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What changed after two years of COVID-19: the PAMPA Cohort update profile and methodology

O que mudou após dois anos de COVID-19: atualização da metodologia e do perfil da Coorte PAMPA

Qué ha cambiado tras dos años de COVID-19: actualización de la metodología y perfil de Cohorte de PAMPA

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Resumo *O estudo PAMPA foi desenhado para avaliar os impactos de longo prazo da pandemia de COVID-19 na saúde física e mental de adultos. Apresentamos dados da quarta onda da Coorte PAMPA, o perfil atualizado da coorte e a metodologia. A Coorte PAMPA é um estudo prospectivo inicialmente desenhado para ter três ondas (junho de 2020, dezembro de 2020 e junho de 2021). Com a progressão da pandemia, foram programadas três novas ondas: 2022, 2023 e 2024. Os participantes responderam sobre atividade física, saúde mental, dor lombar, acesso à saúde e COVID-19, entre outros aspectos. No geral, 2.691 participantes responderam à onda quatro. Os níveis de atividade física aumentaram e os sintomas de ansiedade e depressão diminuíram em comparação com a primeira avaliação. No entanto, foi observada uma elevada proporção de doenças crônicas e um terço dos participantes vivenciava algum grau de insegurança alimentar. Além disso, três quartos foram classificados como tendo COVID longa. Os efeitos indiretos da pandemia na saúde física e mental persistem na vida dos indivíduos.*
Palavras-chave *COVID-19, Exercício, Dor lombar, Saúde mental, Doenças crônicas*

Abstract *The PAMPA Cohort aimed to evaluate the long-term impact of the COVID-19 pandemic on the physical and mental health outcomes of adults. We present data from the fourth wave of the PAMPA Cohort, the updated cohort profile and methodology. The PAMPA Cohort is a prospective study initially designed to have three data collection waves (June 2020, December 2020, and June 2021). With the pandemic progression, three new waves were programmed in addition to the previous waves: 2022. 2023, and 2024. Participants answered about physical activity, mental health, low back pain, healthcare access, and COVID-19, among others. Overall, 2,691 participants answered the wave four. Physical activity levels increased, and symptoms of anxiety and depression were reduced compared to the first assessment. However, a high proportion of chronic diseases was observed, and one-third of participants experienced some degree of food insecurity. Additionally, three-quarters were classified as having long COVID. The indirect effects of the pandemic on both physical and mental health persist in the lives of individuals.*
Key words *COVID-19, Exercise, Low back pain, Mental health, Chronic diseases*

Resumen *El estudio PAMPA fue diseñado para evaluar los impactos a largo plazo de la pandemia de COVID-19 en la salud física y mental de los adultos. Presentamos datos de la cuarta ola de la cohorte PAMPA, el perfil de cohorte actualizado y la metodología. La cohorte PAMPA es un estudio prospectivo diseñado inicialmente para tener tres olas (junio de 2020, diciembre de 2020 y junio de 2021). A medida que avanza la pandemia, se han programado tres nuevas olas: 2022, 2023 y 2024. Los participantes respondieron preguntas sobre actividad física, salud mental, dolor lumbar, acceso a atención médica y COVID-19, entre otros. En total, 2.691 participantes respondieron a la cuarta ola. Los niveles de actividad física aumentaron y los síntomas de ansiedad y depresión disminuyeron en comparación con la primera evaluación. Sin embargo, se observó una alta proporción de enfermedades crónicas y un tercio de los participantes experimentaba algún grado de inseguridad alimentaria. Además, tres cuartas partes fueron clasificadas como portadoras de COVID prolongada. Los efectos indirectos de la pandemia sobre la salud física y mental persisten en la vida de las personas.*
Palabras clave *COVID-19, Ejercicio, Dolor lumbar, Salud mental, Enfermedades crônicas*

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Introduction

The COVID-19 pandemic had far-reaching social, health, and economic impacts on a global scale[1]. In particular, when considering population health, the effects can be categorized as direct (i.e., those directly related to infection, hospitalization, and mortality) and indirect (i.e., consequences associated with the social restrictions implemented to curb the virus spread)[2].

One of the most notable effects of the pandemic social distancing measures was decreased physical activity[3]. During the initial months of the pandemic, there was a significant decline in people's engagement in physical activity, raising concerns about the potential consequences for their physical and mental well-being[4-6]. Simultaneously, there was an increase in anxiety and depression symptoms, highlighting the growing concerns regarding mental health issues within the population during this period[7-9].

The COVID-19 pandemic had a profound impact on healthcare systems worldwide. The urgent focus on treating COVID-19 patients resulted in compromised management of other medical conditions, particularly in developing countries such as Brazil, where demand for public healthcare services is substatial[10]. A specific concern arose about individuals with chronic health conditions (e.g., hypertension, diabetes) who faced challenges accessing medications and effectively managing their diseases[11].

As vaccination efforts commenced in January 2021 in the Rio Grande do Sul state, restrictions gradually eased. Before the third wave (June 2021), immunization had been initiated in Brazil, with nearly 40,000 individuals in the Rio Grande do Sul state receiving their first vaccine dose[12]. Even though 79.7% of the Brazilian adult population has completed the COVID-19 vaccination protocol, the long-term effects of the pandemic might still exert an impact on people's health and the public healthcare system, both directly and indirectly. The PAMPA Cohort was designed to evaluate the long-term impact of the COVID-19 pandemic on the physical and mental health outcomes of adults residing in the southernmost state of Brazil. Here, we presented the data from the wave 4, the updated cohort profile and methodology.

Methods

Study design and sample

The PAMPA Cohort is a prospective cohort study designed to assess the long-term impacts of the COVID-19 pandemic on the physical, mental, and behavioral well-being of adults. The study protocol was approved by the ethics board of the Physical Education faculty at the Federal University of Pelotas, Brazil (CAAE: 31906920.7.0000.5313). The study occurs in the Rio Grande do Sul, the southernmost Brazilian state bordering Argentina and Uruguay. As of September 2022, the state had reported more than 2,728,937 confirmed cases of COVID-19 and 41,029 deaths[13].

Initially, we planned to conduct three data collections: June 2020 (assessed before [retrospectively] and during the COVID-19 pandemic), December 2020, and June 2021. With the pandemic progression, three additional data collection waves were planned, with the first in June 2022 (wave 4), followed by waves 5 and 6 in the same months in 2023 and 2024, respectively. Briefly, the study sample consists of adults aged 18 years and over living in Rio Grande do Sul state. We conducted a sample size calculation aiming to balance the sample within all the state regions, and after accounting for losses and refusals, the required sample size was 1,767. More details about sample size calculation can be found elsewhere[14].

Participant recruitment

The recruitment was conducted in two phases, each lasting four weeks. Briefly, a four-arm approach was adopted to reach participants in all regions of the state (Missioneira, Norte, Sul, Centro-Oeste, Serra, Vales, Metropolitana, in Portuguese). This approach involved sending messages to researchers personal contacts, creating social media campaigns to disseminate the questionnaire link, sending a press release to local media and state agencies (i.e., health departments), and sending messages to universities to be shared with their students, faculty, and staff.

The second recruitment phase involved following up with participants who had completed the questionnaire during the first data collection in June/July 2020. Participants who provided contact information (n = 1,132) were contacted via email, SMS, or WhatsApp/Instagram messages, with three attempts made on each network on each network over a three-day interval.

Those who did not respond were considered lost to follow-up.

Questionnaire

An online-based, self-administered questionnaire was created using the RedCap platform[15]. Participants answered questions on mental health, physical activity, low back pain (LBP), chronic disease management, sleep, COVID-19, and food security. The assessment for each variable is presented in Table 1, and further details are outlined below.

Participants were asked about LBP in the last six months. LBP was assessed by participants experience (i.e., yes/no), pain intensity (i.e., numerical pain rating scale), activity limitation related to LBP (i.e., yes/no), and care-seeking behavior (e.g., General Practitioner, Physiotherapist)[16].

Mental health was assessed through the Hospital Anxiety and Depression Scale (HADS), which has 14 items, seven in each domain (i.e., depression and anxiety). The maximum score is 21 points, as each item can be scored from 0 to 3. Thus, participants are classified, based on their scores, as follows: non-cases (less than 7 points), mild (between 8 and 10 points), moderate (between 11 and 14 points), and severe cases (between 15 and 21 points)[17,18]. In addition, a single question on self-rated memory was included, aiming to identify subjective cognitive decline[19,20].

We assessed chronic diseases (e.g., diabetes, high blood pressure, cancer, heart disease, HIV/AIDS) through questions used on the Brazilian Surveillance of Risk and Protection Factors for Chronic Diseases by Telephone Survey (VIGITEL) [21] and the National Health Survey[22]. A binary variable was built considering participants who report at least one disease and those who report none. Additionally, we asked participants about medication-related (e.g., access, adherence to treatment, and reasons not to take), healthcare characteristics (e.g., type), and access (e.g., reasons not to seek care)[11].

Participants also provided data on moderate-to-vigorous leisure-time physical activity practice (i.e., yes or no), frequency (i.e., days per week), and time (i.e., minutes per day) in the last seven days[23]. In addition, we included questions on physical activity type (e.g., walking/running, strength exercises), place (i.e., at or out of home)[24], motivation to practice, and use of digital platforms. Participants were classified as active or inactive based on the WHO 150 min/week recommendation[25].

Sleep time was assessed by asking participants about their average nightly sleep duration over the past two weeks. We also evaluated the use of sleep medication during the same peri-

Table 1. Summary content of variables collected, Rio Grande do Sul, Brazil.

	Wave 1[a]	Wave 2[b]	Wave3[c]	Wave 4[d]	Wave 5[e]	Wave 6[f]
Socio-demographic characteristics	*	*	*	*	*	*
Participant characteristics	*	*	*	*	*	*
Working characteristics	*	*	*	*	*	*
Economic characteristics	*	*	*	*	*	*
Social distancing behavior	*	*	*			
Mental health	*	*	*	*	*	*
Low back pain	*	*	*	*	*	*
Physical activity	*	*	*	*	*	*
Chronic diseases	*	*	*	*	*	*
Healthcare and medicine access	*	*	*	*	*	*
COVID-19 information		*	*	*	*	*
COVID-19 case detection			*	*	*	*
COVID-19 symptoms				*	*	*
Food situation				*	*	*
Sleep			*	*	*	*
Contact information	*	*	*	*	*	*

[a] Assessed before (retrospectively) and during COVID-19; pandemic (June/July 2020); [b] Assessed on December 2020/January 2021; [c] Assessed on June/July 2021; [d] Assessed on June/July 2022; [e] To be assessed on June/July 2023; [f] To be assessed on June/July 2024.

Source: Authors.

od, with responses classified as "No" or "Yes" [26]. Body mass index (BMI) was calculated based on self-reported weight and height, and participants were classified as normal (< 18.5 km/m^2), overweight (18.5 or < 25 km/m^2), or obese (25 or < 30 km/m^2).

We used the Brazilian Household Food Insecurity Measurement Scale (Escala Brasileira de Insegurança Alimentar, EBIA), a validated tool designed to assess food insecurity within the Brazilian population[27]. Our assessment utilizes a concise version composed of eight items. Each item is a dichotomous question; the possible answers are "yes" or "no." Based on the cumulative scores derived from these responses, we categorized the food situation into the following levels: food security (0 points), mild (1-3 points), moderate (4-5 points), and severe food insecurity (6-8 points)[27]. For analysis purposes, we simplified this variable into two categories: "food security" (0 points) and "food insecurity" (1-8 points), grouping participants who exhibited any level of food insecurity.

Participants reported whether they did COVID-19 tests and, in case any of these, had a positive result. A list of symptoms (e.g., fatigue, cough, headache) was displayed for those participants who reported a positive test for COVID-19. For each symptom, there were the following answering options: 1) did not have, 2) three months, 3) six months, 4) 12 months, 5) 15 months, and 6) 18 months or more. Based on this information, we defined long COVID as experiencing any COVID-related symptoms that lasted at least three months[28].

Data analyses

Data were exported to Stata 15.0 (StataCorp, College Station, Texas). We performed descriptive analyses, and data were reported in proportion with their respective 95% confidence interval (95%CI). Significant differences between prevalence levels were considered when there was no overlap between 95%CI categories.

Results

Table 2 shows the sociodemographic and nutritional characteristics of the 2,691 participants in wave 4. Most of the participants were female (74.5%), mid-age (59.1%), white (88.8%), lived with a partner (64.0%), had tertiary education (68.9%), and were classified as overweight/obese (55.8%).

Table 2. Sociodemographic and nutritional characteristics of the included participants. Rio Grande do Sul, Brazil.

	N (%)	95%CI
Sex (n=2,524)		
Male	669 (26.5)	24.8; 28.2
Female	1,855 (74.5)	71.7; 75.2
Region (n=2,533)		
Norte	230 (9.1)	8.0; 10.3
Vales	195 (7.5)	6.7; 8.8
Centro-oeste	246 (9.5)	8.6; 10.9
Metropolitana	800 (32.3)	29.8; 33.4
Missioneira	188 (7.3)	6.4; 8.5
Sul	721 (28.4)	26.7; 30.3
Serra	153 (6.0)	5.2; 7.0
Age (n = 2,530)		
18-30	779 (30.8)	29.0; 32.6
31-59	1,496 (59.1)	57.2; 61.0
60+	255 (10.1)	8.9; 11.3
Ethnicity (n = 2,528)		
White	2,244 (88.8)	87.5; 89.9
Black	114 (4.5)	3.8; 5.4
Mixed	168 (6.7)	5.7; 7.7
Other	2 (0.1)	0.02; 0.3
Marital status (n = 2,526)		
Living alone	910 (36.0)	34.2; 37.9
With partner	1,616 (64.0)	62.1; 65.8
Highest educational achievement (n = 2,533)		
Primary	81 (3.2)	2.6; 3.9
Secondary	708 (27.9)	26.2; 29.7
Tertiary	1,744 (68.9)	67.0; 70.6
BMI (Kg/m^2) (n = 2,524)		
Normal	1,118 (44.2)	42.4; 46.2
Overweight	853 (33.9)	31.9; 35.7
Obese	553 (21.9)	20.3; 23.6

Source: Authors.

Table 3 presents the study outcomes in wave 4 (June/July 2022) and compares them with wave 1 (June/July 2020). The prevalence of participants meeting recommended physical activity levels was higher in wave 4 than in wave 1 (32.7% and 23.9%, respectively), and health was the main reason reported for practicing physical activity. Also, we observed an increased prevalence of participants practicing physical activity out of home in wave 4 compared to wave 1 (49.3% and 31.0%). No differences were observed in LBP prevalence within waves, and

Table 3. Descriptive data on behavioral, health-related, nutritional and COVID-19 variables of included participants. Rio Grande do Sul, Brazil.

	Wave 4[a]		Wave 1[b]	
	N (%)	95%CI	N (%)	95%CI
Physical activity				
Inactive	1,346 (67.2)	65.2; 69.2	1,744 (76.1)	74.3; 77.7
Active	655 (32.7)	30.7; 34.8	549 (23.9)	22.2; 25.7
Reasons for practicing physical activity				
Medical advice	176 (6.2)	5.3; 7.1	[c]	[c]
Appreciate doing	477 (16.9)	15.5; 18.3	[c]	[c]
Health	817 (28.9)	27.2; 30.6	[c]	[c]
Aesthetics	287 (10.2)	9.1; 11.3	[c]	[c]
Other	55 (1.9)	1.4; 2.5	[c]	[c]
Physical activity out of home	992 (49.3)	47.1; 51.5	701 (31.0)	29.1; 32.9
Physical activity at home	586 (29.1)	27.1; 31.1	949 (42.0)	40.0; 44.0
Used digital platforms for physical activity				
No	934 (86.5)	84.3; 88.3	[c]	[c]
Yes	146 (13.5)	11.6; 15.6	[c]	[c]
Low back pain				
No	515 (24.9)	23.1; 26.8	607 (26.4)	24.6; 28.2
Yes	1,554 (75.1)	73.2; 76.9	1,693 (73.6)	71.8; 75.4
Anxiety				
Normal	777 (37.1)	35.1; 39.2	935 (40.8)	38.8; 42.8
Mild	691 (33.0)	31.0; 35.1	500 (21.8)	20.2; 23.5
Moderate-to-severe	626 (29.9)	28.0; 31.9	858 (37.4)	35.5; 39.4
Depression				
Normal	1,074 (51.2)	49.0; 53.3	1,071 (46.7)	44.7; 48.8
Mild	627 (29.9)	27.9; 31.9	567 (24.7)	23.0; 26.5
Moderate-to-severe	398 (19.0)	17.3; 20.7	655 (28.6)	26.8; 30.5
Subjective memory				
Bad/very bad	769 (36.5)	34.5; 38.6	290 (12.7)	11.3; 14.1
Regular	952 (45.2)	43.1; 47.4	918 (40.0)	38.1; 42.1
Very good/excellent	384 (18.2)	16.6; 19.9	1,085 (47.3)	45.3; 49.4
Chronic diseases				
No	593 (29.2)	27.3; 31.2	1,022 (44.4)	42.4; 46.5
Yes	1,437 (70.8)	68.8; 72.7	1,278 (55.6)	53.5; 57.6
Healthcare access				
No	1,195 (58.8)	56.6; 60.9	1,464 (64.2)	62.2; 66.2
Yes	836 (41.2)	39.0; 43.3	815 (35.8)	33.8; 37.8
Type of healthcare				
Public	171 (20.5)	17.8; 23.3	[c]	[c]
Private	565 (67.5)	64.3; 70.7	[c]	[c]
Both	100 (12.0)	9.9; 14.3	[c]	[c]

it continues

75.1% of participants reported LBP in the last survey.

Regarding mental health outcomes, fewer participants in wave 4 were classified as having moderate-to-severe anxiety (29.9%) and depressive symptoms (19.0%) compared to wave 1. However, a higher proportion of participants reported bad/very bad subjective memory in wave 4 (36.5%) (Table 3).

Overall, 70.8% of participants reported having a diagnosed chronic disease, and 42.6% used medication to manage their condition, which was higher than in wave 1. Healthcare access increased from wave 1 to 4, and most

Table 3. Descriptive data on behavioral, health-related, nutritional and COVID-19 variables of included participants. Rio Grande do Sul, Brazil.

	Wave 4[a]		Wave 1[b]	
	N (%)	95%CI	N (%)	95%CI
Reasons to not seek care				
Fear of being contaminated (COVID-19)	28 (6.3)	4.3; 8.9	214 (9.1)	8.0; 10.3
Financial issues	117 (26.2)	22.2; 30.4	57 (2.4)	1.8; 3.1
Commuting issues	35 (7.8)	5.6; 10.7	48 (2.1)	1.5; 2.6
Telehealth care	10 (2.2)	1.2; 4.1	66 (2.8)	2.1; 3.5
No healthcare professional available	60 (13.4)	10.6; 16.9	18 (0.8)	0.4; 1.1
Other	197 (44.1)	39.5; 49.7	17 (0.7)	0.4; 1.1
Medicine use				
No	1,166 (57.4)	55.2; 59.5	1,523 (66.2)	64.3; 68.1
Yes	865 (42.6)	40.5; 44.7	777(33.8)	31.9; 35.7
Have access to all medications				
No	52 (6.0)	4.6; 7.8	[c]	[c]
Yes	813 (94.0)	92.2; 95.5	[c]	[c]
Sleep (hours)				
< 7	724 (36.7)	34.6; 38.8	[c]	[c]
Between 7 and 8	1,098 (55.7)	53.5; 57.9	[c]	[c]
> 8	149 (7.6)	6.5; 8.8	[c]	[c]
Food situation *				
Food security	1,363 (70.8)	68.7; 72.7	[c]	[c]
Food insecurity	563 (29.2)	27.2; 31.3	[c]	[c]
COVID-19 test				
No	312 (15.8)	14.2; 17.4	[c]	[c]
Yes	1,666 (84.2)	82.5; 85.7	[c]	[c]
Positive tests				
No	667 (40.1)	37.8; 42.5	[c]	[c]
Yes	996 (59.9)	57.5; 62.2	[c]	[c]
Long-covid symptoms				
No	210 (21.6)	19.1; 24.3	[c]	[c]
Yes	762 (78.4)	75.7; 80.9	[c]	[c]

[a] Assessed on June 2022; [b] Assessed before (retrospectively) and during COVID-19 pandemic (June 2020); [c] Not assessed in Wave 1.

Source: Authors.

participants reported seek care in the private system. In Wave 1 fear of being contaminated with COVID-19 was the most reported reason for not seeking care, and financial issues was the most reported reason in wave 4. Most participants reported sleeping between 7 and 8 hours (55.7%). Roughly one-third reported any level of food insecurity (29.3%) (Table 3).

Regarding COVID-19 outcomes, 84.2% of participants had at least one COVID-19 test, and 59.9% had a positive result (Table 3). Among participants with positive tests, 75% lived with long COVID-19. The most common symptoms reported were fatigue (56.7%), headache (41.9%), memory impairment (41.4%), and cough (40.0%) (Figure 1).

Discussion

The COVID-19 pandemic has left a lasting impact on global populations, both directly and indirectly, necessitating ongoing vigilance. We revealed that even 27 months after the commencement of social restrictions in the state of Rio Grande do Sul, the population is still experiencing adverse effects of the pandemic, including a high prevalence of LBP, reduced levels of physical activity, and moderate-to-severe cases of anxiety and depression.

At the onset of the COVID-19 pandemic, concerns centered around physical inactivity and mental health issues (i.e., depression and anxiety). Previous studies primarily focused on

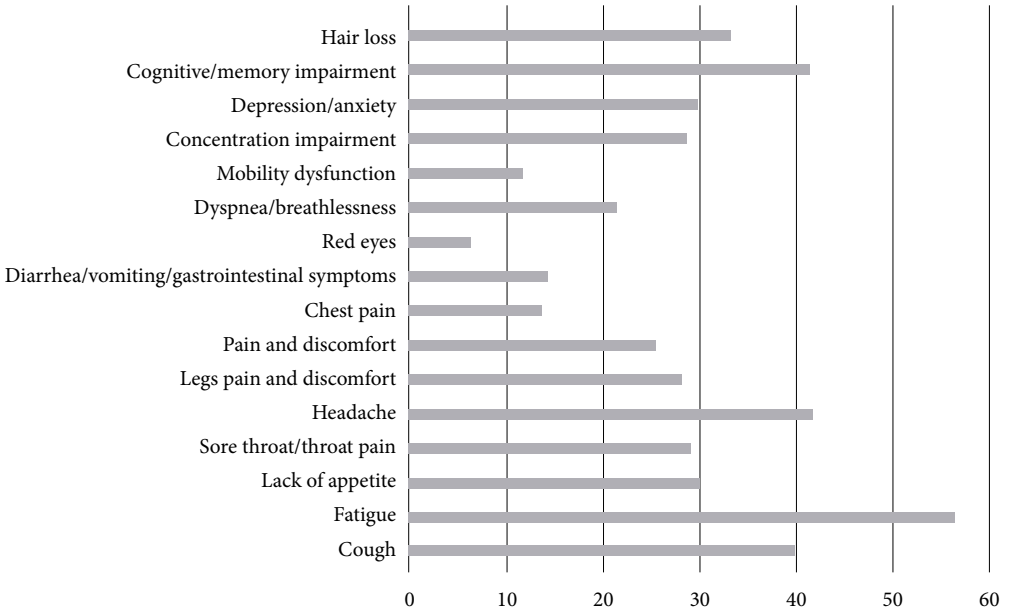

Figure 1. Frequency of long COVID-19 symptoms. Rio Grande do Sul, Brazil, 2022.

Source: Authors.

the early pandemic months or specific periods, such as lockdowns[29]. Although long-term surveillance of physical activity is vital, studies in high-income countries reported fluctuations in activity levels throughout the pandemic, and data on low/mid-income countries are still needed[30,31]. In Brazil, we observed an initial decrease in physical activity during restrictions, followed by a gradual increase[24]. However, even after 27 months of the restrictions onset, activity levels in Rio Grande do Sul remained below pre-pandemic levels [6].

Depression and anxiety symptoms surged during the initial restriction period and persisted for nearly ten months[4,5]. In contrast to countries such as the UK, where these symptoms decreased post-lockdown, moderate-to-severe symptoms remained elevated in Brazil due to the absence of federal social distancing measures[24]. This situation contributed to increased COVID-19 cases and deaths in Brazil, economic instability, and an uncertain future[32]. These findings underscore the urgency for policymakers to prioritize mental health as a public health concern.

LBP poses a significant challenge, causing substantial productivity losses in Brazil[33,34]. The prolonged periods of staying at home and changes in work routines raised concerns about LBP. However, few studies have investigated the prevalence and effects of LBP during the pandemic[35,36]. Worryingly, LBP prevalence remained stable compared to initial data collected in 2020, potentially leading to increased physical, psychosocial, and economic burdens associated with LBP.

This is the first study to prospectively investigate the prevalence of long COVID in a large Brazilian adult population, revealing that three out of four adults in Rio Grande do Sul experienced this condition. Long COVID has emerged as a significant consequence of the pandemic, with fatigue and cognitive/memory issues being prominent symptoms[37-39]. Crunfli et al. (2022) recently highlighted structural changes in the cerebral cortex associated with COVID-19, potentially leading to "brain fog," memory complaints, and attention deficits[40,41]. Previous studies have also suggested the role of vascular-related proinflammatory biomarkers in fatigue symptoms[42]. Thus, it is imperative to continually monitor the consequences of COVID-19 to prepare the healthcare system to address the needs of those living with long COVID.

Adequate sleep is crucial for overall well-being[43]. Sleep disturbances were more preva-

lent during lockdown (42.5%) compared to non-lockdown (37.9%) periods and in 2021 compared to 2020 (47.1% and 36.2%, respectively)[44]. Both short and long sleep durations, as well as sleep disturbances, have been linked to chronic diseases and multimorbidity[45,46]. We showed that nearly 45% of the participants failed to achieve the recommended hours of sleep (i.e., between seven and eight hours), raising concerns about future health consequences.

The pandemic disrupted healthcare provision for individuals with chronic conditions (e.g., diabetes, cardiovascular diseases) and became a concern since the systems were primarily focused on managing COVID-19 patients. Furthermore, the upheaval in daily routines was expected to contribute to an increase in chronic diseases such as obesity, cardiovascular diseases, and multimorbidity[47,48]. We revealed a significant rise in the prevalence of chronic diseases (70.8%) compared to the initial assessment, indicating a concerning prospect for long-term health conditions.

Ensuring sufficient, abundant, and safe food access to meet the nutritional needs of all individuals is known as food insecurity[49]. The COVID-19 pandemic has exacerbated food insecurity in Brazil and globally[50,51]. Food insecurity affected 29.2% of the population, underscoring the need for government intervention through social and public health policies to address this problem.

Some limitations of our study should be acknowledged. Firstly, although in-person research is currently allowed, we opted for a self-reported online-based approach to ensure data comparability with the previous cohort waves. Secondly, our study design precluded an equiprobable sample. While our sample represents a mid/high-income and educated population, it should be noted that in a low-income and less educated population, the scenario should be worsened. Thirdly, online assessments usually have reduced responses from older and less educated/income individuals due to internet restrictions or the inability to use technology. Nevertheless, the demographic characteristics of our sample correspond with the Rio Grande do Sul state population (i.e., most are white and women)[52]. However, the PAMPA cohort is the only ongoing, prospective study initiated during the COVID-19 pandemic involving over 10,000 adults in southern Brazil. The data collected will inform public health policies and help prepare the healthcare system for future needs. We are to continue monitoring the population of Rio Grande do Sul state until 2024.

Conclusion

Our data shows that this sample continues to grapple with the enduring impacts of the COVID-19 pandemic on both their physical and mental well-being. Remarkably, even 27 months into the pandemic-era restrictions, physical inactivity, LBP, and mental health issues persist at levels higher than those observed before the pandemic onset.

In light of these findings, it is evident that robust public health strategies are imperative. These strategies should aim to enhance the overall health of the population and mitigate the lingering consequences of the pandemic. Notably, such measures can help safeguard against the indirect effects that may arise in future pandemic scenarios necessitating social restrictions.

Collaborations

EL Caputo, N Feter, FF Reichert, MC Silva, and AJ Rombaldi conceived the study. EL Caputo performed all analyses and led the writing of the manuscript. FM Delpino, N Schröeder, IA Paz, LS Silva, JS Leite, J Cassuriaga, JQS Rocha, C Nascimento, and YP Vieira conducted the data collection and revised the manuscript. All authors approved the final version of the manuscript.

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