



## Mental health of Brazilian adolescents during the COVID-19 pandemic



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### ABSTRACT

We aimed to assess the factors associated with frequent sadness and nervousness in Brazilian adolescents, during the Covid-19 pandemic, in 9470 adolescents (aged 12–17 years), interviewed from June 27 to September 17, 2020. Prevalences and prevalence ratios were estimated according to socio-demographic variables and factors related to family, school, friends, and health. Brazilian adolescents often felt sad (32.4%) and nervous (48.7%). Higher prevalences of these feelings were related to: being female; aged 15–17 year; from families with financial difficulties; having learned little or nothing with remote education; missing friends; having few friends; family disagreements; having regular/bad health before the pandemic; and worsened health and sleep during the pandemic. Higher prevalence of nervousness was also found in adolescents who worked before the pandemic and those who reported lack of concentration and not knowing if they had COVID-19. Sadness and nervousness in Brazilian adolescents is high and the need for action by the government, schools, health services, and parents to mitigate the impact of the pandemic on the physical and mental health of adolescents. Special attention must be paid to adolescents with previous health problems and those belonging to the most socially vulnerable population.

### 1. Introduction

The pandemic caused by the SARS-CoV-2 virus (COVID-19) has produced health and social contexts that represent unprecedented challenges in most countries. The occurrence of a new pandemic was considered to be predictable or even inevitable, which led researchers to make projections and assess the possible implications of a future pandemic. In 1999, Meltzer et al. (1999) estimated that an upcoming influenza pandemic in the United States could cause from 89 to 207

thousand deaths and 314 to 734 thousand hospitalizations. In January 2021, the current COVID-19 pandemic already accounted for 490 thousand deaths in that country, far exceeding the prediction of the authors (Johns Hopkins University, 2021).

The pandemic and the measures implemented to contain the spread of the virus have resulted in major challenges for the preservation of people's lives and health and heavy economic losses (Brooks et al., 2020; Roberts and Tehrani, 2020).

Among the aspects related to health, the first studies carried out in

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China already pointed out the impact of isolation, quarantine, and social distancing on the mental health of the population. Huang and Zhao (2020) found a prevalence of 35.1% of anxiety and 20.1% of depressive symptoms, especially higher in the province of Hubei. A study by Lei et al. (2020) showed that people in quarantine had higher prevalences of anxiety and depression (8.3% and 14.6%) compared to those not affected by the measure (6.7% and 11.9%). In Brazil, a research developed with a sample of 45,161 Brazilian adults showed that 40.4% often felt sad/depressed, and an even higher percentage, 52.6%, reported feeling frequently anxious/nervous. The study found that the prevalence of these reports was higher in younger adults (Barros et al., 2020), as also found in other research (Gómez-Salgado et al., 2020; Huang and Zhao, 2020).

Some authors draw attention to the fact that, unlike other disasters, with which it shares several aspects in common, the pandemic discourages the congregation of people, and congregation in disaster situations tends to serve as prolonged support to those affected and their families (Sprang and Silman, 2013). The incidence of Post-Traumatic Stress that followed the SARS pandemic in Canada showed a similar prevalence (28.9%) to that observed in natural disasters and acts of terrorism (Hawryluck et al., 2004). The pandemic, by promoting isolation and separation, inhibits family practices (religious, cultural, leisure, among others) that usually regulate and protect the functioning of the family unit in times of crisis and would help preserve resilience and mental health (Sprang and Silman, 2013).

In this Covid-19 pandemic, billions of children and adolescents were left out of school or daycare, without access to group activities, team sports, or leisure facilities (Cluver et al., 2020). G. Wang et al. (2020b) consider that one of the perhaps most overlooked issues during the pandemic is the psychological impact it has on children and adolescents. The challenges and stressors present in the pandemic, such as the prolonged duration of social withdrawal; fear of infection; frustration and boredom; lack of adequate information; lack of personal contact with teachers, colleagues, and friends; lack of adequate space in the home; and challenges in remote education, can have more marked and lasting effects on adolescents and children, who are also greatly affected by the emotional stress, anxiety, and depression of their parents and family (Brooks et al., 2020; Wagner, 2020; G. Wang et al., 2020b). A recent review on the topic recognizes that mental health is an issue of great relevance in the pandemic scenario, and that children and adolescents form a particularly vulnerable subgroup (Miranda et al., 2020).

Understanding the factors associated with the mental health of adolescents during the period of social isolation due to the COVID-19 pandemic is essential for formulating possible intervention strategies. Recognizing the importance of this knowledge and the existing gaps, this study aimed to assess the prevalence, during the pandemic, of feelings of sadness and nervousness in Brazilian adolescents, and to identify the most vulnerable segments.

## 2. Methods

The data analyzed in this study comes from the research “ConVid - Adolescentes – ConVid-Behavior Survey”, developed by the Oswaldo Cruz Foundation (Fiocruz) in partnership with researchers from the Federal University of Minas Gerais (UFMG) and University of Campinas (UNICAMP). The research, which aimed to assess the changes that occurred in the lives of Brazilian adolescents after the arrival of the new coronavirus pandemic in Brazil, was carried out using a virtual questionnaire. Changes in routine activities, lifestyles, relationships with family and friends, school activities, health care, and the mood of young people aged between 12 and 17 were investigated. The questionnaire was prepared using the RedCap (Research Electronic Data Capture) application and self-completed by the adolescent online, using a smartphone or computer with internet access. The information were collected directly over the internet and stored on the server of the Institute of Communication and Scientific and Technological Information in Health of the Oswaldo Cruz Foundation (ICICT/FIOCRUZ).

To obtain a chain sampling, the project participants chose researchers from different Brazilian states to start the process. They sent the survey link to parents of adolescents, who, after accepting the participation of their child(ren), invited other parents by social networks, making up the recruitment chain. In addition, the research coordination team contacted public and private schools, and state and municipal education secretariats, by institutional email. The institutions that joined the survey sent the electronic questionnaires to their students.

For the adolescent to answer the questionnaire, first one of the parents, or some responsible adult, needed to accept the Informed Consent Form and, then, the adolescent would also need to accept the Informed Assent Form. All responses were anonymous and without any other type of identification of the participants. The research was approved by the National Research Ethics Committee (Opinion no.: 4.100.515).

The dependent variables analyzed in this study were the frequency of feeling sad and feeling nervous/irritated. These variables were originated from the questions: “In the period of social distancing, how often did you feel sad?” and “In the period of social distancing, how often did you feel irritated, nervous, or moody?“, both with the alternatives “never,” “rarely,” and “sometimes” – grouped into the “no” category – and the alternatives “most of the time” and “always” – grouped into the “yes” category.

For the analysis of associated factors, some sets of variables were included:

Sociodemographic variables: sex (male, female); age (12–15; 16–17 years old); if they worked (yes, no); if the family had financial difficulties before the pandemic (yes, no); and if it had financial difficulties during the pandemic (yes, no).

Variables related to school activities: difficulties in following remote classes due to: lack of concentration (yes, no); lack of interaction with the teacher (yes, no); not having a proper place at home (yes, no); degree of understanding of what was being taught remotely (almost everything/everything, nothing, a little).

Variables related to family and friends: disagreement with family members (yes, no); what do you miss the most: friends (yes, no) and boyfriend/girlfriend (yes, no); number of close friends (0; 1–2; 3 or more).

Type of isolation during the pandemic, obtained by the question: “During the pandemic, to what extent did you (or are you still doing) restrict contact with people?” with the alternatives: “I didn’t do anything, I led a normal life”; “I just stopped going to school, but went on normally with other activities”; and “I tried to take care, stay away from people, reduce contact with friends, not visit the elderly, but I kept going out,” grouped into the category “none or little”; “I stayed at home most of the days going out to close family members, shopping at supermarkets and drug stores,” which constituted the category “went out a little”; and “I stayed strictly at home, leaving only because of the need for health care,” categorized as “strict”.

Health situation in the pandemic: if the adolescent had COVID-19 (yes, no, and does not know); if a family member or close friend had COVID-19 (yes, no, and does not know); self-assessed health, categorized as bad (including the bad and terrible alternatives) and good or not bad (including excellent, good, and regular); worsening of health status during the pandemic, with the categories: yes (which included the answers “it got a little worse” and “it got a lot worse”) and no (which included “it was the same” and “it improved”); worsening of sleep quality, with the categories “yes” (which grouped the affirmative responses to the alternatives: “with the pandemic, I started having sleep problems” and “I already had sleep problems and they got a lot worse”) and “no” (when the responses to these statements were negative).

### 2.1. Data analysis

Post-stratification procedures were used to obtain the same distribution of adolescents by region of residence, sex, age groups (12–15; 16–17 years), and types of school (public/private), using data from the National Survey of School Health (PeNSE, 2015) of the Brazilian Institute

of Geography and Statistics (IBGE), carried out in partnership with the Ministry of Health. Crude and adjusted prevalences and prevalence ratios were estimated using Poisson regressions, adopting a significance level of 1%. Two-stage hierarchical models were developed for frequent sadness and nervousness, including, in the first stage, demographic and socio-economic variables that presented  $p < 0.01$  in previous analyses. The first stage contained the variables that showed a significant association, with  $p < 0.01$ . The second stage included the variables that were significant in the first stage, aggregating variables related to school activities, family, friends, and health; variables that presented 5% significance level remained in the second stage.

### 3. Results

The results are related to the sample of 9470 adolescents aged between 12 and 17 years old who took part in the survey from June 27 to September 17, 2020. In the weighted sample, 50.2% (95%CI: 48.6–51.9) are female, 67.7% (95%CI: 66.3–69.1) is between 12 and 15 years old, and 32.3% (95%CI: 30.9–33.7) is between 16 and 17 years old.

Among Brazilian adolescents in the surveyed period, 32.4% (95%CI: 30.9–33.9) were always or often sad and 48.7% (95%CI: 47.1–50.4) were always or often nervous/irritated/moody. The prevalence of sadness and frequent nervousness were higher in females, in those aged 16 to 17, in those who had financial difficulties before the pandemic, and in those who presented this type of difficulty during the pandemic (Table 1).

Higher prevalences of sadness and nervousness were associated with: lack of concentration; lack of interaction with the teacher; not having a proper place at home to attend classes; the perception that they learned little or nothing with remote education; lack of friends or boyfriend/girlfriend; not having or having less than three close friends; and the occurrence of disagreements with family members (Table 2). In addition, having had COVID-19 or not knowing, having a close family member/friend with COVID-19 or not knowing if they had, perceived regular or poor health, and worsening health and sleep during the pandemic also increased the likelihood of frequent feelings of sadness and nervousness. There was also an association between the frequency of these feelings and the degree of isolation (Table 3).

Tables 4 and 5 show that, among the demographic and socioeconomic variables analyzed, sex, age, and reports of financial difficulties during the pandemic persist in the models significantly associated with both frequent sadness and nervousness. In addition to these, having financial difficulties before the pandemic was associated with frequent sadness, and having work activity before the pandemic was associated with

**Table 1**  
Prevalence of frequent feelings of sadness and nervousness during the COVID-19 pandemic in adolescents, according to social and demographic variables.

Variables	Sad			Nervous		
	n	%	p	n	%	P
Total	9430	32.4		9427	48.7	
Sex			0.000			0.000
Male	3098	20.6		3093	35.6	
Female	6332	44.0		6334	61.6	
Age			0.000			0.000
12 to 15	5154	29.5		5154	45.5	
16 to 17	4276	38.2		4273	55.4	
Worked (before)			0.070			0.069
Yes	1512	29.5		1513	52.2	
No	7892	32.9		7888	48.2	
Financial difficulty before the pandemic			0.000			0.000
Yes	1968	38.4		1968	52.5	
No	5687	28.1		5685	45.5	
Financial difficulty in the pandemic			0.000			0.000
Yes	3105	37.2		3106	52.0	
No	4465	26.8		4464	43.4	

**Table 2**  
Prevalence of feeling always or often sad and always or often nervous/irritated in the COVID-19 pandemic, according to the situation at school, difficulties, and social network.

Variables	Sad			Nervous		
	n	%	p	n	%	p
<b>Difficulties in following the classes by:</b>						
Lack of concentration			0.000			0.000
Yes	6280	37.9		6278	58.0	
No	3150	24.3		3149	35.4	
Lack of interaction with the teacher			0.000			0.000
Yes	4016	37.6		4018	53.7	
No	5414	29.1		5409	45.5	
Lack of proper place at home			0.000			0.000
Yes	2000	39.6		2001	59.1	
No	7430	30.3		7426	45.7	
Understood what was taught:			0.000			0.000
Nothing/a little	5633	39.5		5631	56.9	
Almost everything/everything	3024	17.6		3024	34.8	
<b>What do you miss the most:</b>						
Friends			0.000			0.000
Yes	7492	35.0		7492	51.9	
No	1938	23.7		1935	38.1	
Boyfriend/girlfriend			0.000			0.000
Yes	1206	44.0		1206	60.0	
No	8224	30.7		8221	47.1	
Number of friends			0.000			0.001
0	999	38.1		999	53.6	
1–2	3063	36.9		3062	51.6	
3 or +	5354	28.6		5352	46.1	
Difficulty in routine due to disagreement with family members			0.000			0.000
Yes	3414	52.5		3415	71.6	
No	6016	23.1		6012	38.1	

**Table 3**  
Prevalence of feeling always or often sad and nervous/irritated in the pandemic according to the occurrence of COVID-19 and health status.

Variables	Sad			Nervous		
	n	%	p	n	%	p
Social distancing followed			0.000			0.000
Nothing/a little	2409	26.7		2406	44.7	
Went out a little	4749	36.6		4752	52.7	
Strict	2255	31.1		2252	46.0	
Had COVID-19			0.000			0.000
No	6987	29.5		6983	44.9	
Yes	351	40.3		351	61.2	
Does not know	2084	41.7		2085	60.4	
Family member or close friend had COVID-19			0.000			0.000
No	4123	26.9		4121	42.6	
Yes	4029	37.6		4029	54.3	
Does not know	1270	33.3		1269	50.4	
Self-assessed health			0.000			0.000
Excellent/good	7142	26.0		7141	42.5	
Regular/bad	2281	54.2		2279	70.2	
Worsened health			0.000			0.000
No	6284	23.5		6281	41.3	
Yes	3128	53.0		3128	65.8	
Worsened sleep			0.000			0.000
No	5740	22.5		5736	38.6	
Yes	3668	50.9		3669	66.9	

frequent nervousness. Regarding variables related to school activities, family, and health, the following remain significantly associated with the two outcomes analyzed: not understanding or understanding little of what was taught remotely; missing friends; having few or no close friends; occurrence of disagreements in the family; having regular/bad health; and worsened health and sleep during the pandemic. In addition

**Table 4**  
Regression models for reporting frequent sadness.

Variables	1st stage		2nd stage	
	Prevalence ratios and 95% CI	p	Prevalence ratios and 95% CI	p
Sex				
Male	1		1	
Female	<b>2.13</b> (1.86–2.44)	<0.001	<b>1.82</b> (1.57–2.10)	<0.001
Age range				
12 to 15	1		1	
16 to 17	<b>1.28</b> (1.16–1.42)	<0.001	1.02 (0.92–1.13)	0.714
Financial difficulty before the pandemic	<b>1.22</b> (1.05–1.41)	0.008	1.09 (0.95–1.25)	0.229
Financial difficulty during the pandemic	<b>1.21</b> (1.04–1.40)	0.012	1.01 (0.88–1.16)	0.895
Understood the remote classes				
Almost everything/ everything			1	
Nothing/a little			<b>1.53</b> (1.31–1.78)	<0.001
Misses friends			<b>1.29</b> (1.11–1.50)	0.001
Number of friends				
None			<b>1.34</b> (1.15–1.57)	<0.001
1 or 2			<b>1.14</b> (1.02–1.29)	<b>0.029</b>
3 or +			1	
Disagreements in family			<b>1.60</b> (1.43–1.78)	<0.001
Regular to poor health (before the pandemic)			<b>1.19</b> (1.07–1.32)	<b>0.001</b>
Worsened health in the pandemic			<b>1.45</b> (1.29–1.62)	<0.001
Worsened sleep in the pandemic			<b>1.66</b> (1.47–1.87)	<0.001

to these variables, lack of concentration and not knowing if they had COVID-19 were associated with frequent nervousness (Table 5).

**4. Discussion**

The results of the study showed that a high percentage of Brazilian adolescents reported feeling frequently sad (32.3%) and nervous (48.7%) during the pandemic, and that female adolescents aged 16 and 17 were those most affected by these feelings. Frequent sadness and nervousness had several associated factors in common related to socioeconomic and health conditions and problems with remote learning.

The finding of a much higher prevalence of frequent feelings of sadness and nervousness in Brazilian female adolescents converges with the results of studies that have investigated the impact of COVID-19 on the mental health of adults (Barros et al., 2020; Gómez-Salgado et al., 2020; Mazza et al., 2020) and also in the mental health of adolescents and students (Qin et al., 2021; C. Wang et al., 2020a; Wathélet et al., 2020). A recent systematic review, however, points to discordant results in the differences between the sexes between studies evaluating children and adolescents (Miranda et al., 2020).

The higher presence of sadness and nervousness in Brazilian adolescents aged 16–17 years, compared to the younger ones, finds similar results in several studies that show a greater presence of depression, anxiety, and somatic symptoms in older adolescents compared to younger ones and children (Miranda et al., 2020; Qin et al., 2021; C. Wang et al., 2020a). The closure of schools indefinitely and the uncertainties concerning the potential negative impact on academic

**Table 5**  
Regression models for reporting frequent nervousness/irritation.

Variables	1st stage		2nd stage	
	Prevalence ratios and 95% CI	p	Prevalence ratios and 95% CI	p
Sex				
Male	1		1	
Female	<b>1.75</b> (1.60–1.91)	<0.001	<b>1.53</b> (1.40–1.67)	<0.001
Age range				
12 to 15	1		1	
16 to 17	<b>1.21</b> (1.13–1.30)	<0.001	1.02 (0.96–1.09)	0.538
Work before the pandemic	<b>1.16</b> (1.08–1.25)	<0.001	<b>1.12</b> (1.02–1.23)	<b>0.014</b>
Financial difficulty during the pandemic	<b>1.18</b> (1.08–1.30)	<0.001	1.01 (0.94–1.09)	0.725
Lack of concentration			<b>1.43</b> (1.27–1.62)	<0.001
Understood the remote classes				
Almost everything/ everything			1	
Nothing/a little			<b>1.19</b> (1.09–1.31)	<0.001
Misses friends			<b>1.22</b> (1.09–1.36)	<0.001
Number of friends				
None			<b>1.19</b> (1.04–1.36)	<b>0.013</b>
1 or 2			<b>1.08</b> (1.00–1.16)	<b>0.041</b>
3 or +			1	
Disagreements in family			<b>1.35</b> (1.26–1.44)	<0.001
Had COVID-19				
No			1	
Yes			1.13 (0.97–1.33)	0.126
Does not know			<b>1.09</b> (1.01–1.17)	<b>0.025</b>
Regular to poor health (before the pandemic)			<b>1.16</b> (1.08–1.24)	<0.001
Worsened health in the pandemic			<b>1.16</b> (1.07–1.25)	<0.001
Worsened sleep in the pandemic			<b>1.28</b> (1.19–1.38)	<0.001

progression should affect more strongly the 16 and 17-year olds who are in a period closer to the definition of study options and professional careers.

The presence of financial difficulties during the pandemic was significantly associated with frequent nervousness and sadness, and the financial difficulty before the pandemic also persists associated with the frequent sadness of adolescents. Insufficient financial conditions affect all living conditions, from the availability of the resources necessary for survival to housing conditions and the possibility of adapting to new forms of work and remote learning. Loss of employment and reduction of work resulting from the pandemic and control measures further aggravate the problems of insufficient resources and the financial insecurity of the most socially vulnerable segments. A literature review on the impact of quarantine on previous epidemics and pandemics pointed to the vulnerable situation to which the lower income strata and families suffering loss of income caused by the health situation are exposed, indicating the need for assistance and financial reimbursement policies (Brooks et al., 2020). In the COVID-19 pandemic, a study conducted in China with more than one million children and adolescents revealed a significantly higher risk of psychological distress in those belonging to the lower socioeconomic strata (Qin et al., 2021). A recent systematic review

confirms the greater risk of the impact of the COVID-19 pandemic on the mental health of adolescents and children in the worst socioeconomic conditions (Miranda et al., 2020), highlighting the need for interventions focused on these strata, as well as income transfer policies. The impact of socioeconomic inequalities became even more evident with the advent of the COVID-19 pandemic, and tends to be stronger in countries with a high concentration of income such as Brazil (Oxfam Brasil, 2021).

The finding of a higher prevalence of frequent sadness and nervousness in Brazilian adolescents who reported the occurrence of family disagreements refers to the impact that the pandemic and social isolation have on family dynamics. Pandemic situations and social distancing prevent certain family rituals, which normally regulate interactions between members and help to protect the family unit in times of crisis (Sprang and Silman, 2013). Authors describe children and adolescents as attentive to changes in mood, to the presence of agony, fear, anxiety, and concern in their parents and in the people around them (Liu, 2020). In the pandemic, family dynamics are strongly affected by rising unemployment rates and a shortage of means of support (Saxena and Saxena, 2020).

Studies show that unemployment and prolonged confinement increase the risk of abuse, child abuse, increased alcohol consumption, and family disagreements (G. Wang et al., 2020b). The pandemic is then a challenge for the stability of the family and a factor of psychosocial adversity for the children (Palacio-Ortiz et al., 2020). A previous study on the impact of adverse childhood experiences on mental health identified economic difficulties, family disagreements, parents' illnesses, and alcohol consumption as the most frequent, and that the presence of two of these factors increases four times the probability of mental disorder (Biederman et al., 2002). These adverse situations tend to worsen in periods of crisis and have been reported in the COVID-19 pandemic. Worsening adult health and increased alcohol consumption during the pandemic have also been reported in Brazilian studies (Malta et al., 2020; Szwarcwald et al., 2021). Adult depression and anxiety are potential adversity factors for children and adolescents (Saxena and Saxena, 2020). Data from a Brazilian study point to a high level of depression and anxiety during the pandemic in adults, and especially in women and young adults (Barros et al., 2020), a situation with the potential to affect the level of stress of children and adolescents in the family nucleus.

In Brazilian adolescents, having health self-assessed as regular or bad before the pandemic or having worsened health during the pandemic are conditions associated with frequent nervousness and sadness. Research carried out in adults has already reported the presence of a previous health problem inducing greater damage to mental health during the COVID-19 pandemic (Mazza et al., 2020; Ping et al., 2020; Stanton et al., 2020). In Canada, a research that included individuals aged 15 years or older found a higher prevalence of a worse level of mental health in those who had a previous health problem (Findlay et al., 2020). A recent systematic review confirmed that, in children and adolescents, the presence of pre-existing health problems and chronic diseases are associated with a higher level of stress, anxiety, depression, and post-traumatic symptoms (Miranda et al., 2020).

The presence of health problems can increase the anxiety of patients because of the well-known and reported higher lethality of COVID-19 in people with chronic diseases, and also because health problems imply a greater demand for health services that, in an epidemic period, are more restricted and provide a greater risk of contamination. If the compromised health was due to previous mental illness, the effect is more severe, as reported by reviews on the topic (Brooks et al., 2020; Miranda et al., 2020). A Brazilian survey found much higher prevalences of sadness (PR=1.87) and nervousness/anxiety (PR=2.26) during the pandemic in adults with a previous diagnosis of depression (Barros et al., 2020).

In this study, worsened sleep during the pandemic was associated with an increased prevalence of frequent nervousness and sadness. Poor sleep quality has also been part of the harm caused by the pandemic and is associated with mental health. A meta-analysis of longitudinal studies confirms insomnia as a risk factor for depression (Baglioni et al., 2011),

and another study identified the bidirectional relationship between sleep and optimism (Lau et al., 2015). A research carried out with adults in Spain during the COVID-19 pandemic found worse quality of sleep was associated with psychological distress and feelings of loneliness (Losada-Baltar et al., 2020). A research carried out in Brazil also reported that Brazilian adults with a previous diagnosis of depression were at higher risk of having a sleep problem or of worsening their sleep problem compared to those without a diagnosis (Barros et al., 2020).

In Brazilian adolescents, not knowing whether they had COVID-19 was associated with a higher prevalence of frequent nervousness, but not with sadness. Other studies point to the psychological impact of fear of infection and of presenting symptoms potentially related to the disease (Wathelet et al., 2020). This fear concerns one's own health, but also of infecting family and friends (Brooks et al., 2020). Presenting symptoms of COVID-19 and having close contact with an individual with the disease proved was associated with a high level of psychological distress in a research carried out in Spain (Gómez-Salgado et al., 2020). In Italy, having an infected relative was associated with a high level of depression and stress (Mazza et al., 2020). Presenting symptoms and not knowing whether or not you have the disease generates a condition of uncertainty that promotes anxiety. A review on the topic shows that the concern to experience physical symptoms potentially related to the infection and the fear of having the infection result in psychological stress that can persist until several months later (Brooks et al., 2020).

The concern over the impact of pandemics on health care for children and adolescents is a topic that has been discussed in light of the prospect of a likely new pandemic. As early as 2005, Woods and Abramson (2005) asked whether we would be prepared to care for children in the next influenza pandemic. Children and adolescents were also expected to be hit more severely based on what happened in the H1N1 pandemic (Sprang and Silman, 2013); however, this did not happen with SARS-CoV-2, which has higher lethality in the elderly. In children and adolescents in China, it was observed that about 90% of those infected have mild or moderate symptoms, 4.2% are asymptomatic, and 5.8% have more severe symptoms (Dong et al., 2020). Although susceptible to SARS-CoV-2 infection, children and adolescents have a low rate of hospitalization by the disease (2.5–4.1%) and the need for intensive care is more rare (Nehab and Menezes, 2020). In spite of this, the pandemic has caused suffering for adolescents – in this study detected by high rates of sadness and nervousness –, which, in part, are also caused by the presence of symptoms without confirmation of the diagnosis.

The closure of schools and remote learning made the pandemic a challenging situation for adolescents and children and for parents and teachers. Reports of difficulty concentrating and having learned nothing or very little with remote learning were associated, in this study, with frequent sadness and nervousness in Brazilian adolescents. With the closure of schools, the lack of access to education, and sometimes to food, the lack of contact with colleagues and teachers, the inability to carry out sports activities are, among other consequences, potential factors of adversity for children and adolescents (Saxena and Saxena, 2020). The difficulty of concentration and the perception that learning is not being adequate affects students and teachers alike. The need to learn to deal with new teaching/learning techniques generates anxiety, as does the perception of low performance (Liu, 2020).

The perception of low personal effectiveness and the disbelief in their own abilities to obtain good results in the new study conditions are correlated with the anxiety generated by COVID-19. High effectiveness would be a protective factor against the anxiety produced in the pandemic (Petzold et al., 2020). A study developed in Spain with adults also showed a more prevalent psychological distress in individuals with a worse perception of their own effectiveness (Losada-Baltar et al., 2020).

The responsibility of the education sector is enormous, since the difficulties that remote education imposes are important sources of sadness and anxiety for children and adolescents. Students from lower-income strata are less likely to access remote learning programs and tend to be even more disadvantaged. In Latin America and the Caribbean,

only 30% of children from poor families have access to a computer, compared to 95% of children from wealthy families (Oxfam Brasil, 2021).

Living and housing conditions, space at home, internet access, and deprivation of basic resources must be considered by educational institutions, which need to adopt support measures and seek solutions to mitigate the severity of the impact. Also during the pandemic, the habits of adolescents tend to worsen, which usually happens during vacation, and which is much more aggravated by the condition of social isolation and restriction at home (G. Wang et al., 2020b). In this sense, authors suggest that schools should help to stimulate physical activity, a healthy diet, and various types of activities such as gardening, helping with housework, and doing art and craft activities, among others, to try to minimize the impact of the pandemic (Saxena and Saxena, 2020; G. Wang et al., 2020b).

Adolescents and young adults live a transition period in which the development process is based on affective investments in social relationships beyond the family (Parola et al., 2020), which implies a greater challenge for this age group before the social isolation imposed by the pandemic. In this context, we understood the association, in this study, between the situation of having few friends and of missing those friends and a higher prevalence of sadness. In this scenario, family life and virtual contact with teachers, colleagues, and friends play a fundamental role in reducing the risk of social isolation with immediate psychological consequences and future risks still undefined.

The high presence of sadness and nervousness in Brazilian adolescents in the context of the COVID-19 pandemic poses crucial questions and challenges for the government, schools, health services, and parents. It is necessary that all bodies pay special attention to the physical and mental health of adolescents, making social isolation as tolerable as possible. The results of this study, in line with the findings of other studies, identify the segment of adolescents in the stratum with financial difficulties as the most affected. To face this unusual health context, the government needs to provide a national organization scientifically oriented towards the effective control of the pandemic and the consequences generated by it, and provide financial aid to ensure the subsistence of disadvantaged social groups. These initiatives need to consider that Brazil has the highest concentration of income in the world when considering the richest 1% of the population, and that the pandemic has shown more strongly the effects of the increasing concentration of income in the world and the widening of social inequalities (Oxfam Brasil, 2021). One must minimize the effects of the pandemic, especially poverty, food insecurity, and the risks of domestic violence (Miranda et al., 2020).

The performance of the educational sector can play a decisive role in the context of social isolation, with actions that manage to minimize the harm to the mental and physical health of adolescents. The adequacy and quality of online education; monitoring the perception of teachers and students about the effective understanding of the contents taught; initiatives aimed at promoting or preserving a healthy lifestyle, encouraging physical activity, balanced diet, regular sleep pattern, and correct hygiene practices to avoid contamination; creative teaching activities that promote virtual interaction with teachers and colleagues; and correct scientifically based information on issues related to the pandemic are some of the many actions that schools can provide to reduce the impact of the pandemic on the physical and mental health of adolescents and to avoid consequences that may ensue (Brooks et al., 2020; Miranda et al., 2020; G. Wang et al., 2020b).

Health services, overburdened with care for serious cases of the disease, also need to organize the provision of mental health care to those who need it, in addition to seeking to promote actions that also focus on the mental health of children and adolescents.

Social distancing with confinement of adolescents at home can increase the occurrence of situations of disagreement and aggression, especially in poorer families who live in precarious homes without conditions to adapt adequately to remote learning and the home office

situation (Miranda et al., 2020). However, depending on the conditions of the families, social distancing may also offer a good opportunity for improving the interaction between parents and children, for involving children and adolescents in family activities, and for improving their skills and self-sufficiency. Support and dialogue between family members is considered an essential factor to increase cohesion and minimize sadness and loneliness (G. Wang et al., 2020b).

The analysis of the results of this study needs to consider some limitations. Among them, we highlight that we use just one question to evaluate the perception of adolescents about the frequency of their feeling of sadness and another question to evaluate the frequency of nervousness and that those questions were not submitted to a previous validation study. Even though there are several validated scales to measure humor, depression, anxiety, hopelessness, and other feelings, the central focus of the research was on behavior changes and, besides that, the condition to have a not long questionnaire to be applied by internet, restrict the evaluation of anxiety and sadness to just one question each. However, the results obtained in this study, with these two questions, reveal a consistent and expected pattern of associations. Another important limitation of this study is the use of a virtual questionnaire what tends to exclude individuals without access to the internet and electronic devices. To reduce this selection bias, post-stratification weights were used. The snowball sample design, without definition of the recruiter-recruited pairs, tends to select similar individuals, and may have conglomeration effects (siblings, relatives, students from the same school) not considered in the analysis. In the analyses of this study, a significance level of 0.01 ( $p < 0.01$ ) was used for the insertion of variables in the final models to take into account the sample size and the non-consideration of the possible intraclass variance.

## 5. Conclusion

The results of this study show high rates of feelings of sadness and nervousness/irritability in an expressive sample of Brazilian adolescents. The presence of these feelings was associated with being female and with economic, social, school, family, and health difficulties. The determinants of these feelings include the family's financial situation, which refers to the pressing need for financial assistance, especially in a country such as Brazil, which ranks among those with the highest income concentration in the world.

The breadth of the areas associated with the indicators of suffering in adolescents points to the need for intersectoral actions involving financial, educational, physical, and mental health support measures, aiming to reduce the impact described and the potential harm in the medium and long run. Special attention should be paid to adolescents who already have health problems and those whose health has deteriorated in the pandemic. Fundamental actions by the education sector are urgent to seek to reduce the impact of the pandemic and the post-pandemic, with priority for the most socially vulnerable segments of the population.

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### Author contributions

Barros MBA contributed to the conception and design of the study, analysis and interpretation of the data, writing and relevant critical

review of the intellectual content and final approval of the manuscript, and assumes their responsibility for all aspects of the work, including ensuring their accuracy and integrity. Lima MG and Fehlberg BK contributed to analysis and interpretation of the data, writing and relevant critical review of the intellectual content and final approval of the manuscript. Malta DC, Szwarcwald CL, Azevedo RCS, Romero D, Da Silva DRP, Werneck AO, De Souza Jr PRB, Azevedo LO, Machado IE, Damacena GN, Gomes CS, Gracie R and Pina MF contributed to the writing and relevant critical review of the intellectual content of the manuscript and approval of its final version. All authors are responsible for all aspects of the work, including ensuring its accuracy and integrity.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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