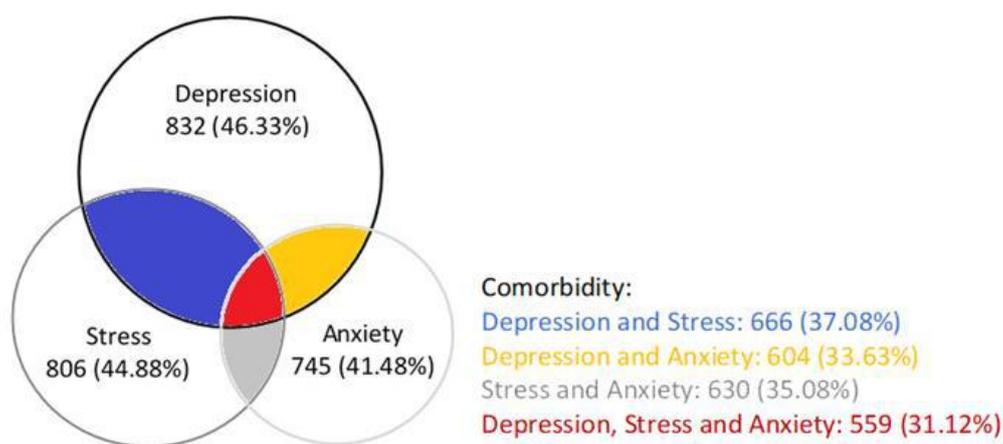
<b>Race/skin color</b>							
White	973 (54.18)	14.90		12.74		30.22	
Black/Pardo	735 (40.92)	13.88	0.835	12.52	0.425	32.24	0.662
Indigenous/Yellow	88 (4.90)	14.77		7.95		31.82	
<b>Educational level</b>							
Master/PhD	230 (12.81)	11.74		9.57		16.09	
University degree	909 (50.61)	14.08	0.258	13.09	0.349	31.35	<0,001
Primary/Secondary	657 (36.58)	15.98		12.48		36.07	
<b>Relationship with the University</b>							
Professor	104 (5.79)	6.73		7.69		14.42	
Staff	276 (15.37)	13.04	0.042	6.16	<,001	14.49	<0,001
Student	1,416 (78.84)	15.32		13.98		35.59	
<b>Marital state</b>							
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	
<b>Children</b>							
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	
<b>Risk group for Covid-19</b>							
No	1,354 (75.39)	15.36	0.062	13.00	0.191	27.33	<0,001
Yes	442 (24.61)	11.76		10.63		42.76	
<b>Substance use (alcohol, tobacco, illicit drugs, etc)</b>							
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	
<b>Cohabits?</b>							
Family/Partner	1,312 (73.05)	13.80		12.58		29.34	
Friends/Roommates	146 (8.13)	15.75	0.391	9.59	0.544	48.63	<0,001
No, lives alone	338 (18.82)	16.57		13.02		30.47	
<b>Computer and household internet access</b>							
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	
<b>Feeling that keeping remote activities helps to lessen oneself' sensation of social isolation/distancing (loneless)</b>							
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	
<b>Signs/symptoms suggesting Covid-19 infection during social/physical isolation/distancing</b>							
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	
<b>Financial/material hardship during physical/social isolation</b>							
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	

<b>Fear of being infected with SARS COV-2</b>							
No fear	114 (6.35)	15.79		13.16		15.79	
Little fear	918 (51.11)	14.71	0.846	11.76	0.693	24.73	<0,001
Very scared	764 (42.54)	14.01		13.09		41.10	
<b>Feeling well informed about the pandemic and the reasons for social/physical isolation/distancing</b>							
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	
<b>Self-rated emotional state during social/physical isolation/distancing</b>							
Remained the same	548 (30.51)	13.87		6.02		11.31	
Got better	124 (6.90)	15.32	0.873	13.71	<,001	25.00	<0,001
Got worse	1,124 (62.58)	14.68		15.39		41.46	
<b>Previous diagnostic of mental disorders before the Covid-19 pandemic</b>							
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	

Source: Author.

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 1 outcome', 12.42% (n=223) 'Positive for 2 outcomes', and 31.12% (n=559) 'Positive for all the 3 outcomes (head of Table 1).

**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.



Source: Author.

### 3.2 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 2 - column 3).

### 3.3 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 as got better (95%CI: 1.43-5.66) and as got worse (95% CI: 2.62-6.15) in emotional state 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 2 - column 5).

### 3.4 Factors associated with being screened ‘Positive for all the 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 the 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 the 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/loneless (95%CI: 0.53-0.94) were potentially protective for being screened positive for the three outcomes (Table 2 - column 7).

**Table 2.** 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.

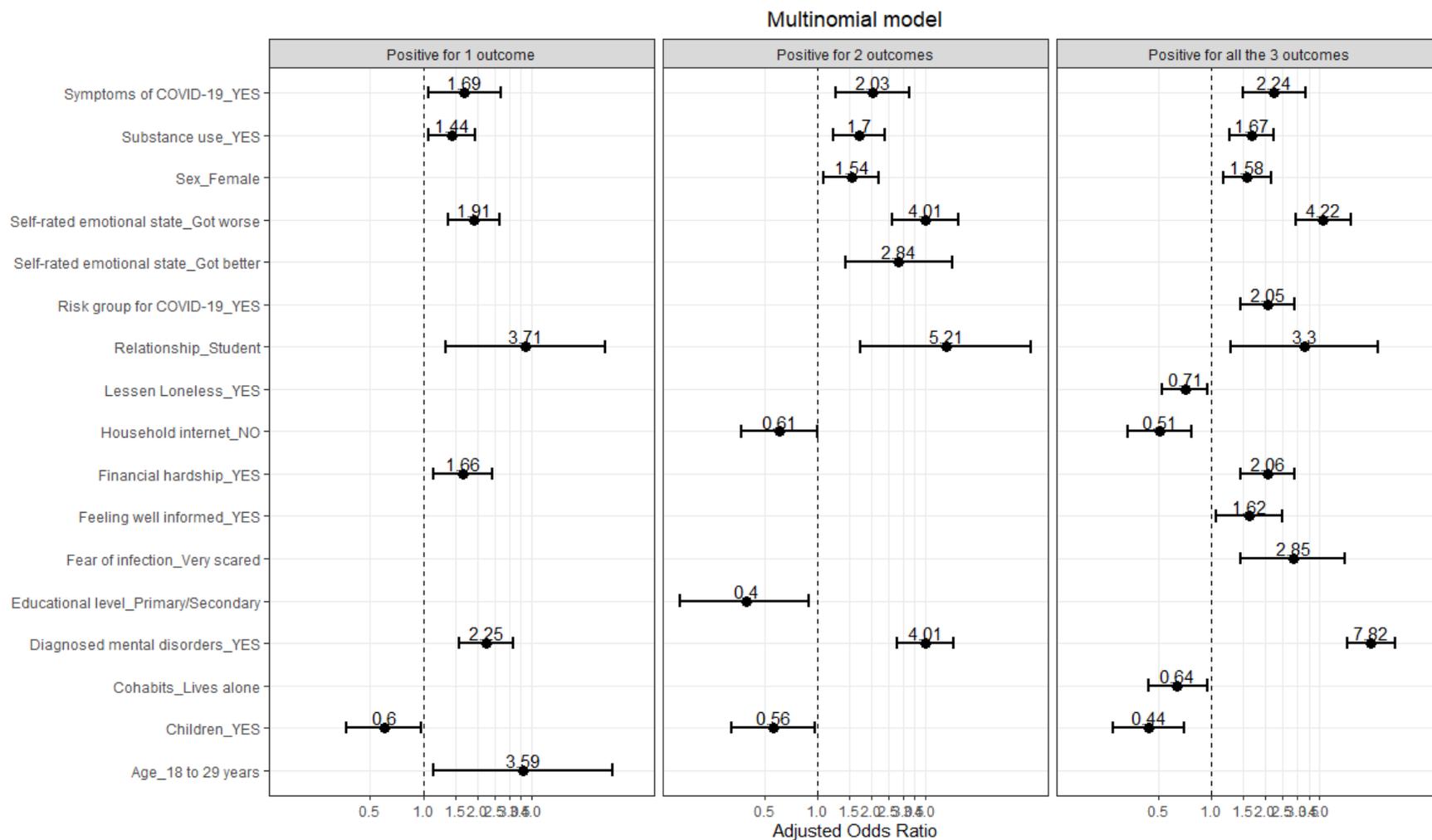
Characteristic	Number of morbidities (depression, anxiety, and stress)					
	Positive for 1 outcome	<i>p-value</i>	Positive for 2 outcomes	<i>p-value</i>	Positive for all the 3 outcomes	<i>p-value</i>
<b>Sex</b>						
Male	-		-		-	
Female	1.02 (0.74-1.38)	0.943	1.54 (1.07-2.21)	0.019	1.58 (1.17-2.15)	0.003
<b>Age group</b>						
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	-		-		-	
<b>Educational level</b>						
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
<b>Relationship with the University</b>						
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)	
<b>Marital state</b>						
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
<b>Children</b>						
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
<b>Risk group for Covid-19</b>						
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
<b>Substance use (alcohol, tobacco, illicit drugs, etc)</b>						
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
<b>Cohabits</b>						
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)	
<b>Computer and household internet access</b>						
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
<b>Feeling that keeping remote activities helps to lessen oneself' sensation of social isolation/distancing (loneless)</b>						
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
<b>Signs/symptoms suggesting Covid-19 infection during social/physical isolation/distancing</b>						
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
<b>Financial/material hardship during social/physical isolation/distancing</b>						
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
<b>Lack of medical assistance during social/physical isolation/distancing</b>						
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

<b>Fear of being infected with SARS COV-2</b>						
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)	
<b>Feeling well informed about the pandemic and the reasons for social/physical isolation/distancing</b>						
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
<b>Self-rated emotional state during social/physical isolation/distancing</b>						
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)	
<b>Previous diagnostic of mental disorders before the Covid-19 pandemic</b>						
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

Hosmer-Lemeshow test (multinomial model):  $\chi$ -squared = 11.301, df = 24, p-value = 0,9867. Source: Author.

**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.



Source: Author.

#### 4. 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., 2021; Moghanibashi-Mansourieh, 2020; Ozamiz-Etxebarria et al., 2020; Verma & Mishra, 2020).

To the best of our knowledge, this is 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 and colleagues (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).

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 example, 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. Also 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 (Vindegard & 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 Covid-19 in the general population of Ireland (Hyland et al., 2020), although in the USA, 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 analyse. 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., 2021; Mishra et al., 2021; Ruengorn et al., 2021). Also the 2019's Brazilian rate of households internet access, taken to be at 82,70% (Ministry of Communication. Available at: <https://www.gov.br/mcom/pt-br/noticias/2021/abril/pesquisa-mostra-que-82-7-dos-domicilios-brasileiros-tem-acesso-a-internet>), may be taken in account. So, individuals without Internet access or unwilling to use Information and Communication Technologies (ICTs) could not be represented in this study. Finally, cross-sectional study design have no power to clarify the temporal association between outcome and determinants.

## 5. Final Considerations

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 been 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 and future studies to better address mental problems during and after crisis.

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