

ORIGINAL ARTICLE/ ARTIGO ORIGINAL

## The Health and Socio-Demographic Factors Associated with Depressive Symptoms During the COVID-19 Pandemic: A Cross-Sectional Study Fatores Sociodemográficos e de Saúde Associados aos Sintomas Depressivos Durante a Pandemia de COVID-19: Um Estudo Transversal

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### Abstract

**Introduction:** Our objective was to analyze depressive symptoms during the COVID-19 pandemic and their association with health and sociodemographic factors.

**Methods:** A survey of 4203 adults from ten municipalities was conducted in Mato Grosso state, Amazon region of Brazil. Data collection was done at home, with the collection of sociodemographic characteristics, and aspects of both physical and mental health. The DSM-5 level 1 cross-sectional symptom scale was used to identify symptoms of depression, substance use disorders, sleep disturbances, and anxiety. Chemiluminescence was also used to detect IgG anti-SARS-CoV-2 antibodies.

**Results:** The estimated prevalence of anti-SARS-CoV-2 antibodies was 12.5% and the prevalence of depressive symptoms was 23.2%. In the multivariate analysis, depression was associated with being male, having a low income, the level of physical activity before the pandemic, chronic illness, substance use disorder, sleep and anxiety disorders.

**Conclusion:** Evidence on depression and its associated factors is critical to understanding the extent of the population situation from which recommendations can be made to guide public policy.

### Resumo

**Introdução:** O nosso objetivo foi analisar a associação entre sintomas depressivos e fatores sociodemográficos e de saúde durante a pandemia de COVID-19.

**Métodos:** Foi realizado um estudo com 4203 adultos de dez municípios do estado de Mato Grosso, região amazônica do Brasil. A recolha de dados foi realizada na residência, com levantamento de informações sobre as características sociodemográficas, aspectos de saúde física e mental. A Escala de Sintomas Transversais de Nível 1 do DSM-5 foi utilizada para identificar sintomas de depressão, transtorno por uso de substâncias, distúrbios do sono e ansiedade. A quimiluminescência foi utilizada para detectar anticorpos IgG anti-SARS-CoV-2.

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**Resultados:** A prevalência estimada de anticorpos anti-SARS-CoV-2 foi de 12,5% e a prevalência de sintomas depressivos foi de 23,2%. Na análise multivariada, a depressão esteve associada a ser do sexo masculino, ter baixa renda, nível de atividade física antes da pandemia, ter doença crônica, apresentar transtorno por uso de substâncias, transtornos do sono e de ansiedade.

**Conclusão:** Os achados sobre a depressão e seus fatores associados são essenciais para a compreensão sobre a magnitude do quadro desses sintomas na população, a partir de onde podem ser feitas recomendações que norteiem as políticas públicas.

**Keywords:** Brazil; Depression; Mental Health; SARS-CoV-2; Surveys and Questionnaires

**Palavras-chave:** Brasil; Depressão; Inquéritos e Questionários; Saúde Mental; SARS-CoV-2

## INTRODUCTION

After the emergence of COVID-19 and the changes arising from the development of the ‘new normal’ in societies, the world is now experiencing multidimensional challenges. In the health sector, in addition to the constant search for better therapies for the treatment of COVID-19 and the intensification of prevention activities, such as immunization, there is great concern about the impact of the pandemic on the mental health of the population.<sup>1-3</sup> There is evidence indicating that globally there has been a reduction in physical and psychological well-being since the start of the pandemic.<sup>4-6</sup>

A negative impact on people’s mental health has already been reported after previous epidemics, such as Ebola,<sup>7</sup> however, the impact is greater with the current global pandemic because of the rapid worldwide spread, both viral and the infodemic and fake news.<sup>8</sup> A meta-analysis study, comparing pandemic and pre-pandemic data, found a significant increase in depression rates.<sup>9</sup> As well as a 34.3% prevalence of depression in major international studies since the identification of SARS-CoV-2.<sup>10</sup> The COVID-19 Mental Disorders Collaborators estimated that since the beginning of the pandemic there was a 27.6% increase in global cases of depressive disorder in 2020 and major depressive disorder caused 49.4 million (33.6 to 68.7) DALYs.<sup>11</sup> However, the mechanisms of depression in COVID-19 cases are still unclear, even though it is the most common disorder of neurological symptoms post infection.<sup>12</sup>

Variables such as being married, having a lower level of education, having a chronic illness and having a previous history of depression in pregnant women were associated with depression in women during the pandemic.<sup>13</sup> In students, severe symptoms of depression were observed, higher in males and among those with a lower level of social support.<sup>14</sup> Among elderly Brazilians, women had a higher prevalence of depressive symptoms than men, which was again associated with low income.<sup>15</sup> For individuals who had a previous history of major depressive disorders, the pandemic intensified symptoms and impacted psychopharmacological treatment.<sup>16</sup> The complexity of the compounding factors of depression has already been described in international studies, however, studies must

be expanded worldwide to enable mental health services to confront the mental health consequences of the COVID-19 pandemic. Thus, the present study aims to analyze the health and socio-demographic factors associated with depressive symptoms during the COVID-19 pandemic in the population of three main Brazilian biomes.

## METHODS

A cross-sectional household survey was carried out in the state of Mato Grosso, a state that, due to its wide territorial extension, is home to the three main biomes of the country, namely the Amazon, Cerrado and Pantanal. Ten cities were listed, whose populations ranged from 30 000 to 600 000 inhabitants, and which are located in 3 of the main Brazilian biomes (Cerrado [5 cities], Pantanal [1 city] and Amazônia [3 cities]). The main connections of regional integration are also considered, and it was possibly through these that the hierarchical diffusion process of COVID-19 in this region took place. This study is part of the matrix project “*Endemic and epidemic diseases in Mato Grosso*”.<sup>17</sup>

The sample size calculation was performed using the 2019 population estimate for the 10 selected municipalities (sample space: 1 650 643 inhabitants in the 10 municipalities of the study), considering a confidence level of 95%, design effect equal to 1.5, the prevalence of 3% and precision of 0.65%.<sup>18</sup> The sample size was calculated using OpenEpi21. A 13% recomposition was added to the sample size, considering the anticipated losses resulting from refusals and the existence of closed households during attempted recruitment. The sample weight of each selected unit (census sector, household and individual) was calculated separately for each municipality, considering the inverse of the selection probability according to the proposed sampling plan, including calibrations for adjustments to the known population totals. Medium-sized municipalities, census sectors in urban areas and residents over 18 years of age were included, and municipalities with less than 25 000 inhabitants, census sectors that encompassed rural areas and indigenous reserves and unconscious bedridden residents were excluded.<sup>19</sup>

Data collection took place between September and October 2020 by professionals and undergraduate health

students. Prior training was carried out in August 2020 to standardize interviews, blood collection and pilot testing. The pilot test was carried out in a census sector not selected for sampling and its data were not included in the analysis. During data collection, the selected census sector was covered following a systematic approach of selecting households by “jumps” determined for each sector. If the selected household was empty at the time or the selected resident did not agree to participate in the research, the next residence on the left was taken as a substitute.

When the participants' home was visited for recruitment, a resident over 18 years of age was randomly selected to answer the questionnaires, which were applied through Epi InfoTM<sup>20</sup> on Smartphones, which was also used to capture geographic coordinates. Fieldwork was carried out by a coordinator in each selected municipality. The data that was collected during the interview with the individual included (i) sociodemographic data, (ii) physical health data and (iii) mental health symptoms.

The socio-demographic data included simple questions about gender (female and male), race/skin colour (non-white and white), education (illiterate, elementary, secondary and higher education and more) and household income before the pandemic (< 1 minimum wage (MW), 1-3 and >3MW) (family income was assessed using R\$ 1045.00 or US\$ 183.91), reduced income during the pandemic (yes or no) and food insecurity (yes or no) analyzed by the question: “*Since the beginning of the COVID-19 Pandemic, has there been a time when food ran out in your house and you didn't have the money to buy more?*”.

ii) Health – which involved questions about body weight change since the beginning of the pandemic; physical exercise before the pandemic; physical exercise during the pandemic; the presence of antibodies against SARS-CoV-2 (confirmed by chemoimmunofluorescence), self-reported symptoms of COVID-19; hospitalization for COVID-19; and the interaction between having a chronic disease and taking medication.

Mental Health Symptoms – Mental health variables were obtained using the DSM-5 Level 1 Symptoms Scale, except for alcohol use, which used the question about weekly alcohol use (yes/ no). Thus, the dependent variable depression (yes/ no), and the independent variables substance use disorder (yes/ no), sleep disorder (yes/ no) and anxiety disorder (yes/ no) were investigated using the DSM-5.

The DSM-5 is an instrument developed by the American Psychiatric Association [APA],<sup>21</sup> which assesses mental health symptoms. This scale has also shown promise as a screening tool for research. The adult version contains 23 items with a response on a five-point scale (0=none; 1=rare, less than one or two days; 2=mild or several days; 3=moderate or more than half of the days; and 4=severe or nearly every day) to assess 13 psychiatric domains. The depression, medication use, sleep disorder and anxiety domains were selected for this study. For the substance use domain, scores are considered positive: very mild (1), mild (2), moderate (3) or severe (4) scores and only the score nothing (0) is considered negative. For depression, sleep disorders and

anxiety symptoms, the results of the DSM-5 domains when the scores are positive then the symptoms are considered mild, moderate or severe and when the scores are negative then there are no or very mild symptoms.

The presence of antibodies against SARS-CoV-2 was confirmed by chemoimmunofluorescence through biological samples that were collected at home and later cryopreserved at -20° to be transported to the Central Laboratory of Public Health of Mato Grosso (LACEN-MT), where laboratory tests were performed.

All analyzes were performed using Stata software version 16, mainly the “svy” module, which allows the addition of weighting factors and takes into account the complex design of the sample.

The depression variable was considered a dependent variable and all sociodemographic, health and mental health variables were considered independent variables. Initially, a descriptive analysis of the data was performed. Variables with *p* values lower than 0.20 were tested in the Poisson multiple regression model with robust variance in the bivariate analysis between the dependent and independent variables, considering the prevalence ratio adjusted by the method. The prevalence ratios (PR) and their respective 95% confidence intervals (95% CI) were calculated using the model mentioned above. Variables with *p*-values lower than 0.20 in the bivariate analysis were included in the multiple model and variables with *p*-values lower than 0.05 by the stepwise forward method remained in the final model.

## RESULTS

The sample was characterized by women of working age (18 to 49 years), who were ethnically non-white, with a low level of education, with a low family income (1 and 3 minimum wages), and a reduced income after the start of the pandemic but had not been experiencing food shortages at home in September/October 2020. The prevalence of anti-SARS-CoV-2 antibodies was estimated at 12.5% (95% CI: 10.5; 14.7), ranging from 7.4% to 24.3% among the municipalities, and the prevalence of depressive symptoms (DSM-5) was 23.2%.

In the bivariate analysis, depression was associated with being ethnically non-white, having a low-income pre-pandemic (< 1 minimum wage and between 1-3 minimum wages), and a reduction in family income during the pandemic (Table 1). As regards physical health, there was a positive association between increased body weight after the start of the pandemic, physical activity before and after the start of the pandemic, chronic disease, weekly use of alcohol, as well as with symptoms of substance abuse disorder, sleep disorder and anxiety disorders (DSM-5) (Table 2).

In Table 3, the associations with depression continued to be being male (PR=1.04, CI=1.01;1.07, *p*=0.017), with the family income before the pandemic being less than one minimum wage (PR=0, 92, CI=10.86;0.99, *p*=0.020), not taking physical exercise after the start of the pandemic (PR=1.16, CI=1.07;1.27, *p*<0.001), the interaction between

chronic disease/medication use (PR=1.08, CI=1.01;1.15,  $p=0.017$ ) was inversely associated with depression, with a 15% lower prevalence of depressive symptoms among those classified as having this disorder (Table 3).  
 $p=0.036$ ), sleep disorders (PR=1.41, CI=1.32; 1.50,  $p<0.001$ ) and anxiety disorders (PR=3.07, CI=2.57;3.66,  $p<0.001$ ). Substance use disorder (PR=0.95, CI=0.91;0.99,

Table 1. Depression and socioeconomic factors, physical and mental health during the COVID-19 pandemic in the population of the three main Brazilian biomes, according to sociodemographic and economic variables. Mato Grosso, Brazil, 2020 (N=4,203).

Variables	Depression		RP <sub>b</sub> **	IC (95%)**	p value
	No	Yes			
<b>Gender</b>					
Male	1146	330	1.03	(0.99; 1.08)	0.155
Female	2084	643	1.00	-	-
<b>Race/skin colour</b>					
No white	2233	601	1.07	(1.02; 1.12)	0.007*
White	997	372	1.00	-	-
<b>Schooling</b>					
Illiterate	149	46	0.99	(0.88; 1.10)	0.782
Elementary school	1150	388	0.98	(0.93; 1.04)	0.509
High school	1101	312	1.02	(0.93; 1.03)	0.416
Undergraduate and more	830	227	1.00	-	-
<b>Family income before the pandemic</b>					
< 1 minimum wage (MW)	318	281	0.62	(0.56; 0.68)	<0.001*
≤ 1 WM <3 WM	1747	455	0.94	(0.90; 0.97)	0.001*
>3 WM	1165	237	1.00	-	-
<b>Reduction in income during the pandemic</b>					
Yes	1814	477	1.08	(1.03; 1.12)	0.002*
No	1416	496	1.00	-	-
<b>Food insecurity</b>					
Yes	271	76	0.99	(0.91;1.07)	0.7451
No	2959	897	1.00	-	-

RP<sub>a</sub>: prevalence ratio estimated by the robust simple Poisson regression model. 95% CI: 95% confidence interval. \*\*: Prevalence and 95% confidence intervals (95% CI) estimated under sample weights.  $p$ :  $p$  value. \*: significant at the 5% level.

Table 2. Depression and socioeconomic aspects, health and mental health during the COVID-19 pandemic in the population of the three main Brazilian biomes, according to variable health aspects. Mato Grosso, Brazil, 2020 (N=4,203).

Variables	Depression		RP <sub>b</sub> **	IC (95%)**	p value
	No	Yes			
<b>HEALTH</b>					
<b>Body weight after the beginning of the pandemic</b>					
Yes, increased	1120	286	1.07	(1.02; 1.12)	0.004*
Yes, decreased	463	127	1.06	(0.99; 1.13)	0.054
No	1647	560	1.00	-	-
<b>Practice of physical exercises before the pandemic</b>					
No	2972	582	2.08	(1.85; 2.3454)	<0.001*
Yes	258	391	1.00	-	-
<b>Practice of physical exercises during the pandemic</b>					
No	2628	495	1.51	(0.62; 0.71)	<0.001*
Yes	602	478	1.00	-	-
<b>Presence of antibodies against SARS-CoV-2</b>					
Positive	447	132	1.00	(0.94; 1.06)	0.99
Negative	2783	841	1.00	-	-
<b>COVID-19 self-reported symptoms</b>					
Yes	245	68	1.01	(0.93; 1.09)	0.793
No	2985	905	1.00	-	-
<b>Hospitalization for COVID-19</b>					
Yes	18	6	1.05	(0.84; 1.32)	0.667
No	3212	967	1.00	-	-
<b>Interaction between having chronic illness and medication use</b>					
Yes	1316	337	1.07	(1.03; 1.12)	0.001*
No	1914	636	1.00	-	-
<b>MENTAL HEALTH SYMPTOMS</b>					
<b>Weekly alcohol use</b>					
Yes	688	152	1.10	(1.06; 1.15)	<0.001*
No	2542	821	1.00	-	-
<b>Substance use disorder</b>					
Yes	2384	840	0.86	(0.82; 0.89)	<0.001*
No	846	133	1.00	-	-
<b>Sleep disorder</b>					
Yes	3057	334	4.19	(3.56; 4.94)	<0.001*
No	173	639			-
<b>Anxiety disorder</b>					
Yes	2608	185	2.12	(1.97; 2.28)	<0.001*
No	622	788	1.00	-	-

RP<sub>a</sub>: prevalence ratio estimated by the robust simple Poisson regression model. 95% CI: 95% confidence interval. \*\*: Prevalence and 95% confidence intervals (95% CI) estimated under sample weights. *p*: *p* value. \*: significant at the 5% level.

**Table 3** - Final model of the multiple analysis between depression and socioeconomic factors, physical and mental health during the COVID-19 pandemic in the population of the three main Brazilian biomes, Mato Grosso, Brazil, 2020 (N= 4203).

Variables	Depression		RP <sub>b</sub> **	IC (95%)**	p value
	No	Yes			
<b>SOCIODEMOGRAPHIC</b>					
<b>Gender</b>					
Male	1146	330	1.04	(1.01; 1.07)	0.017*
Female	2084	643	1.00	-	-
<b>Family income before the pandemic</b>					
< 1 minimum wage (MW)	318	281	0.92	(0.86; 0.99)	0.020*
≤ 1 WM <3 WM	1747	455	0.98	(0.95; 1.02)	0.150
>3 WM	1165	237	1.00	-	-
<b>HEALTH</b>					
<b>Participating in physical exercises before the pandemic</b>					
No	2972	582	1.16	(1.07; 1.27)	<0.001*
Yes	258	391	1.00	-	-
<b>Interaction between having a chronic illness and medication use</b>					
Yes	989	276	1.08	(1.01; 1.15)	0.036*
No	2241	697	1.00	-	-
<b>MENTAL HEALTH SYMPTOMS</b>					
<b>Substance use disorder</b>					
Yes	2384	840	0.95	(0.91; 0.99)	0.017*
No	846	133	1.00	-	-
<b>Sleep disorder</b>					
Yes	2608	185	1.41	(1.32; 1.50)	<0.001*
No	622	788	1.00	-	-
<b>Anxiety disorder</b>					
Yes	3057	334	3.07	(2.57; 3.66)	<0.001*
No	173	639	-	-	-

Notes: RPa: prevalence ratio estimated by the robust simple Poisson regression model. 95% CI: 95% confidence interval. \*\*: Prevalence and 95% confidence intervals (95% CI) estimated under sample weights. p: p value. \*: significant at the 5% level.

## DISCUSSION

The main limitation of the present study is that its design does not allow causal conclusions between predictors and depression; however, it explores the relationship between the variables, with results consistent with those found in longitudinal studies. In addition, there was still the risk of interviewer bias and to minimize it, previous training of interviewers and field supervision were carried out. Memory bias and desirability bias related to mental health issues (responses to socially accepted standards) were potential factors for participants. To mitigate against these the interview was held in a discreet place, guaranteeing all the

necessary time, in addition to emphasizing the anonymity of their answers.

In the Brazilian biomes studied here, 23.2% of participants had depressive symptoms, similar to the average observed in other countries of 34.3%, ranging from 6.8% to 83.7%.<sup>22-27</sup> Among the associated factors were, being male, low income, not taking physical exercise before the pandemic and other components of mental health such as anxiety, sleep and substance use.

Importantly, depression was not associated with having anti-SARS-CoV-2 antibodies (evidence of past infection), even when there was a COVID-19 prevalence of 12.5%

in the population studied. This finding is based on the fact that the limitations imposed by social distancing increased loneliness, stress in relationships and disconnection in communities, regardless of viral infection.<sup>28</sup> In this light, the findings of Tsang and Avery<sup>29</sup> remain, which describe that the relationship between depression and COVID-19 was importantly mediated by fear of the disease.

Regarding gender, studies point to a higher risk among women,<sup>27,30</sup> with results highlighting a higher prevalence of depression.<sup>31,32</sup> However, contradicting these studies, in this study there was an association between depression and being male. Possibly, this is related to the fact that men have a worse clinical course and higher mortality from COVID-19,<sup>33,34</sup> or due to the behavior of men in maintaining healthy habits and lifestyles, thus tending to engage less in the search for care and prescribed treatments.<sup>35</sup> Another possibility lies in the sociogeographical aspect of this investigated region, which in the last pre-pandemic decade sustained high suicide rates among males, among all causes of death of this nature (ICD X60 to X84),<sup>36</sup> a circumstance that reflects among other aspects, the symptom and repercussions of depression, often not verbalized and/or treated by men, but which during the pandemic became familiar in this group, as manifesting depression in this period did not refer to the fragility so avoided by men at other times. Furthermore, it is important to note that in China, no association was found between gender and depression during the pandemic.<sup>37</sup>

Another relevant point is the complex relationship between race/ethnicity, mental disorders and depression. Previous and contemporaneous research carried out in the United States<sup>38,39</sup> and Brazil<sup>40,41</sup> showed an association between people of colour and depressive symptoms. It is known that there is no biological relationship that associates ethnicity and mental health,<sup>42</sup> however, belonging to socially and economically disadvantaged ethnic groups can trigger emotional overloads and reduce positive states of mood and well-being.<sup>43</sup>

The negative economic impact caused by the pandemic was exorbitant, yet the financial weaknesses had an even more aggressive impact on people's mental health.<sup>44</sup> The current research contributes to the knowledge about this relationship in a developing country such as Brazil. In the population studied, representing 10 municipalities in the state of Mato Grosso, an association was detected between depressive symptoms and having a low income and reduced family income during the pandemic. Similar to results in the North American countries, such as a Canadian study in which the loss of income occurred in 10.3% of those evaluated, with a 12% increase in the cases of depression<sup>45</sup> and American adults who lost their jobs after the start of the pandemic.<sup>46</sup> This financial strain and income disruption have also been reported among the risk factors for depression in Asia.<sup>27</sup>

Staying at home as a strategy to control viral spread in the first year of the pandemic was necessary. However, this strategy led to less physical activity, predisposing people to an increased risk of depression.<sup>47</sup> In the three Brazilian biomes studied, it was shown that not practising physical

activity before and after the beginning of the pandemic was statistically associated with depression. Dun *et al*<sup>48</sup> describe that prior physical fitness may be inversely associated with depression in adults during the pandemic.

An Australian study at the beginning of the pandemic described that the reduction in physical exercise and increased sedentary lifestyle had a direct impact on the mental health of the population,<sup>49</sup> with it being reported that reconciling healthy eating with physical activity is important to enhance the relief of depressive symptoms<sup>50</sup> and that improvement in these two behaviours were associated with low levels of depression in adolescents.<sup>51</sup> Thus, the increase in body weight after the pandemic is related to the risk for depression in our study, noting that people's attitudes towards food are important when maintaining healthy lifestyle habits. Weight gain in uninfected people may occur due to decreased physical exercise, changes in food purchase and consumption habits, greater stress when eating, economic stress and anxiety.<sup>52</sup>

The change in behaviour resulting from the challenges posed by the pandemic affected the global community, but for those with chronic diseases, there were additional aggravating factors, such as the suspension of routine monitoring health services, limiting access and weakening clinical management.<sup>2</sup> In our study, there was an association between having a chronic condition and depression during the pandemic, as also described in dialysis patients,<sup>53</sup> cancer patients,<sup>54</sup> diabetics, patients with hypertension, COPD and asthma,<sup>55,56</sup> as well as Parkinson's.<sup>57</sup>

The increase in negative emotions during the pandemic has been described as a motivating factor for alcohol consumption, including among those who were long-term abstainers.<sup>58,59</sup> The phenomenon has been managed differently across countries since in some there was a loosening of access<sup>60,61</sup> and in others, there was a temporary ban,<sup>62,63</sup> a fact recorded unevenly in Brazilian municipalities. A systematic review presented data on the change in alcohol consumption, highlighting the concern about the increase in alcohol consumption after the onset of the pandemic, and its association with depression and anxiety in most of the studies investigated.<sup>64</sup>

The consumption of alcohol during COVID-19 has been described differently in the world, with different findings concerning gender, age, skin colour/ethnicity and income, however, high rates of depression associated with increased use of alcohol stand out in Poland,<sup>65</sup> Canada,<sup>66</sup> the United States<sup>67</sup> and Australia.<sup>68</sup>

Substance use disorder is defined as a pattern of substance use of any kind, leading to clinically significant distress or impairment.<sup>21</sup> A study carried out in the United States showed that 13% of the population started or increased substance use after the beginning of the pandemic,<sup>67</sup> with a similar increase being detected in Canada,<sup>69</sup> while in Poland there was an increase in the consumption of recreational drugs, but in a lower percentage (1.4%).<sup>70</sup> In the present study, after adjusting for the other variables in the multiple models, there was a 15% lower prevalence of depression among those classified as having a substance use disorder. This result can be explained by the fact that this disorder is

related to depression, mainly in moments of abstinence and in chronic use, since initially use can minimize the effects of depression.<sup>71</sup>

Another relevant aspect associated with depression is sleep disorder; with pre-pandemic evidence, in both an international meta-analysis<sup>72</sup> and a Brazilian study,<sup>73</sup> showing the correlation between sleep disorders and depression. With the changes in lifestyle and the restrictions associated with the pandemic, sleep disorders have increased over time with rates reaching 48% of insomnia in the population.<sup>74</sup>

This complex relationship between sleep and depression is described in studies with the general population in Bangladesh,<sup>75</sup> Italy<sup>76</sup> and China,<sup>77</sup> as well as specific populations such as pregnant women<sup>78</sup> and health professionals.<sup>79</sup> It is also worth noting the negative emotional impact of the exacerbated use of online tools during the pandemic, due to the loneliness of the home office, online games, social media and internet shopping or the uninterrupted attack of *fake news*<sup>80</sup> may have contributed to the sleep disturbance.

The relationship between depression, sleep disorder and not practising physical activity is mostly permeated in a transversal way by anxiety. An alert issued by the World Health Organization in March 2022, suggested that countries pay attention to the impact of the pandemic on mental health and include more effective actions in their COVID-19 response plans, given the 25% increase in the prevalence of depression and anxiety.<sup>81</sup> The COVID-19 Mental Disorders Collaborators, however, consider that at the beginning of the pandemic there was a significant increase in depression and anxiety rates in response to the acute and emerging crisis, however, over time it softened, approaching pre-pandemic values.

Depression and anxiety were prominent before the pandemic, and constituted the most prevalent mental health disorders, demanding a great global effort to address them. It should be noted that the disorganization of mental health services and the fragility of resources pre-pandemic<sup>82</sup> were aggravated by the growing demand at the beginning of the pandemic, interruption of care in mental health services and personal limitations.<sup>83</sup>

Data points to an average anxiety prevalence rate of 38% in several international studies with Chinese,<sup>84</sup> Italian,<sup>25</sup> Indian<sup>85</sup> and Turkish<sup>86</sup> populations. Despite the high prevalence

of depressive and anxious symptoms, both are not necessarily recorded together, but a complex relationship can exist so that one triggers the mechanisms of the other and vice versa, as they result from the interaction of the same social, psychological and biological factors.<sup>87</sup> Thus, this association between depression and anxiety is complex and must be understood considering several factors.

## CONCLUSION

The high prevalence of depressive symptoms during the first year of the pandemic identified here refers highlights the reality for a significant proportion of the population during this difficult time, as well as socioeconomic conditions already present in everyday life before SARS-CoV-2. Multivariate analysis in this study demonstrates that depression is associated with being male, having a low income, having a sedentary lifestyle before the pandemic, chronic illness, substance use disorder, sleep and anxiety disorder (DSM-5).

The pandemic has created a greater urgency to strengthen mental health systems in most countries, so investigating the impact on the mental health of populations, especially depression and its associated factors, is fundamental in providing the acquisition of knowledge that directs assertive actions of interventions that should be implemented to cushion the negative effects of SARS-CoV-2 on mental health.

Research on depression must be continuous and comprehensive regarding associated factors to support the understanding of the duration, magnitude and severity of the pandemic's impact on the mental health of populations. Mitigation strategies must be recommended to incorporate ways to promote mental well-being, reduce the determinants of mental health and target appropriate interventions to treat those who develop a mental disorder.

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## Responsabilidades Éticas

**Conflitos de Interesse:** Os autores declaram a inexistência de conflitos de interesse na realização do presente trabalho.

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**Confidencialidade dos Dados:** Os autores declaram ter seguido os protocolos da sua instituição acerca da publicação dos dados de doentes.

**Proteção de Pessoas e Animais:** Os autores declaram que os procedimentos seguidos estavam de acordo com os regulamentos estabelecidos pela Comissão de Ética responsável e de acordo com a Declaração de Helsínquia revista em 2013 e da Associação Médica Mundial.

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**Confidentiality of Data:** The authors declare that they have followed the protocols of their work center on the publication of data from patients.

**Protection of Human and Animal Subjects:** The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki as revised in 2013).

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### Declaração de Contribuição

**ACPTT:** Concepção, delineamento, coleta de dados, interpretação dos dados, redação, revisão crítica e aprovação da versão.

**APM e ACSA:** Concepção, projeto, coleta de dados, interpretação dos dados, redação, revisão crítica e aprovação da versão.

**ECO:** Coleta de dados, redação, revisão crítica e aprovação da versão.

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**ACPTT:** Contributed to the conception, design, data collection, data interpretation, writing, critical review and approval of the final version.

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