



## The Impacts of Covid-19 on Individuals with Cardiovascular Disease

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### Abstract

In the face of the COVID19 pandemic, people with prior cardiovascular disease (CVD) were more likely to develop worrisome forms of the disease. With this scenario comes the importance of a watchful and expanded look at CVD patients who have had COVID19. This study aimed to identify the consequences of COVID19 in these patients. This is a cross-sectional, mixed, analytical study, with the application of a questionnaire to patients with CVD. It was concluded that at the time of COVID19 infection, 80% of respondents were already vaccinated, resulting in mild symptomatic conditions and low hospitalization rates. The length of hospital stay in individuals without vaccination of any dose of the vaccine had a significantly higher average,  $16.5 \pm 2.1$  days, when compared to those who were already vaccinated,  $3.5 \pm 0.7$  days. There were no hospitalizations in vaccinated patients with more than 2 doses. After infection, 56% of the participants began to experience dyspnea on mild-moderate exertion, 63% experienced episodes of tachycardia and blood pressure lability, among other symptoms: weaknesses, memory and psychic alterations. We conclude the need for long-term follow-up of these patients, due to the high rates of development of sequelae presented. In addition, it observed a beneficial effect of vaccination.

**Keywords:** Cardiovascular Disease; COVID19; Coronavirus

### Introduction

The Brazilian population has been undergoing a transformation in its demographic profile for some time, characterized by a decrease in birth rates and an increase in life expectancy. Population aging is already a reality in the country, and simultaneously with it the growth of cases of chronic non-communicable diseases (NCDs), these being associated the main cause of morbidity and mortality in society. Among the main diseases of this group we can mention cardiovascular diseases (CVD), Diabetes Mellitus, respiratory diseases and neoplasms [1-3].

In 2019, according to the Mortality Information System (SIM), the leading cause of death in Brazil was due to diseases of the

circulatory system - CAD (27%), followed by neoplasms (17%) and in third place diseases of the respiratory system (12%). Concomitant with the large number of deaths, work disability is often associated with those diagnosed, generating great impacts both on the quality of life and on the socioeconomic situation of these patients [4-6].

In view of this, the growing urgency of attention to the care of this population is indispensable. The implementation of an efficient screening and early diagnosis, associated with the stimulation of a healthy lifestyle is essential for the prevention and control of CVD, since the presence of obesity, sedentary lifestyle, hypertension, diabetes, dyslipidemia and smoking are predominant risk factors in the development of CAD. [7-9].

In addition, the creation of effective public health policies, based on multidisciplinary actions, are the basis for successful control and treatment in patients with cardiovascular disease. In this context, Cardiovascular Rehabilitation (CVR) is also highlighted, focusing on physical exercises, both in the aerobic component and peripheral resistance strengthening, promoting significant improvements in quality of life and reducing the risk of cardiovascular events, thus reflecting in the decrease in mortality from CVD [10-12].

However, congruent to the current scenario, this group presented a greater prominence, when related to cardiovascular impairment, worsening of the clinical picture and even an increase in the mortality rate [13].

In December 2019, in Wuhan, China, a new virus was identified and named as SARS-CoV-2, and in March 2020, due to its high rate of transmissibility and mortality, the World Health Organization (WHO) decreed the Coronavirus Syndrome 2019 (COVID-19) pandemic, resulting in the immediate adoption of preventive and restrictive isolation measures as protection [14-16].

With a characteristic clinical picture of a respiratory syndrome, presence of cough, fever and tiredness, COVID-19 tends to manifest itself in a more worrisome and often fatal way in patients with previous cardiovascular comorbidities [2,16].

Associated with this, SARS-CoV-2 has the tendency to interact with the cardiovascular system of the infected, causing dysfunction in the myocardium and in the function of the enzyme angiotensin 2 (ACE2) converter, which culminates in the manifestation of sequelae, such as the presentation of arrhythmias, myocardial ischemia, myocarditis, congestive heart failure (CHF) and even shock [2,16-18].

Given this scenario, the importance of a watchful and expanded look at patients with cardiovascular diseases who have had COVID-19 is paramount. Investigating and obtaining an overview of the current situation and the degree of depth of the impact of the Coronavirus Syndrome 2019 pandemic on individuals with cardiovascular disease, will assist in future decision-making, thus considering the implementation of health actions specific to this specifically affected group.

## Methods

This is a cross-sectional, quantitative-qualitative, analytical study conducted with patients diagnosed with cardiovascular disease (CVD) treated by the Vila Gloria Family Health Strategy in the city of Assis-SP.

All individuals were informed about the objective of the study, and after acceptance and signing of the free and informed consent form (ICF), they actively participated in the research. The study was approved by a Research Ethics Committee (CEP) CAAE: 52865621.0.0000.8547.

- **Inclusion criteria:** over 18 years of age; linked to the coverage zone of the territory of action of the ESF Vila Glória; previous diagnosis of CVD, including arterial hypertension, congenital heart disease, angina, arrhythmias, heart failures, coronary heart disease and acute myocardial infarction; Signature of the Informed Consent Form.
- **Data collection:** The questionnaire was applied in a single collection, during home visits, accompanied by the community agent of the unit, individually, by the researcher herself. The questions were explained identically for all participants and there was no application time limit.
- **Data analysis:** After collecting the research data, these were transcribed by the researcher herself, maintaining the confidentiality of the subjects. Since the study of quantitative-qualitative character, the data analysis was performed by two means: for the quantitative variables, the analysis was performed through the Excel program, while in relation to the qualitative data, it was carried out by the technique of content analysis of Bardin (2011). The qualitative analysis followed three phases proposed by the reference: pre-analysis; material exploration; treatment results obtained and interpretation, allowing the approach of three categories: physical manifestations, cognitive manifestations and without manifestations [19].

## Findings

### Quantitative analysis

The present study had the participation of 30 individuals, with a mean age of 55.9±14.4 years. Of this total, 73.3% of the participants were female and 26.7% were male.

Following the inclusion criteria, all participants in this study had cardiovascular disease prior to the COVID-19 pandemic. Among the cardiovascular alterations, arterial hypertension was the predominant one among the individuals interviewed, corresponding to 27 cases (90%).

Other hemodynamic changes were present as angina 20% (6 cases), arrhythmias and atherosclerosis with 16.7% (5), congenital heart diseases 13.3% (4), Acute Myocardial Infarction (AMI) and Heart Failure with 6.7% (2) and thrombosis, Chronic Venous Insufficiency (CVI), Left Ventricular Hypertrophy (LVH) and Coronary Artery Disease with 3.3% (1). It is noteworthy that some of the participants had more than one cardiovascular disease concomitantly.

Regarding vaccination against COVID-19, all participants in the sample stated that they are currently vaccinated, with an average of  $3.5 \pm 0.6$  doses, with 4 doses being 63% (19), 3 doses (27%) and 2 doses (10%).

According to the inclusion criteria of the current study, all patients should have previous cardiovascular diseases when infected by the SARS-CoV-2 virus.

Regarding the number of doses of COVID-19 vaccine already taken prior to COVID infection, the distribution showed the following result: 20% of respondents reported that at the time of infection by the SARS-CoV-2 virus, they had not yet been vaccinated, both because they did not have vaccines already developed and approved for application at the time, and because they were not yet the age group of the application on the corresponding date.

Of the remaining 80% (24) already vaccinated, 20.8% (5) participants reported that they had already taken the 4 doses when infected with COVID, 41.7% (10) were vaccinated with 3 doses, 29.9% (7) with 2 doses and 2 with 1 dose only (8.3%).

A greater number of participants vaccinated with more than 2 doses at the time of infection was observed, it was associated with relatively positive outcomes and infections with relatively mild symptomatic conditions. This was reflected in the low rates of the variable of need for hospitalization, in which 80% of the cases reported not having needed hospitalization.

Regarding the length of hospital stay, the participants had not taken any doses of the vaccine against COVID-19, demonstrating a significantly higher average,  $16.5 \pm 2.1$  days, when compared to

those who were already vaccinated with one or two doses of the vaccine,  $3.5 \pm 0.7$  days. There were no hospitalizations in individuals vaccinated with more than 2 doses.

Of the total number of respondents, 6.7% of the cases reported needing intensive hospital care, and unfortunately there were no beds available.

The clinical manifestations presented by the participants during the active infection of COVID-19 were mainly flu-like symptoms, ranging from mild in 36.7% of the individuals to severe in 40%, with runny nose, nasal congestion and cough being the most predominant symptoms. Successively body pain (46.7%), sore throat (40%), fatigue (36.7%), fever and dyspnea (26.7%), followed by headache and decreased oxygen saturation (23.3%). The other clinical manifestations are presented in table 1.

Main clinical manifestations in COVID	Number of individuals	Percentage
Mild flu condition	11	36.7%
Strong flu condition	12	40%
Body pain	14	46.7%
Sore throat	12	40%
Fatigue	11	36.7%
Fever	8	26.7%
Dyspnea	8	26.7%
Decreased oxygen saturation	7	23.3%
Headache	7	23.3%
Dizziness	4	13.3%
Prostration	3	10%
Blood pressure fluctuations	3	10%
Anxiety crisis	2	6.7%
Hyperglycemia	2	6.7%
Diarrhea	2	6.7%
Backache	2	6.7%
Nausea	2	6.7%
Constipation	1	3.3%
Insomnia	1	3.3%
Palpitations	1	3.3%
Asymptomatic	1	3.3%

**Table 1:** Relative and absolute distribution of the main clinical manifestations during COVID-19 infection.

Regarding the use of medication for Cardiovascular Diseases, 83.3% of the participants reported that they were already using some medication continuously. Among the main medications reported by the participants, in descending order, were: Losartan 60%, Hydrochlorothiazide 28%, Atenolol 20%, Bisoprolol 16%, ASA, Ritmonorm, Venaflon and Simvastatin 8%.

When asked if there were changes in their medications of continuous use after COVID-19, 36.7% (11) of the participants reported that yes, being of this total, 2 individuals who did not require the continuous use of medication to control their CVD before the infection by COVID-19, currently lack the prescription.

Three other participants reported the need to add one more medication for control, namely Benicar, Enalapril and Chlorthalidone. Two of the individuals surveyed stated that they had developed diabetes mellitus as sequelae, currently requiring the use of medication against it. Two others reported the added use of antidepressant and anxiolytic medication to help control their health. And finally, unlike the others, one participant declared that there was no longer any need to use medication against his CVD, being suspended by medical prescription, and another mentioned having suspended one of his routine medications against CVD (Valsartan) also for medical advice.

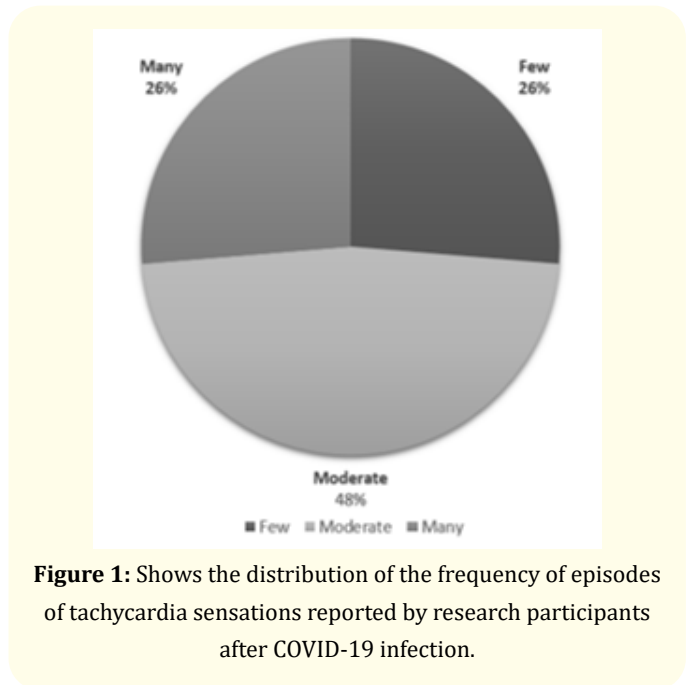
Regarding non-drug interventions, 44.8% of the participants declared that they practiced, with walking and bodybuilding being the most prevalent activity, varying the frequency from three to five times a week and an average time of one to one hour and 30 minutes, and in a smaller number of pilates and water aerobics, twice a week and an average time of one hour.

When asked how much the COVID-19 pandemic period interfered with this intervention, 69.2% of practitioners reported that a lot, 15.4% said that medium, and 15.4% was little compromised.

Of the total number of individuals interviewed, 100% reported routine follow-up of their cardiovascular disease, 83.3% of them through the Unified Health System (SUS) and 16.7% through medical insurance. At the time they were asked if they considered that this follow-up was impaired at the time of the pandemic, 60% said that yes, there was difficulty in going through a medical appointment, often delaying the deadline for return.

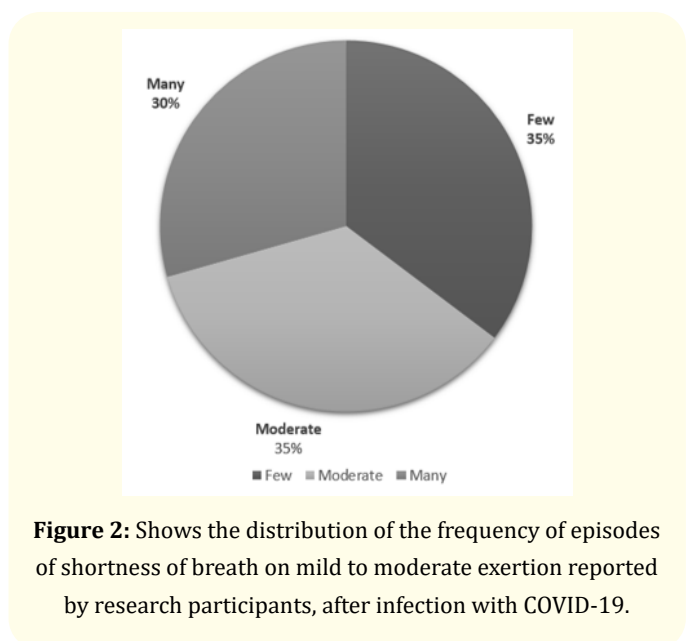
Regarding the impairment after infection by the SARS-CoV-2 virus, 63.3% (19) of the interviewees reported that they

experienced episodes of tachycardia, reported in the form of palpitations or a sensation of “racing heart”, and 48% claimed an average frequency of occurrence, and equivalently, 26% reported a frequency of little and a lot of such manifestation (Figure 1).



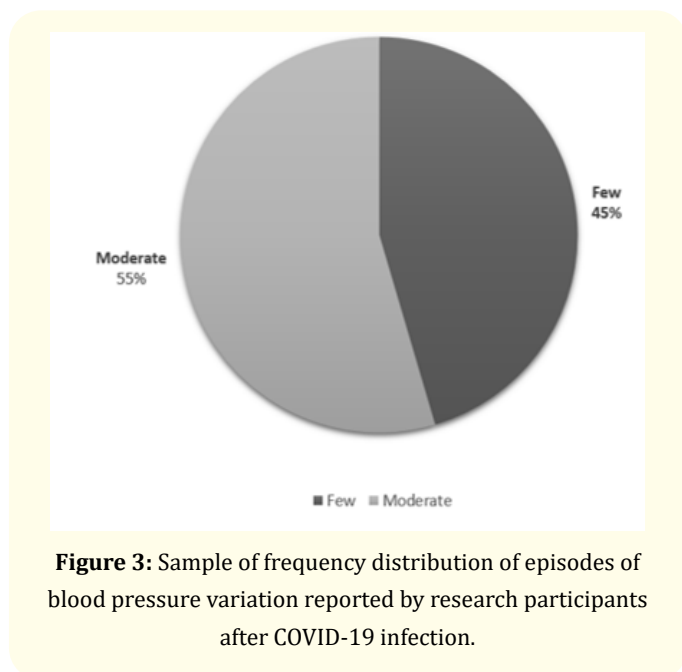
**Figure 1:** Shows the distribution of the frequency of episodes of tachycardia sensations reported by research participants after COVID-19 infection.

Regarding shortness of breath at low intensity efforts, such as climbing a ladder or taking a walk, 56.7% of the participants demonstrated that they had started to feel, being also 35% presented medium and little frequency, and 30% very often (Figure 2).



**Figure 2:** Shows the distribution of the frequency of episodes of shortness of breath on mild to moderate exertion reported by research participants, after infection with COVID-19.

When asked about situations in which there were changes in their blood pressure, many of the participants reported not having the habit of making the routine measurement, thus, 63.3% stated that they had not observed episodes of alteration of this one. On the other hand, 36.7% of the individuals surveyed demonstrated the presence of these variations, being 45.5% in low frequency and 54.5% in medium frequency (Figure 3).



**Figure 3:** Sample of frequency distribution of episodes of blood pressure variation reported by research participants after COVID-19 infection.

**Qualitative analysis**

The qualitative approach evidenced a diversity of characteristics related to the impact of the COVID-19 pandemic period on the lives of these participants.

Thus, the qualitative analysis was evidenced by the characteristics presented in the table below, where they were divided into 3 thematic categories and their corresponding thematic axes (Table 2).

Category	Thematic axis
Physical Manifestations	Fatigue and dyspnea after minor exertion
	Lower limb weakness
	Cardiovascular changes
Cognitive Manifestations	Psychic changes
	Memory changes
No Manifestations	

**Table 2:** Sample distribution of qualitative analysis in thematic categories and their axes.

Among the dimensions related to impact, the presence of physical complaints was the most prevalent, evidenced in category 1.

**Category 1-physical manifestations**

The research subjects reported that after Covid infection, they presented some physical manifestations such as feelings of fatigue and dyspnea associated with small efforts, weakness of the lower limbs and cardiovascular changes, especially “beatings” and palpitations, were often reported, as indicated in the following statements.

In view of the dialogues collected during the application of the questionnaire, reports on impairments of physical aspects such as feelings of fatigue and dyspnea associated with small efforts, weakness of the lower limbs and cardiovascular changes, especially “beaters” and palpitations, were frequently reported.

**Fatigue and dyspnea after slight exertion**

S2.1 *“I could never walk more than 30 minutes again, now it’s terrible, I have shortness of breath in small efforts, climbing stairs, climbing a slope, I’m not the same person anymore, I had to go in with medication for high blood pressure, I gained weight (+20kg), I lost muscle mass and strength, I have frequent headaches”*

S4.1 *“today I am more tired, I feel very short of breath for a little thing”*

S4.2 *“before I had much more will, willingness, to do things, now I avoid because of shortness of breath”*

**Weakness of lower limbs**

S3.1 *“It hurt a lot, I was more than 20 days away, my motor part was very compromised, I lost a lot of muscle mass, I had to try very hard to get back to walking, to move my arms.”*

S10 *“my health worsened a lot, the body gave a ‘thud’.. weak legs, frequent headaches worsen almost 100%, I believe they are sequelae.”*

**Cardiovascular changes**

S3.2 *“post covid I started having episodes of pressure drop and a lot of circulation problems”*

S17 *“I believe that because I have already taken the 3 doses, I had very few symptoms, it was more the same palpitations”*

S25 "My covid was quiet, but after covid I got palpitation sensations"

S5 "after covid I started to feel a lot of 'beating', to have a lot of pain in the body, bones, hurt knees, ankles, worsened my memory, greatly increased tiredness and shortness of breath, simple things like cleaning the house, now I already feel"

S16 "after covid I started to have tachycardia, shortness of breath on slight exertion, fainting sensations, it made everything worse"

### Category 2- Cognitive manifestations

Another post-Covid implication pointed out by the subjects was the alteration in cognitive function, characterized by the alteration of short-term memory and psychic alterations associated with emotional impairment, as follows

#### Psychic Changes

Reports of feeling of fear, insecurity, the restrictions imposed by social isolation, the loss of loved ones and were also preponderant, corroborating the statement of 2 participants who pointed out the need for use of antidepressant medication after Covid-19.

S1.2 "We are more afraid, we no longer have the freedom that we had, we become more cautious"

S9.1 "Fear, we know we have some health problems. In addition, we lost many friends, acquaintances, who grew up together."

S18 "I'm very afraid to have it again, my physique I've recovered, but my emotional no, I'm very afraid"

S15 "A lot of things changed, the feelings of fear and insecurity increased, I started to value other things more"

S12 "The bad thing about the pandemic for me was to stay indoors, to stop Agita Assis, I couldn't go to the right market, pharmacy, nothing"

#### Memory changes

Another variable pointed out by the research participants were cognitive complaints related to short-term memory, with forgetfulness being the predominant nuisance.

S6.1 "my memory was a little bad, I'm pretty forgetful"

S1.3 "I realized that I became more forgetful, sometimes I forget some routine things like a password that I use every day, or your name that you spoke a short time ago"

S7.2 "I was very forgetful, little things of the day to day that I take to do, at the time I forget"

### Categoria 3: Sem manifestações

Houve relatos de autopercepção na qual declarou-se não ter exercido influencia nenhuma, sendo muitos desses reiterados a importância de estarem vacinados no momento da infecção.

S8 "Pra mim a pandemia não influenciou em nada, porque não saí de casa, mas espero que acabe logo, porque me preocupo com meus filhos e netos que precisam sair para trabalhar."

S22 "Graças a Deus não mexeu comigo não, e quando todo mundo aqui pegou estávamos imunizados"

S23 "Minha covid foi tranquila, fiquei bem, estou vacinado e pronto para próxima dose"

### Discussion

#### Quantitative analysis

Epidemiological studies point to cardiovascular diseases (CVD) as the main cause of mortality worldwide, in addition to the global trend of increasing the number of the population with this category of diseases. This data became a cause for much concern when it was observed that patients with cardiovascular comorbidity were related to proportionally more fatal outcomes of Covid-19 infection [2,20,21].

At the beginning of the pandemic, faced with the lack of knowledge of effective treatments against Covid-19 infection, the lack of specific vaccines against SARS-CoV-2 and in order to reduce the number of contaminations, contact restrictions became paramount. The adoption of social isolation measures, and with it the closure of the areas destined to the practice of physical activity, made it difficult for the population to maintain their exercise routine, thus contributing significantly to the increase in sedentary lifestyle, as pointed out in the present study, in which 69.2% of the practitioners reported as "a lot" the intensity of the impediment to the practice of their physical activities in their daily lives during the pandemic period [17,22].

However, the race to develop vaccines against COVID-19 and the remarkable success in the distribution and application of these in the Brazilian population, reflected in the decrease in the numbers of deaths from Covid-19, in addition to avoiding severe cases of the syndrome, as illustrated in this article, where no person with two doses or more of the vaccine reported the need for hospital admissions. This data corroborates the Orellana study (2022), which also exhibited a pattern of substantial reductions in the risk of hospitalizations and death from Covid-19 in individuals with two doses of the vaccine, regardless of their manufacturing laboratory [23-25].

However, some symptoms of Covid-19 may persist beyond the infectious period of the disease, such as dyspnea and fatigue, which 56.7% of respondents still reported feeling, in intensity of varying frequencies, negatively interfering with their functional capacity. This was also evidenced in the Evidence Map on sequelae and post-Covid-19 rehabilitation, a study of cooperation between the Ministry of Health and the Pan American Health Organization (PAHO/WHO), of March 2022. Fabián, *et al.* (2021) also observed a close relationship between the virus and the development of Chronic Fatigue Syndrome (CFS), due to the similarity of the residual symptoms that post-Covid-19 patients present, such as chronic fatigue, diffuse muscle pain, cognitive dysfunction and sleep disorders [20,26].

Unfortunately, the clinical manifestations of Covid-19 are not restricted only to the respiratory system, as well as its sequelae. In the current study, the development and/or intensification of cardiovascular changes were frequently reported, such as episodes of tachycardia and changes in blood pressure levels, cited by 63.3% of the participants for both symptoms. Importantly, these individuals claimed to have their previous cardiovascular diseases controlled before Covid-19, either by medications or healthy lifestyle, but after infection by the virus began to present these episodes. It is noteworthy that 13.3% of the total respondents needed to change their medication against CVD due to post-Covid-19 changes. These manifestations of lability pressure and rhythm tend to be associated with interference of SARS-Cov-2 in the Autonomic Nervous System (ANS), favoring increased sympathetic activity, especially in patients with pre-existing CVD [27,28].

### Qualitative analysis

The process of becoming ill is a subjective experience of each individual, and allied to the context of the COVID-19 pandemic, the fear of the unknown, the insecurity of the non-existence of effective treatment and the mourning for the growing number of deaths, reflects on the experience and confrontation of the disease on different realities. From the dialogues captured, it is noted different nuances and developments of SARS-CoV-2 in the health of individuals. Sensations of fatigue and dyspnea were frequently reported by the interviewees, along with these, cardiovascular changes, muscle weakness and memory loss, which according to authors, compatible with the development of CFS, which the pathophysiology is linked to dysfunctions of the ANS and immune system [26,29,30].

However, other cardiovascular changes are systematically mentioned, such as arrhythmias, myocardial injury, myocarditis and acute coronary syndrome, heart failure and shock. These and other echocardiographic findings of changes in cardiac function and/or structure were commonly observed, especially in patients with CVD, according to Rojas, *et al.* (2021) and Barberato, *et al.* (2021) [31,32].

These findings can be explained due to the pathophysiology of SARS-CoV-2 virus infection in humans. Upon entering the body, viruses use the cellular receptor ECA2 (angiotensin-converting enzyme II) to invade cells and then replicate. This receptor is expressed in several vital organs such as pneumocytes of the lungs, cardiomyocytes of the heart, among others, thus resulting in different complications. However, we know that ACE 2 plays an important role in the regulation of cardiovascular physiology, associated with vasodilation, but by binding to this enzyme, the Covid-19 virus causes several changes in signaling pathways, leading to widespread impairment [33,34].

Current studies claim that post-Covid-19 cardiovascular changes are possibly caused by 2 mechanisms: hypoxemia and "cytokine storm." Changes in oxygen delivery are associated with ischemic impairment, resulting in changes in cardiac troponin (hs-cTn) levels, development of myocardial lesions due to hypoxia, arrhythmias and acute coronary syndrome. On the other hand, the increased presence of cytokine levels is directly related to impaired cardiac function, such as damage to the heart valves, reflecting in

acute heart failures; precipitation of rupture of the atherosclerotic plaque, which may result in AMI and/or stroke [32,34,35].

The pandemic period, with its social isolation, and even the very confinement of quarantine days, can also affect both the physical and mental well-being of individuals. Fear, the insecurity of the unknown and the sadness of losses were common issues manifested by the majority of the population. In the current research, reports of “increased feelings of fear and insecurity” were frequent. Along with this, the effects of the Covid-19 infection manifested themselves in all the systems of the body, especially in the psychological, as in dialogues captured during the application of the questionnaire: “I am very afraid of having it again, my physique I have recovered, but my emotional one does not, I am very afraid.” [36,37].

What is currently known is that the Sars-CoV-2 virus can stimulate the hypothalamic-pituitary-adrenal (HHA) axis, related to the functions of the sympathetic nervous system, thus promoting the activation of the stress cascade. The rapid and controlled release of neurotransmitters from this axis is essential for survival, but continued activation can result in the development of disorders such as anxiety, depression and others. This corroborates the findings of this study in which 6.6% of the participants stated the need to start antidepressant or anxiolytic medication, post-Covid-19 [26].

On the cognitive point of view, many of the participants report memory deficit after infection by Covid-19: “I realized that I was more forgetful, sometimes I forget some routine things like a password that I use every day, or your name that you spoke a short time ago” “I was very forgetful, little things of the day to day that I get to do, at the time I forget.” These findings are consistent with Aguiar, et al. (2021), and in which they point to memory loss and difficulty concentrating as persistent symptoms. In the literature there are still no plausible explanations for these manifestations, but it calls these symptoms, associated with fatigue, as “brain fog”, highlighting the prevalence of this, post Covid-19, and the concern with the impairment in the life of the population [30,36,39].

However, multiform clinical manifestations of COVID-19, from asymptomatic to moderate to critical cases, alert us to the importance of systematic monitoring of individuals. In addition, the importance of vaccination, especially in the group of patients with heart disease, is defended by the Brazilian Society of Cardiology

(2021), in order to aim at an adequate confrontation of COVID-19 [23,39].

## Conclusion

The present study identified the importance of an attentive and expanded look at patients with cardiovascular diseases who had COVID-19, since the findings showed significant complications in this post-infection population, often related to cardiovascular impairments such as episodes of tachycardia and frequent blood pressure lability, as well as dyspnea of mild-moderate intensity, as well as systemic as symptoms of weakness, memory problems and psychic changes.

It was also observed the relevance of vaccination against COVID-19, especially in favor of this vulnerable population, noting its beneficial effect for preventing the development of severe forms of the disease, resulting in a decrease in the incidence of the number and length of hospitalizations.

It reinforces the need for more in-depth studies to understand physical and cognitive impairments, and the best form of intervention to prevent them.

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