

Recovery after covid-19: treatment program in an integrated rehabilitation center

Reabilitação pós-COVID-19: demandas dos pacientes e resultado da intervenção por equipe multidisciplinar

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ABSTRACT

Despite reaching clinical discharge criteria, patients with COVID-19 do not resume daily activities due to disability, and the rehabilitation process is of interest to health services and society. **Objective:** To describe the post-COVID-19 patient's level of functionality and the result of a multidisciplinary rehabilitation program. **Methods:** This is an observational, descriptive study with a quantitative analysis of assessments concerning demands and an interdisciplinary rehabilitation program. **Results:** 22 patients of both sexes with and mean age of 48.46 (± 12.63) years were included in the study. 81.8% of the participants had comorbidities and 95.5% were overweight or had some degree of obesity. All participants reported decreased QoL (SF36), and none of them reached the average distance expected for the 6-minute walk test (6MWT). Twenty patients presented dyspnea during daily activities and 21 had limitations on the Post-COVID Functional Status Scale-19 (PCFS). Twenty patients completed the rehabilitation program and the results of the baseline and discharge comparison showed significant differences in muscle strength ($p < 0.001$), peak flow Meter ($p < 0.001$), Berg Balance Scale ($p < 0.001$), Barthel Index ($p < 0.001$), and heart rate and distance during 6MWT ($p = 0.002$ and $p < 0.001$, respectively). The SF-36 differences from baseline to discharge for the General Health and Emotional Well-being domain were not significant ($p = 0.058$ and $p = 0.194$, respectively). Significant differences were found between the baseline and discharge scores of PCFS ($p < 0.001$) and dyspnea ($p < 0.001$). **Conclusion:** Our findings evidence that, at admission, physical disability had a greater correlation with the length of hospital stay and that an interdisciplinary rehabilitation process improves the functionality and QoL of the patient with COVID-19 sequelae.

Keywords: COVID-19, Rehabilitation Services, Physical Therapy Modalities, Occupational Therapy

RESUMO

Apesar de atingirem padrões de alta clínica, pacientes com COVID-19 não retomam as atividades cotidianas devido à incapacidade, sendo o processo de reabilitação de interesse dos serviços de saúde e sociedade. **Objetivos:** Descrever o nível de funcionalidade do paciente pós-COVID-19 e resultados de um processo de reabilitação multidisciplinar. **Métodos:** Estudo observacional, descritivo, de abordagem quantitativa, relativo à avaliação das demandas e processo de reabilitação interdisciplinar. **Resultados:** 22 pacientes participaram do estudo, idade 48,46 anos ($\pm 12,63$), 50% homens, sendo que 81,8% apresentavam comorbidades e 95,5% sobrepeso ou algum grau de obesidade. Todos apresentaram diminuição na QV (SF36) e não alcançaram a distância média esperada para o teste de 6 minutos, 20 pacientes apresentaram dispnéia para realizar as atividades cotidianas e 21 apresentaram limitação na Escala de Status Funcional pós-COVID-19 (PCSF). O resultado do processo de reabilitação com 20 pacientes, mostrou na comparação antes e depois, diferenças significativas na força muscular ($,000$) Peak Flow Meter ($,000$), Berg ($,000$), Barthel ($,001$), teste 6 minutos para frequência cardíaca ($,002$) e distância percorrida ($,000$). Na SF-36 para os domínios de Estado Geral da Saúde ($,058$) e Aspectos Emocionais ($,194$) a diferença não foi significativa. Para as variáveis ordinais houve diferença significativa para PCSF ($,000$) e dispnéia ($,000$). **Conclusão:** O estudo aponta que a incapacidade do paciente teve maior correlação na entrada do serviço com o tempo de internação e que um processo de reabilitação interdisciplinar melhora na funcionalidade e QV do paciente com sequelas de COVID-19.

Palavras-chaves: COVID-19, Serviços de Reabilitação, Modalidades de Fisioterapia, Terapia Ocupacional

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Submitted: July 25, 2021

Accepted: 23 February, 2022

How to cite

Crema CMT, Hummelgen E, Demogalski LCB, Cardoso L, Bauer C, Nickel R. Recovery after covid-19: treatment program in an integrated rehabilitation center. *Acta Fisiatr.* 2022;29(1):50-55.



10.11606/issn.2317-0190.v29i1a188822



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INTRODUCTION

At the end of 2019, a new coronavirus (SARS-COV-2) emerged, generating a global pandemic of a highly infectious and multi-systemic disease, the COVID-19, a recurrently severe disease that can be fatal. Many survivors demand specialized health care and may develop psychological, physical, and cognitive problems. Hence, there is an evident need for guidelines and planning for the physical rehabilitation of these survivors,^{1,2} which should establish the rehabilitation needs according to the dysfunctions presented. A Chinese study with 280 people found sleep disorders (63.6%), decreased resistance to activity (61.4%), and respiratory dysfunction (57.9%) as the primary physical sequelae among post-covid patients, whereas anxiety (62.1%) was the main psychological symptom.³

It was the end of July 2021 and Brazil summed more than 19,400,000 confirmed cases of COVID-19, 545,000 deaths, and 18,206,000 recovered patients.⁴ Considering these numbers about a disease with direct, indirect, and medium- and long-term health consequences, extensive economic and social impacts should be expected, as numerous active workers, including those in health-related areas, are being infected by the new coronavirus.⁵

In this context, providing the post-COVID-19 patients with a multi and interdisciplinary rehabilitation service, thoroughly assessing the functional demands and the result of the intervention is an emerging need for health services and the justification of this study.

OBJECTIVE

The main objective of this study was to describe the functional status of post-Covid-19 patients and the results of a multidisciplinary rehabilitation process.

METHODS

This study was designed as observational, descriptive, and quantitative and was conducted at the Rehabilitation Center of the Angelina Caron Hospital.

Patients who had a confirmed diagnosis of COVID-19 (RT-PCR or serological), away from the transmission period (>14 days and 72 hours without any symptoms), older than 18 years, and regardless of both sexes were eligible. The Research Ethics Committee of the Angelina Caron Maternity Hospital approved this study under protocol number 4,249,213.

Patients who agreed to participate in the study undertook a treatment protocol composed of three phases: baseline assessment, intervention, and post-treatment assessment at hospital discharge.

The baseline assessment phase comprised the evaluations of Muscle Strength (0 to 5), Barthel Index (BI), Post-COVID-19 Functional Status Scale (PCFS), Modified Medical Research Council Dyspnea Scale (mMRC), Modified Borg Scale (MBS), Berg Balance Scale (BBS), 6-Minute Walk Test (6MWT), Peak Flow test for expiratory assessment with Peak Flow Meter (PFM), and Short Form Health Survey 36 (SF-36).

The core rehabilitation team was composed of a Physiatrist, a Physical Therapist, and an Occupational Therapist (OT). Other professionals formed a support group, such as a Psychologist,

Speech therapist, Social Worker, and Nursing Technician.

The intervention flow comprised a medical visit with the Physiatrist, ten 45-minute physical therapy and/or occupational therapy sessions twice a week, and intervention sessions with the support team when necessary. After performing the defined intervention sessions, the team gathered in a meeting to assess the patient and decided on discharge, a new cycle of sessions, or referral to the Public Health System.

The main objectives of Physiotherapy were the rehabilitation of respiratory function and mobility. The interventions were based on breathing exercises and kinesiotherapy. Occupational Therapy focuses on the rehabilitation of personal care and recovery of daily routine, achieved with specific task training, daily reorganization, and use of assistive technology.

Rehabilitation sessions were individualized and took place in a specific facility, with a maximum of two patients at each scheduled time for each physical therapist, occupational therapy, or support team intervention delivered. Oxygen saturation, blood pressure, heart rate, and level of physical effort were evaluated before, during, and after the therapy sessions by the nursing team. The session was paused or terminated whenever a significant change in these indicators was observed.

The decision to discharge or continue the program was discussed during weekly meetings of the intervention team with the physiatrist or at the end of the pre-defined 10-session intervention protocol.

Patient care was conducted according to the standards and protection measures provided for by Technical Guidelines GVIMS/GGTES/ANVISA N 04/2020.⁶

Statistical analysis

The data collected in the study was quantitative, with nominal, ordinal, and numerical variables. The variables comprised the participants' demography, intervention process, and assessments. The data were described as frequency, distribution, and correlations, and the difference between the baseline and post-intervention assessments were tested with Wilcoxon statistics for paired samples.

RESULTS

This study was conducted between September 2020 and April 2021. According to the eligibility criteria, 28 patients were included. One participant died, five dropped out, and 22 finished the program, but only 20 participants performed all the revaluations. Figure 1 presents the flow of all participants' inclusion, exclusion, intervention, and assessments.

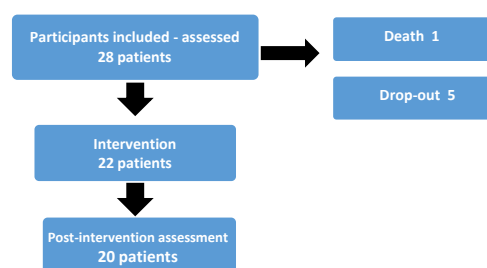


Figure 1. Chart of patients included and excluded

Given the sample loss, the description of baseline evaluations and the correlation between demographic variables and the post-COVID-19 functionality included the 22 participants. However, the intervention results and analysis were conducted with the 20 participants undertaking the entire protocol.

The participants mean age was 48.46 years (± 12.63), ranging from 19 to 76 years, and 50% of the sample was male patients. The Body Mass Index (BMI) analysis showed that 40.9% were overweight, 27.3% had grade I obesity, 22.7% had grade II obesity, 4.5% were underweight, and 4.5% had normal BMI.

Regarding comorbidities, 18.2% had diabetes, 13.6% had obesity and systemic hypertension combined. Half of the sample had a combination of comorbidities, and 18.2% reported no comorbidity.

Regarding the choice of clinical treatment during COVID-19 infection, 18.2% underwent home isolation, 18.2% stayed in the nursery, and 63.6% were admitted to the ICU. The mean length of hospital stay was 7.50 (± 1.91) days and 28 (± 12.21) days for nursery and ICU, respectively.

Four of the 22 participants received physical therapy only based on the functional demand. The others received physical therapy and occupational therapy combined. The mean number of physical therapy and occupational therapy sessions was 15.23 (± 7.80) and 10.82 (± 9.17), respectively, whereas the mean rehabilitation time was 55.86 (± 24.87) days. Regarding the support services, 12 participants were referred to Psychology and 4 to Speech Therapy. The support of the nursing team was constant throughout the rehabilitation process with all participants.

The initial analysis of body functions showed that the expiratory flow (PFM) ranged between 0 and 490. In this assessment, only one participant had higher flow when compared to the reference for age and height.

The level of dyspnea for performing activities of daily living (mMRC) showed that 9.1% of the participants had level 0, 27.3% had level 1, 18.2% had level 2, 22.7% had level 3, and 22.7% had level 4. Therefore, 20 participants presented some degree of dyspnea performing daily activities. Combined with the 6MWT, other variables were measured completing the test, such as the Modified Borg Scale (MBS), oxygen saturation, and heart rate. Regarding the perceived exertion, Figure 2 presents the median MBS, with scores ranging from the comfort zone, at the beginning of the evaluation, to a tolerated comfort zone, at the end of the 6MWT.

Figure 3 shows the mean variation of oxygen saturation (SatO₂) and cardiac rate during the 6MWT.

The assessment of daily activities performance, functionality, and quality of life (QoL) were analyzed respectively by the BI, PCSF, and SF36.

The BI showed that 8 participants were independent at baseline (score 100). Nine participants scored between 60 and 99 points, and five others scored below 60 points, indicating that most participants could live independently.

The PCSF scores evidenced that only one participant had no functional limitation (Grade 0), whereas two had negligible functional limitations (Grade 1), seven had slight functional limitations (Grade 2), four had moderate functional limitation (Grade 3), and eight had severe functional limitation (Grade 4).

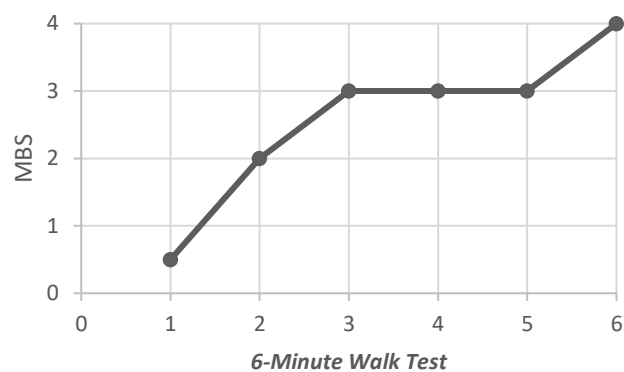


Figure 2. Median scores of Modified Borg Scale during 6-Minute Walk Test

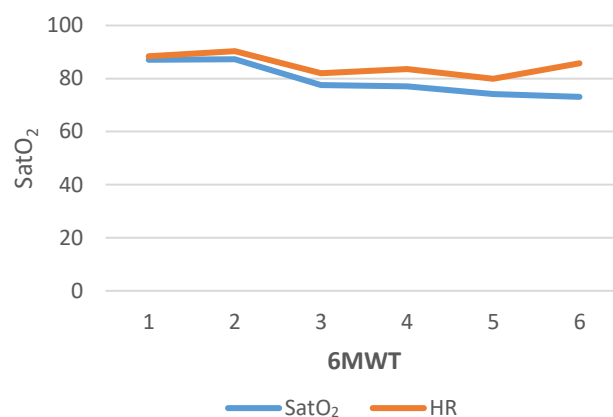


Figure 3. Mean oxygen saturation and heart rate variation during the 6-minute walk test

All participants underwent a decrease in QoL measured by SF36. The most affected domains were physical functioning (10.23), physical limitations (role functioning/physical) (37.27), and social functioning (42.18). The best scores were found in emotional well-being (63.64). The pain was evaluated within the SF-36 scale, reaching an average of 50.32 points, being one of the domains with the best score on the SF-36.

After the descriptive and frequency statistics, a correlation test was conducted between the numerical scales and demographic factors such as age and weight and clinical variables such as length of hospital stay. Due to the nonparametric distribution and the sample of 22 subjects, Spearman's rho correlation coefficient was used. Table 1 presents the results of the correlations.

The PCFS is an ordinal variable correlated with other numerical variables tested by Spearman's rho correlation coefficient. PCFS was associated with most evaluations presented, except for the MBS, a variable with a weak or very weak correlation with all the other evaluations. The MBS was collected in the sixth minute in the 6MWT.

Table 2 presents these correlations. As shown in Tables 1 and 2, there are important correlations between the variables. The interpretation is rated as inexistent or very weak correlation (0.00 to 0.19), weak correlation (0.20 to 0.39), moderate correlation (0.40 to 0.69), strong correlation (0.70 to 0.89), very strong correlation (0.90 to 1.00).

Table 1. Spearman correlation between numerical variables

Variables		Age	Weight	LoS	PFM	BBS	BI	6MWT	MBS
Age	rho	1	-0.306	0.108	-0.232	-.561**	-0.391	-0.325	-.556**
	p-value		0.633	0.633	0.3	0.007	0.072	0.139	0.007
Weight	rho	-0.306	1	0.244	.423*	0.286	-0.01	0.012	-0.088
	p-value	0.166		0.274	0.05	0.197	0.964	0.959	0.696
LoS	rho	0.108	0.244	1	-0.158	-.544**	-.664**	-.620**	-.448*
	p-value	0.633	0.274		0.482	0.009	0.001	0.002	0.036
PFM	rho	-0.232	.423*	-0.158	1	.542**	.607**	.431*	0.012
	p-value	0.3	0.05	0.482		0.009	0.003	0.45	0.957
BBS	rho	-.561**	0.286	-.544**	.542**	1	.783**	.783**	0.235
	p-value	0.007	0.197	0.009	0.009		0	0	0.293
BI	rho	-0.391	-0.01	-.664**	.607**	.783**	1	.790**	0.25
	p-value	0.72	0.0964	0.001	0.003	0		0	0.262
6MWT	rho	-0.325	0.012	-0.62	.434*	.783**	.790**	1	0.211
	p-value	0.139	0.959	.002-	0.045	0	0		0.346
MBS	rho	-.556**	-0.088	-.448*	0.012	0.235	0.25	0.211	1
	p-value	0.007	0.696	0.036	0.957	0.293	0.262	0.346	

LoS, length of hospital stay; PFM, Peak Flow Meter; BBS, Berg balance scale; BI, Barthel index; 6MWT, 6-Minute Walk Test; mBS, modified Borg scale; ** Statistical significance at level 0.01 (bilateral); * Statistical significance at level 0.05 (bilateral)

Table 2. Correlation of PCFS and MBS with other assessments

Variável		PCSF	mMRC	MBS	PFM	BI	6MWT
PCSF	rho	1	.471*	-0.342	-.472*	-.834**	-.753**
	p-value		0.027	0.119	0.026	0	0
mMRC	rho	.471*	1	0.025	.497*	-.678**	-.551**
	p-value	0.027		0.911	0.019	0.001	0.008

Interestingly, the following findings arise from the correlations:

- No correlation was found between age and length of stay;
- There is a moderate correlation between age and BBS (rho=-0.556; p=0.007). The negative sign indicates that the older the age, the lower the balance score, which could be expected given aging characteristics. However, the sign could also be expected to be positive for MBS (greater age, higher scores for shortness of breath), however it was the opposite. In order to provide a better description of this association, age analysis was conducted by quartiles of age subgroups. Among participants of the age group from 56.76 to 76 years old, only one participant had a score of 7 in the BMS, whereas 5 participants from 19 to 38.50 years old scored between 5 and 8 points;
- There was a moderate and positive correlation between weight and PFM (rho=0.423; p=0.050);
- The length of hospital stay showed correlations with BI (rho=-0.664; p=0.001), MBS (rho=-0.448; p=0.036), and 6MWT (rho=-0.620; p=0.002), all moderate and negative correlations, showing that the length of hospital stay had a substantial influence on disability;

- The expelled airflow velocity evaluated in the PFM had a moderate positive correlation with weight (rho=0.423; p=0.05), BI (rho=0.607; p=0.003), and the total distance during the 6MWT (rho=0.431; p=0.045).

PCSF was moderately correlated with mMRC (rho=0.471; p=0.027), moderately and negatively correlated with PFM (rho=-0.472; p=0.026), BI (rho=-0.834; p<0.001), and 6MWT total distance (rho=-0.753; p<0.001). Regarding mMRC, this assessment was moderately and positively correlated with PFM (rho=0.497; p=0.019), BI (rho=-0.687; p=0.001) and 6MWT total distance (rho=-0.551; p=0.008).

As described, the analysis evolution interventions results regard the 20 participants who concluded the study per protocol, and their results were analyzed by the Wilcoxon nonparametric statistical method.

Considering these 20 participants, 11 were male, with a mean age of 49.20 (±11.03) years and a mean length of hospital stay of 19.85 (±15.63) days. One participant was underweight, one had normal weight, seven was overweight, six had obesity grade I, and five had obesity grade II. All of them took Physiotherapy sessions, but only 17 took occupational therapy.

The mean rehabilitation period was 55.15 (±24.01) days, composed of an average of 16.20 (±7.36) physical therapy sessions and 11.85 (±8.98) occupational therapy sessions.

Numerical outcome variables collected before and after the interventions, such as PFM, BI, MBS, oxygen saturation and heart rate during the 6MWT, and the total distance achieved at the 6MWT were compared (Table 3).

Regarding SF36, the pain domain was evaluated at baseline, 51.75 (±35.37), and at discharge, 69.65 (±27.48), showing a significant statistical difference after the intervention (0.012, Wilcoxon test).

Table 3. Comparison of baseline and discharge assessments

Assessment	Baseline	Discharge	p-value
Peak Flow Meter	285 (±120,93)	430 (±99,52)	0
Barthel Index	74.75 (±21,40)	97.75 (±2,36)	0.001
Balance Berg Scale	39.95 (±30,23)	54.90 (±6,17)	0
6MWT SatO ₂	86.00 (±29,82)	98.05 (±2,66)	0.03
6MWT Heart rate	84.90 (±34,79)	111.35 (±15,59)	0.001
6MWT Total distance	229.63 (±147,27)	406.79 (±111,65)	0

As shown in Table 3, there is a significant difference between the variables after the rehabilitation program.

Regarding the ordinal variables, PCFS, mMRC, and MBS, Table 4 compares baseline and discharge results.

Table 4. Comparison of PCFS, mMRC, and MBS baseline and discharge results

Assessment	Baseline	Discharge	p-value
PCSF	2.70(±1.218)	.85(±.813)	0
mMRC	2.30(±1.380)	.25(±.716)	0
MBS	1.05(±1.276)	1.80(±1.881)	0.112

For the ordinal variables, the only one that did not have a significant difference between both time points was the MBS.

DISCUSSION

COVID-19 is associated with severe morbidity and considerably demands medical routine services due to the large influx of patients. A rehabilitation program must be started within the first 30 days (post-acute phase) to achieve better results,¹ positively impacting those services.

Dyspnea, fatigue, weakness, anosmia, nausea, and pain are the most frequent persistent post-COVID-19 symptoms, taking months to improve, impacting the quality of life even in non-hospitalized patients who have experienced moderate illness during the acute phase of the infection.⁷ In our study, even participants who underwent home isolation needed the rehabilitation service, corroborating the literature findings.

The length of hospital stay was one of the aspects closely correlated with the participants functional disability at baseline. The average length of hospital stay in the ICU was 28 (±15.51) days, being moderately correlated with BS, BI, 6MWT, and MBS. More severe injuries in different functioning domains are expected in patients with prolonged treatment.⁸

Considering the comorbidities, Sheehy cites that the most common diseases among COVID-19 are hypertension (55%), coronary heart disease and stroke (32%), and diabetes (31%). Huang et al. described hypertension as the most common comorbidity among these patients.^{9,10}

In our study, only 18.2% of the participants had no comorbidities, whereas 27.3% had obesity, 18.2% had diabetes, and 13.6% had obesity and systemic hypertension combined. Other patients had a combination of comorbidities, and the mean age of this group was 48.46 (±12.63) years.

Regarding BMI, a study by Sonnweber et al. found that 61% of participants were overweight or obese. In our evaluation, 40.9% were overweight, 27.3% had grade I obesity, and 22.7% had grade II obesity.¹¹

In a study on disability in the Brazilian population, conducted with 1.451 older adults, dependence for activities of daily living and instrumental activities of daily living of 36% and 34% were reported, respectively.¹² Leite et al.¹³ found dependence for ADLs and IADLs among 38.9% and 84.6% of patients in ICU, and 27.3% and 74.5% in the nursery, respectively. According to the BI assessment of our study, eight participants were independent (100 points), nine scored between 60 and 99 points, and five scored below 60 points.

Regarding the 6MWT, the reduction in the distance among patients with a history of SARS is already described in the literature, as demonstrated by Herridge et al.¹⁴ in 2011. None of the participants reached the expected distance in our study, and only two reached the minimum expected limit for the total distance performed in the test.

Regarding the mMRC, an assessment that evaluates the limitation imposed by dyspnea on activities of daily living, our study found 20 participants with some degree of dyspnea, 27.3% with level 1, 18.2% with level 2, and 22.7% of the participants were classified as level 3 or 4, with baseline average of 2.3 points. At discharge, the mean mMRC was 0.25.

An Italian study evaluated 32 patients in a rehabilitation center and all participants ranked 4 or 5 at mMRC at baseline.¹⁵

Oppositely, an Austrian study reported that only 2% and 4% had severe dyspnea in the mMRC with 3 and 4 points, respectively, after discharge. A Norwegian study obtained scores above 0 and 1 in 52 (56%) and 22 (24%) patients at baseline, respectively. Three months after discharge, scores above 0 and 1 were found in 37 (54%) and 13 (19 %) patients, respectively,¹⁶ demonstrating the evolution of the dyspnea symptom.

There is still no consensus on the best tool for assessing functional capacity in COVID-19. In Italy, a case study of rehabilitation intervention with 1 to 2 30-minute daily sessions, six days a week, progressive physical exercises, and the patients' evolution assessment showed improvements in the MBS scale and 6MWT. At admission, the physical performance of these patients was low (6MWT mean distance of 172.9±64.1m). Their group also reported a case where the total 6MWT was 120m at baseline, reaching 306m at discharge, with MBS going from 7 to 2 at baseline and discharge assessments, respectively.¹⁷

In our study, the mean 6MWT distances at baseline and discharge were 229.63m and 406m, respectively, and one of our patients improved the MBS from 8 to 0.

Studies are not yet specific regarding disability levels for ADLs and physical tests, nor is the best data on these issues to provide a better understanding of COVID-19 in association with functionality.

The PCFS results regarding the level of functionality after the intervention showed a significant improvement as its median started at 3 (total variation between 0 and 4 points), defined as a moderate functional limitation, and finished at 1 (total variation between 0 and 2 points), a negligible functional limitation. In a study developed by Imamura et al.¹⁸ a clear trend toward improvement in PCFS was observed in patients under a rehabilitation program. These results show that the PCFS can be a meaningful outcome variable to measure the results of a rehabilitation program.

One of the main limitations of this study is the small number of participants and the lack of some important data that was not collected. According to the referrals from the support team, there was an evident need for more information on emotional domains such as anxiety and depression, a cognitive screening scale, assessments for voice, speech, and swallowing functions, and a more specific assessment of pain.

CONCLUSION

This study demonstrated that disability is mainly correlated with the length of hospital stay and that an interdisciplinary rehabilitation process can help post-COVID patients to resume their daily activities with improved functionality and quality of life.

New and extensive studies should be conducted on the rehabilitation of the post-COVID patient, as the disabilities shown by our results are found in all components of the biopsychosocial model, generating, as expected in all rehabilitation processes, the need for an intervention, not only interdisciplinary and multidisciplinary but intersectoral, enabling the individual to exercise their citizenship thoroughly.

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