DOI: 10.1590/1809-2950/e22018023en



ORIGINAL RESEARCH

# Perception of health, quality of life and functional capacity in adults and elderly after hospitalization due to complications of COVID-19 - a longitudinal study with 6-month follow-up

*Percepção de saúde, qualidade de vida e capacidade funcional em adultos e idosos pós–internação hospitalar em função de complicações da COVID–19 – estudo longitudinal com follow–up de seis meses*

*Percepción de salud, calidad de vida y capacidad funcional en adultos y ancianos poshospitalización por complicaciones del COVID–19 – estudio longitudinal con seguimiento de seis meses*

**Débora Vieira de Araújo[1], Ana Laura Rodrigues de Lima[2], Erika de Cassia Santos Costa[3], José Maria Montiel[4], Angélica Castilho Alonso[5], Guilherme Carlos Brech[6]**

**ABSTRACT |** The study aims to evaluate the perception of health, quality of life and functional capacity during six months after COVID-19-related hospitalization. This is a prospective longitudinal study carried out at Universidade São Judas Tadeu (USJT) in partnership with the Instituto Ânima Brasil. Thirteen adult participants, including young and older adults, were evaluated, had a confirmed diagnosis of COVID-19 and were hospitalized. A characterization and interdisciplinary questionnaire built by the researchers was used to assess health perception, quality of life, and functional capacity of participants. In this study, participants were followed for a 6-month period and the main results obtained were: the identification of a significant increase in walking time after three months (p=0.002) as well as an improvement in the perception of quality of life (p=0.002). In addition, the levels of tiredness and physical activity were evaluated; the mean responses were "little tired" and "irregularly active," respectively, and remained unchanged over six months. Considering that patients who were hospitalized due to COVID-19 showed a reduction in the perception of quality of life and walking time soon after the hospital period, it was identified that over time they tend to improve these perceptions.

Keywords | Quality of Life; Physical Fitness; Health; Perception; COVID-19.

**RESUMO |** O objetivo do estudo foi avaliar a percepção de saúde, a qualidade de vida e a capacidade funcional dos pacientes durante seis meses após a internação por COVID-19. Trata-se de um estudo de delineamento prospectivo longitudinal realizado na Universidade São Judas Tadeu (USJT) em parceria com o Instituto Ânima Brasil. Foram avaliados 13 participantes adultos, entre jovens e idosos, que apresentaram diagnóstico confirmado de COVID-19 e foram internados. Foi utilizado um questionário de caracterização e interdisciplinar construído especificamente para inquirir a percepção de saúde, a qualidade de vida e a capacidade funcional dos participantes. Neste estudo, eles foram acompanhados no período de seis meses, e os principais resultados obtidos foram: a identificação do aumento significativo no tempo de caminhada após três meses (p=0,002), bem como a melhora

The study was developed in the Graduate Program in Science of Aging at Universidade São Judas Tadeu as part of Guilherme Carlos Brech's Physiotherapy Coursework, entitled Perception of health, quality of life, and functional capacity in adults and elderly post-hospitalization due to complications of COVID-19 – a longitudinal study with 6-month follow-up, defended on June 22.

[1]Universidade São Judas Tadeu (USJT) – São Paulo (SP), Brazil. E-mail: deboravieira424@gmail.com. ORCID-0000-0002-5884-3583
[2]Universidade São Judas Tadeu (USJT) – São Paulo (SP), Brazil. E-mail: analima.1710@outlook.com. ORCID-0000-0002-8338-7583
[3]Universidade São Judas Tadeu (USJT) – São Paulo (SP), Brazil. E-mail: cassiaerika01@gmail.com. ORCID-0000-0003-2390-8831
[4]Universidade São Judas Tadeu (USJT) – São Paulo (SP), Brazil. E-mail: montieljm@hotmail.com. ORCID-0000-0003-0182-4581
[5]Universidade São Judas Tadeu (USJT) – São Paulo (SP), Brazil. E-mail: angelicacastilho@msn.com. ORCID-0000-0002-9644-5068
[6]Universidade São Judas Tadeu (USJT) – São Paulo (SP), Brazil. E-mail: guibrech@gmail.com. ORCID-0000-0002-0403-0632

Corresponding address: Guilherme Carlos Brech – Rua Taquari, 546, 2º andar, Bloco C – São Paulo (SP), Brazil – ZIP Code: 03166-000 – E-mail: guibrech@gmail.com –
Financing source: CAPES (Funding code 001) – Conflict of interests: nothing to declare – Presentation: Nov. 3rd, 2022 – Accepted for publication: Apr., 20th, 2023 – Approved by the Research Ethics Committee: Protocol No. 4.099.421.

na percepção de qualidade de vida (p=0,002). Além disso, foram avaliados os níveis de cansaço e de prática de atividade física, e as respostas médias foram, respectivamente, "pouco cansaço" e "irregularmente ativo", as quais se mantiveram inalteradas ao longo de seis meses. Tendo em vista que os pacientes que foram submetidos à internação hospitalar devido à COVID-19 apresentaram redução da percepção de qualidade de vida e do tempo de caminhada logo após o período hospitalar, foi identificado que, com o decorrer do tempo, eles demonstraram tendência de melhora dessas percepções.
Descritores | Qualidade de Vida; Aptidão Física; Saúde; Percepção; COVID-19.

**RESUMEN |** El objetivo de este estudio fue evaluar la percepción de salud, calidad de vida y capacidad funcional durante seis meses posteriores a la hospitalización por COVID-19. Se trata de un estudio prospectivo longitudinal, realizado en la Universidade São Judas Tadeu (USJT) y el Instituto Ânima Brasil. Se evaluaron a trece participantes, entre adultos jóvenes y adultos mayores, que tenían diagnóstico confirmado del COVID-19 y se encontraban hospitalizados por complicaciones de esa enfermedad. Se utilizó un cuestionario de caracterización e interdisciplinario elaborado por los investigadores para evaluar la percepción de salud, la calidad de vida y la capacidad funcional de los participantes. En este estudio se realizó seguimiento de los participantes durante un período de seis meses, y los principales resultados fueron: un significativo aumento en el tiempo de caminata después de tres meses (p=0,002), así como una mejora en la percepción de la calidad de vida (p=0,002). Además, se evaluaron los niveles de cansancio y de actividad física, y las respuestas medias fueron "poco cansado" e "irregularmente activo", las cuales se mantuvieron sin cambios durante seis meses. Considerando que los pacientes que fueron hospitalizados por COVID-19 presentaron una reducción en la percepción de calidad de vida y en el tiempo de marcha tras el período en el hospital, se identificó que con el tiempo tienden a mejorar estas percepciones.
Palabras clave | Calidad de Vida; Aptitud Física; Salud; Percepción; COVID-19.

## INTRODUCTION

Health perception can be understood as the individual's global health assessment of their own life, based on objective and subjective aspects. This analysis can be related to the way people feel and how they are able to judge qualitative factors of their own lives, especially in given moments and contexts.

According to the World Health Organization, quality of life is a concept that relates to an individual's perception of how they fit into different aspects of life, as well as their ability to cope with various events, such as their health, and how this relates to their life goals and expectations[1]. In general, it can involve the perception of different aspects of life, such as their spiritual, physical, mental, psychological, and emotional well-being, and how the individual makes use of their personal, social, and family relationships, and can also involve educational and socioeconomic factors, among others, other than the absence of disease or disabling conditions[2].

COVID-19 is a disease caused by the SARS-CoV-2 virus, which had its first reports in December 2019 in China, being responsible for the pandemic situation decreed in all regions of the planet. Current data estimate that there are more than 490 million confirmed cases and more than 6 million deaths reported globally, representing a serious public health risk to the world population[1], especially when considering the different variants and their respective complicating factors. Even in face of several initiatives by various global organizations to control the pandemic situation, the main method of prevention was the use of masks and the vaccination (immunization) of the population[1,3].

It should be noted that individuals of all ages are susceptible to infection and to the development of the manifestations of COVID-19, of which a significant amount is considered severe, requiring hospitalization and more selective procedures for the treatment of clinical symptoms. Literature has shown, however, that the lethality level is associated with some factors such as age, since older adults have a greater tendency to develop the severe form; gender, since males have a higher mortality rate; ethnicity, since racial and ethnic minorities have a discrepant hospitalization rate; and pre-existing comorbidities, such as obesity, cardiovascular disease, diabetes mellitus, among other clinical conditions[3].

As for symptoms, patients in the acute phase of COVID-19 tend to present varied manifestations depending on their health status, but usually the main clinical symptoms include cough, fever, nausea, diarrhea, vomiting, muscle and joint pain, fatigue, anosmia, and, among the most commonly found in severe cases, there is acute respiratory failure[4,5]. However, some other

manifestations may appear after infection, such as dyspnea (10.4%), neuropathy (5.1%), fatigue (5.5%), mental confusion (3.8%), and muscle pain (3.0%)[6].

It is noteworthy that severe cases require greater clinical interventions. In cases of admission to intensive care units (ICU), mechanical ventilation, neuromuscular blockade, and sedation therapy are often used as therapeutic resources, which are associated with the emergence of new physical, cognitive, and psychological disorders that may persist even after hospital discharge. And, although a larger number of individuals infected with SARS-CoV-2 develop mild symptoms, about 20% require hospitalization for severe clinical conditions[7].

According to Greve et al.[8], critically ill patients are prone to musculoskeletal, neurological, and neuromuscular impacts, and polyneuropathy and diffuse non-necrotizing myopathy are common conditions that cause muscle weakness, reduced function, loss or decrease in quality of life and endurance, symptoms that may persist long after the infection. The authors describe that long periods of hospitalization can generate an imbalance in muscle homeostasis due to changes in the rhythm of protein synthesis and degradation, resulting in a gradual decrease in the renewal of muscle proteins, which tends to cause greater damage and different clinical manifestations. These manifestations can affect the functional capacity of patients due to pathophysiological changes at the systemic level and prolonged immobilization, which can result in severe loss of muscle mass, strength, endurance, and immune status[9].

It is noteworthy that the length of hospitalization is directly related to worse prognosis and disability, becoming an important factor to be considered in the recovery of these individuals. One can attribute the loss of muscle integrity to the loss of mechanical load in antigravitational muscles, such as the knee extensors and trunk muscles; in addition, changes in different muscles of the upper limbs should also be investigated and considered[9].

Regarding these individuals' quality of life, health perception and ability to perform daily tasks, they tend to be affected by the persistent symptoms of COVID-19, especially because they are conditions that were not usually present before ICU admission. Among the most common symptoms, arthralgia; fatigue, which varies from mild to severe in survivors; dyspnea; difficulty walking slowly or fast; postural imbalance; difficulty getting up, down or up stairs are common manifestations after hospitalization[10].

Based on these statements, the suffering of patients infected by COVID-19 after hospitalization is notorious, especially because it damages their abilities and their daily lives. In this context, it is opportune to better understand the possible clinical implications of the infection in order to drive appropriate treatment and intervention strategies. It is worth noting that, in the set of aspects associated with quality of life, functional capacity and perception of the person, the actual consequences of long periods of hospitalization due to COVID-19 are not clear, but literature has reported significant losses.

Given the above, this study aims at assessing the perception and influence of hospitalization on health, quality of life, and functional capacity of individuals after hospitalization for COVID-19.

## METHODOLOGY

### Type of study

This is a prospective longitudinal study carried out at Universidade São Judas Tadeu (USJT) in partnership with the *Instituto Ânima Brasil*.

### Participants

The study included 13 young and old adults of both genders, who had a confirmed diagnosis of COVID-19 and were hospitalized due to complications of the disease. To participate in the research, they had to present preserved cognitive capacity to answer a questionnaire, as well as to consent to participate in the study and sign the informed consent form.

### Instrument

The authors developed a questionnaire on characterization, health perception, quality of life, and functional capacity. Participants were characterized through a survey of personal data, anthropometric traits, and education. In addition, it included questions about the disease and about the hospitalization. Finally, there were questions about the perception of health, current and previous to the disease, at the level of physical activity and quality of life.

### Procedures

The questionnaire was completed on three occasions. The first was immediately after hospital discharge; the second, three months after hospital discharge; and the third, six months after hospital discharge. Topics were separated in order to facilitate understanding the results obtained, with the purpose of defining the existence of variations in the results of health perception, quality of life, fatigue level, and performance in physical activities in the mentioned periods.

### Statistical analysis

Data were analyzed using the Shapiro-Wilk test in order to verify whether the variables were normal, due to the sample size, and the distribution was not normal. For the categorical variables the chi-square test was applied, and for the comparison of the three moments the Friedman test with Dunn's post-hoc was applied, adopting the 5% significance level throughout the statistical analysis.

## RESULTS

All participants (n=13) were from the state of São Paulo (100%), being 46.1% married, 38.4% single, and 15.2% divorced/widowed. As for education, 46% had complete higher education and 7.6% incomplete; 15.3% had completed high school and 7.6% incomplete; and 23% had incomplete elementary school.

Most participants reported having some comorbidity (53.8%), with diabetes mellitus (23%), heart disease (15.4%), obesity (15.4%), and high cholesterol (15.4%) being the most frequent. As for hospitalization, 77% of the participants were admitted to a public hospital, while 23% were admitted to a private hospital. Other data characterizing the sample are shown in Table 1.

Regarding the perception of quality of life after hospitalization, there was variation over the 6-month period (p=0.002), as shown in Figure 1.

As for perception of health after hospitalization, there was no variation over the 6-month period (p=0.195), as shown in Figure 2.

As for physical aspects, no difference was found in the perception of physical activity level (p=0.323) and fatigue (p=0.102), as shown in Figure 3.

Walking data, on the other hand, are presented in Figure 4.

Table 1. Participants' characterization data

| | Medium | SD |
|---|---|---|
| Age (years) | 49.3 | (±9.1) |
| Body mass (kg) | 86 | (±17.1) |
| Height (m) | 1.64 | (±8.2) |
| Number of individuals living in the same house | 2.69 | (±1.13) |
| Days at the ICU | 82.4 | (±18.8) |
| Days of hospitalization in infirmary | 59.9 | (±26.3) |

SD: standard deviation; ICU: intensive care unit.

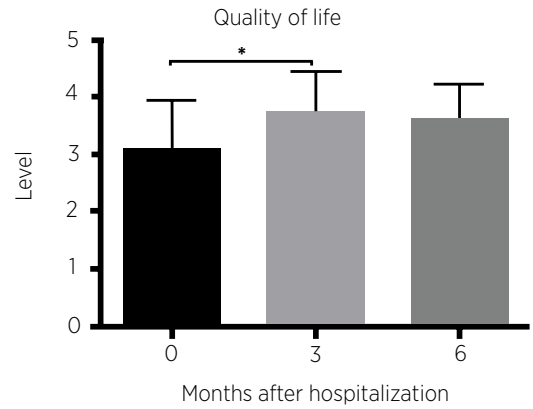


Figure 1. Perception of quality of life
*p<0.05.

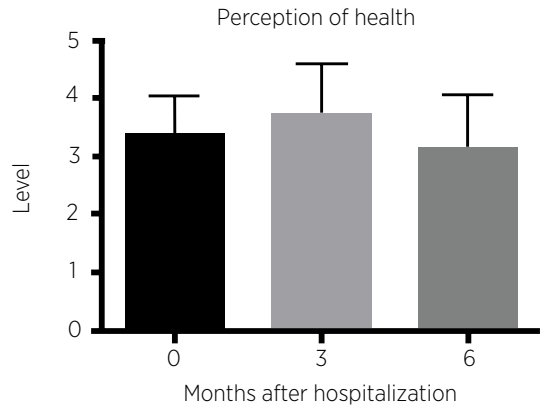


Figure 2. Perception of health

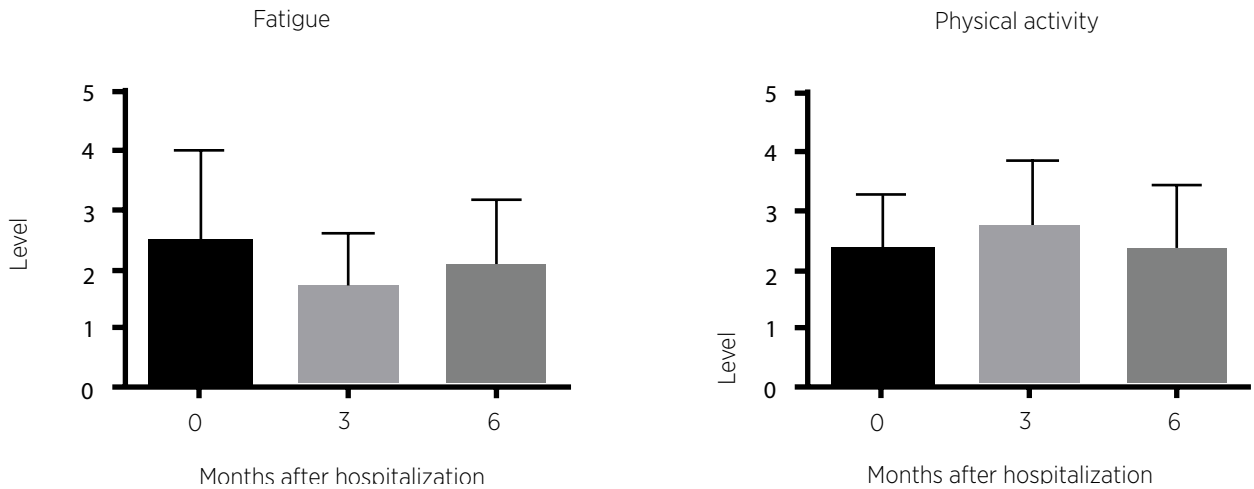


Figure 3. Perception of physical activity level and fatigue

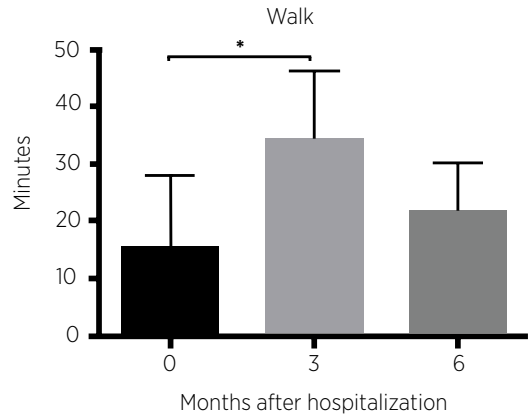


Figure 4. Walking time

*p<0.05.

## DISCUSSION

The hospitalization and complications resulting from COVID-19 may promote short and long-term sequela in survivors, which, however, are still not well understood[6]. In this study, participants were followed for a 6-month period, and the main results obtained were a significant increase in walking time after three months, and an improvement in perception of quality of life. In the first moment, right after the hospitalization period, the average walking time among participants was 15 minutes; in the third month it increased to 32 minutes; and in the sixth month there was a decline in the average walking time, falling to 22 minutes. In addition, there was an increase in the score of perception of quality of life, so that over the six months the average went from 3 (regular quality of life) to 4 (good quality of life).

Patients in this study, right after hospitalization, described their health as regular, and there was no variation in health perception over the 6-month period. Jacobs et al.[10] observed that the evaluation of general health post-COVID-19 is associated with the level of perception of health pre-COVID-19. That is, those who previously described their health level as excellent or good are more likely to indicate it as good or very good in the post-COVID-19 period. In addition, participants who required oxygen supplementation during hospitalization accounted for 58% among those who had a self-rated very good or excellent physical health pre-COVID but later reported poorer health.

Kingery et al.[6] found a worsening in the perception of health in 41.5% of the survey participants, noting that the more severe the disease, the greater the reported worsening. The authors also pointed out that the deterioration of health status, the persistence of symptoms, and the decline in tolerance to exertion were reported by most of the participants, not being homogeneous only among those who had comorbidities initially or a more severe level of COVID-19.

Strumiliene et al.[11] obtained similar results regarding health status, identifying in participants negative impacts on social activities due to physical, vitality, and general health problems. The findings of Anastasio et al.[12] corroborate these results; however, the researchers report that mental health was constantly referred to as normal by the respondents, although they experienced a long period of social isolation and absence of responses to the

general complications of COVID-19. In this sense, the importance of maintaining good health is demonstrated, as participants with better health status before the disease also reported better conditions during the period of recovery from COVID-19.

In this study, there was a significant increase in the score of the quality of life variable between the third and sixth month after hospitalization. In general, the quality of life of the study participants was affected by hospitalization, since it is associated with compromised physical, psychological, and emotional well-being, and may also affect the financial life. Demoule et al.[13] identified a worsening in the quality of life after admission of patients to the ICU over 12 months, and 7% of patients had significant loss of body mass; 27%, altered appearance of the neck skin; 22%, alteration in the voice; 25% started taking medication for depression or anxiety; and only 44% were able to return to work, but only part-time.

The study by Greco et al.[14] describes that the quality of life of people with higher socioeconomic status was higher than that of people with low socioeconomic status, among whom 47.4% had no income or a very low income, and 89.5% of the families received government assistance. This impact was caused by the COVID-19 pandemic and social isolation, worsening the quality of life and leaving families in vulnerable conditions. Thus, as participants lost quality of life due to the disease and hospitalization, their perception of quality of life increased.

Based on the results of this study, significant differences were noticed in the walking time, which showed a considerable increase in the third month against the immediate period after discharge. This finding differs from that of Baptista et al.[15], who found that more than one third of the participants had reduced exercise capacity three months after severe infection by COVID-19, associating this data to lung function and reduced skeletal muscle mass and function.

Also in their study, Baptista et al.[15] revealed that participants had a hidden reduced exercise capacity since they did not present clinical signs or even changes in the 6-minute walk test, the condition was only identified with a cardiopulmonary testing. Thus, the reduced walking time recorded in our study at the sixth month may be associated with this finding, since walking time alone is not enough to determine changes immediately after discharge or within three months.

Kingery et al.[6] also reported in their study a walking limitation in 22.1% of patients after almost one year of discharge from COVID-19 hospitalization. Huang et al.[16] followed 1,733 survivors of the disease for six months and found that among those who had a mean 6-minute walking distance lower than the expected values, on the COVID-19 severity scale 75% were between 3 (admitted to the hospital but without need for supplemental oxygen) and 6 (admitted with need for extracorporeal membrane oxygenation, invasive mechanical ventilation, or both), the results being proportional to the impairment of lung diffusion in these patients.

Over six months, no significant differences were identified in the patients' perceived level of physical activity, which remained as 'irregularly active,' as well as in the level of fatigue. These findings are consistent with those of Anastasio et al.[12], who identified a decrease in respiratory function and physical activity capacity in the participants of their study, with reduced oxygen saturation at rest and during the 6-minute walk test, especially among those who developed acute respiratory distress syndrome while in the acute phase. Some of the factors present in the acute phase that are related to reduced functional capacity post-COVID-19 are: the severity of pneumonia; the need for non-invasive mechanical ventilation during hospitalization; and worse partial saturation and inspired oxygen fraction ratio values[17].

Hazarika et al.[18] carried out the follow-up of patients after ICU discharge, studying separately those receiving invasive and non-invasive oxygen therapy, highlighting that patients receiving invasive mechanical ventilation present a long-term clinical condition with greater complications, such as abnormal pulmonary function, with noticeable changes in the spirometry, showing that these patients have a restrictive lung pattern in general.

Kingery et al.[6], in turn, reported that patients who have been hospitalized longer tend to have a greater impairment of functional capacity in the long term, mainly due to greater impairment of muscle strength. When associated with COVID-19, this reduction in functional capacity is worsened by chronic fatigue, a condition that did not exist before hospitalization. Strumiliene et al.[11] found similar results regarding the improvement of physical activity levels and fatigue. The authors reported that two months are not enough for significant and positive changes to occur in these symptoms, and after two months of follow-up, most

patients presented fatigue, dyspnea, asthenia, and reduced level of physical activity.

This study had some limitations. First, the type of instrument applied, intentionally built for the study, and its filling out, which was done online, made it difficult for participants with low socioeconomic status to access it, as well as for older adults to fill it out without the help of others. The second limitation is related to the sample: small, heterogeneous, and without a control group.

As for clinical implications, the study may favor the identification of post-COVID symptoms and complaints, especially those that require early and prolonged intervention, with influence in the different areas and dimensions associated with the patient's quality of life. In this sense, it may serve as a guide for the development of rehabilitation protocols for COVID-19 survivors in the short, medium, and long term. In this context, we highlight the importance of the participation of a multiprofessional team as a differential in rehabilitation procedures.

Future studies should assess in detail which areas and/or dimensions of the individual's life tend to remain altered after infection, and also which ones may be more resistant to multidisciplinary interventions in the post-COVID-19 period.

## FINAL REMARKS

The findings of this study show that patients submitted to hospitalization due to COVID-19 showed a reduction in the perception of quality of life and walking time right after hospitalization, but with a tendency to improve their health status sometime after hospital discharge. As for the perception of health, tiredness, and physical activity, the results show that despite the negative impact caused by the hospital stay, there was no significant variation over six months. In this sense, it is noticeable the need for these patients to be followed by health professionals in the long term to mitigate and minimize possible consequences and effects of hospitalization from COVID-19.

## ACKNOWLEDGMENTS

To the *Instituto Ânima* (IA) and the Coordination for the Improvement of Higher Education Personnel (Capes) Brazil.

## REFERENCES

1. World Health Organization. WHO Coronavirus (COVID-19) dashboard [Internet]. Geneva: WHO; [cited 2022 Apr 9]. Available from: http://covid19.who.int/.
2. Almeida MAB, Gutierrez GL, Marques RFR. Qualidade de vida: definição, conceitos e interfaces com outras áreas de pesquisa. São Paulo: EACH/USP; 2012.
3. Cascella M, Rajnik M, Aleem A, Dulebohn SC, Di Napoli R. Features, evaluation, and treatment of Coronavirus (COVID-19). Treasure Island: StatPearls Publishing; 2023.
4. Elhiny R, Al-Jumaili AA, Yawuz MJ. An overview of post-COVID-19 complications. Int J Clin Pract. 2021;75(10):e14614. doi: 10.1111/ijcp.14614.
5. Kerget B, Çelik E, Kerget F, Aksakal A, Uçar EY, et al. Evaluation of 3-month follow-up of patients with postacute COVID-19 syndrome. J Med Virol. 2022;94(5):2026-34. doi: 10.1002/jmv.27579.
6. Kingery JR, Safford MM, Martin P, Lau JD, Rajan M, et al. Health status, persistent symptoms, and effort intolerance one year after acute COVID-19 infection. J Gen Intern Med. 2022;37(5):1218-25. doi: 10.1007/s11606-021-07379-z.
7. Gardashkhani S, Ajri-Khameslou M, Heidarzadeh M, Rajaei Sedigh S. Post-intensive care syndrome in Covid-19 patients discharged from the intensive care unit. J Hosp Palliat Nurs. 2021;23(6):530-8. doi: 10.1097/NJH.0000000000000789.
8. Greve JMD, Brech GC, Quintana M, Soares ALS, Alonso AC. Impacts of COVID-19 on the immune, neuromuscular, and musculoskeletal systems and rehabilitation. Rev Bras Med Esporte. 2020;26(4):285-8. doi: 10.1590/1517-869220202604ESP002.
9. Alonso AC, Silva-Santos PR, Quintana MSL, Silva VC, Brech GC, et al. Physical and pulmonary capacities of individuals with severe coronavirus disease after hospital discharge: a preliminary cross-sectional study based on cluster analysis. Clinics (Sao Paulo). 2021;76:e3540. doi: 10.6061/clinics/2021/e3540.
10. Jacobs LG, Gourna Paleoudis E, Lesky-Di Bari D, Nyirenda T, Friedman T, et al. Persistence of symptoms and quality of life at 35 days after hospitalization for COVID-19 infection. PLoS One. 2020;15(12):e0243882. doi: 10.1371/journal.pone.0243882.
11. Strumiliene E, Zeleckiene I, Bliudzius R, Samuilis A, Zvirblis T, et al. Follow-up analysis of pulmonary function, exercise capacity, radiological changes, and quality of life two months after recovery from SARS-CoV-2 pneumonia. Medicina (Kaunas). 2021;57(6):568. doi: 10.3390/medicina57060568.
12. Anastasio F, Barbuto S, Scarnecchia E, Cosma P, Fugagnoli A, et al. Medium-term impact of COVID-19 on pulmonary function, functional capacity and quality of life. Eur Respir J. 2021;58(3):2004015. doi: 10.1183/13993003.04015-2020.
13. Demoule A, Morawiec E, Decavele M, Ohayon R, Malrin R, et al. Health-related quality of life of COVID-19 two and 12 months after intensive care unit admission. Ann Intensive Care. 2022;12(1):16. doi: 10.1186/s13613-022-00991-0.
14. Greco ALR, Silva CFR, Moraes MM, Menegussi JM, Tudella E. Impact of the COVID-19 pandemic on quality of life, health and income in families with and without socioeconomic risk: a cross-sectional study. Res Soc Dev. 2021;10(4):e29410414094. doi: 10.33448/rsd-v10i4.14094.

15. Baptista BR, D'Humières T, Schlemmer F, Bendib I, Justeau G, et al. Identification of factors impairing exercise capacity after severe COVID-19 pulmonary infection: a 3-month follow-up of prospective COVulnerability cohort. Respir Res. 2022;23:68. doi: 10.1186/s12931-022-01977-z.

16. Huang C, Huang L, Wang Y, Li X, Ren L, et al. 6-month consequences of COVID-19 in patients discharged from hospital: a cohort study. Lancet. 2021;397(10270):220-32. doi: 10.1016/S0140-6736(20)32656-8.

17. Lerum TV, Aaløkken TM, Brønstad E, Aarli B, Ikdahl E, et al. Dyspnoea, lung function and CT findings 3 months after hospital admission for COVID-19. Eur Respir J. 2021;57(4):2003448. doi: 10.1183/13993003.03448-2020.

18. Hazarika A, Mahajan V, Kajal K, Ray A, Singla K, et al. Pulmonary function, mental and physical health in recovered COVID-19 patients requiring invasive versus non-invasive oxygen therapy: a prospective follow-up study Post-ICU Discharge. Cureus. 2021;13(9):e17756. doi: 10.7759/cureus.17756.