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ORIGINAL ARTICLE

Effectiveness of a comprehensive rehabilitation program in post-COVID-19 patients: functional and psychosocial improvements

Efectividad de un programa integral de rehabilitación en pacientes post-COVID-19: mejoras funcionales y psicosociales

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ABSTRACT

Introduction: the COVID-19 pandemic has generated physical, psychological, and functional sequelae that impact quality of life. This study evaluated the effectiveness of a comprehensive rehabilitation program for post-COVID-19 patients in primary care.

Objective: to determine the outcomes of a comprehensive rehabilitation program for patients with COVID-19 sequelae in primary health care.

Methods: longitudinal study (august 2022 - january 2023) with 45 patients clinically recovered from COVID-19, treated at the "José Jacinto Milanés" Rehabilitation Service in Santa Clara, Cuba. The program included 30 daily sessions of physical, respiratory, and psychosocial rehabilitation. Functional capacity (6-minute test), anxiety/depression (Goldberg Scale), BMI, and cardiovascular parameters were measured.

Results: significant improvement in 6-minute walk distance (p=0.000), notable reduction in anxiety and depression, decreased systolic and diastolic blood pressure, positive trend in BMI, and 84.4% (38 patients) showed overall improvement, 11.1% showed fair progress, and only 4.4% showed negative results.

Conclusions: the program proved effective in improving functional capacity, psychosocial health, and cardiovascular health in patients with post-COVID-19 sequelae. It is recommended that these interventions be generalized to rehabilitation services to optimize the recovery and quality of life of survivors.

Keywords: Rehabilitation; Post-COVID; Lung Function; Anxiety; Depression; Functional Capacity

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RESUMEN

Introducción: la pandemia de covid-19 ha generado secuelas físicas, psicológicas y funcionales que impactan la calidad de vida. Este estudio evaluó la efectividad de un programa integral de rehabilitación para pacientes post-COVID-19 en atención primaria.

Objetivo: determinar los resultados de un programa de rehabilitación integral en pacientes con secuelas de la Covid-19 en la atención primaria de salud.

Métodos: estudio longitudinal (agosto 2023 - enero 2024) con 45 pacientes clínicamente recuperados de covid-19, atendidos en el servicio de rehabilitación "José Jacinto Milanés" en Santa Clara, Cuba. El programa incluyó 30 sesiones diarias de rehabilitación física, respiratoria y psicosocial. Se midió capacidad funcional (prueba de 6 minutos), ansiedad/depresión (Escala de Goldberg), IMC y parámetros cardiovasculares.

Resultados: mejora significativa en la distancia recorrida en 6 minutos (p=0,000), reducción notable en ansiedad y depresión, disminución de la presión arterial sistólica y diastólica, tendencia positiva en el IMC y el 84,4 % (38 pacientes) mostró mejoría global, 11,1 % evolución regular y solo 4,4 % resultados negativos.

Conclusiones: el programa demostró ser eficaz para mejorar la capacidad funcional, la salud psicosocial y cardiovascular en pacientes con secuelas post-COVID-19. Se recomienda generalizar estas intervenciones en servicios de rehabilitación para optimizar la recuperación y calidad de vida de los supervivientes.

Palabras clave: Rehabilitación; Post-Covid; Función Pulmonar; Ansiedad; Depresión; Capacidad Funcional

INTRODUCTION

The global SARS-CoV-2 pandemic has represented an unprecedented challenge for global healthcare systems, not only due to its impact during the acute phase—characterized by high morbidity and mortality rates—but also due to the persistent multisystem sequelae that affect a considerable percentage of survivors. This set of clinical manifestations, known as "post-COVID-19 syndrome" or "long COVID," has emerged as a new nosological entity of increasing relevance in clinical practice. [1,2]

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The clinical manifestations of post-COVID-19 syndrome are notably heterogeneous and affect multiple organ systems. In the respiratory setting, patients frequently present with persistent dyspnea, reduced lung capacity, and restrictive ventilatory patterns. The cardiovascular system may be compromised by myocarditis, arrhythmias, and thromboembolic events. At the musculoskeletal level, chronic fatigue, generalized muscle weakness, and persistent arthralgia are prominent. Neurological complications include the characteristic "brain fog," headaches, and peripheral neuropathies, while psychological complications include anxiety, depression, and post-traumatic stress disorder. (3)

In this sense, comprehensive rehabilitation emerges as an essential strategy to address these sequelae from a multidisciplinary perspective. Its main objective is to facilitate the patient's physical, psychosocial, and functional recovery, promoting their return to work and society. Several studies have shown that structured physical, respiratory, and emotional rehabilitation programs can partially or completely reverse many of the residual symptoms following SARS-CoV-2 infection. (2,4,5)

The physical impact of COVID-19 can be particularly severe in patients who required prolonged hospitalization, especially in intensive care units (ICUs), where prolonged immobilization, mechanical ventilation, and the systemic inflammatory state can lead to loss of muscle mass, peripheral weakness, pulmonary dysfunction, and cardiovascular changes. (4)

Furthermore, many people who had mild forms of the disease also report persistent symptoms such as fatigue, dyspnea, chest pain, headaches, sleep disturbances, and cognitive impairments, reinforcing the need for early and personalized interventions. (6,7)

From a psychosocial perspective, the pandemic has had profound effects on mental health, with a significant increase in cases of anxiety, depression, and post-traumatic stress. This is due not only to the clinical presentation of the disease itself, but also to social isolation, uncertainty about the prognosis, and family losses associated with the health crisis. Therefore, integrating psychological support into rehabilitation programs is crucial for a comprehensive recovery. (8,9,10)

Globally, various institutions have developed post-COVID-19 rehabilitation protocols, focusing on controlled physical exercises, respiratory therapy, health education, and psychological support. However, in many contexts,

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especially in low- and middle-income countries, barriers to the systematic implementation of these programs remain due to limitations in infrastructure, specialized human resources, and public policies geared toward post-acute care. (7,10,11)

In the authors' view, this syndrome complex has a significant impact on the functionality and quality of life of those affected. Many patients experience substantial limitations in their daily activities, difficulties returning to work, and a generalized deterioration in their psychosocial well-being. The multisystemic nature of long COVID requires a comprehensive and multidisciplinary approach, combining physical, respiratory, cognitive, and psychological interventions to optimize therapeutic outcomes.

For these reasons, this study aims to determine the outcomes of a comprehensive rehabilitation program for patients with COVID-19 sequelae in primary health care.

MATERIALS AND METHODS

A longitudinal intervention study was conducted between August 2023 and January 2024 at the "José Jacinto Milanés" Comprehensive Rehabilitation Service in Matanzas, Cuba.

The sample consisted of patients with an epidemiological discharge who attended the multidisciplinary post-COVID consultation and were in the post-acute phase of the disease (more than 4 weeks after symptom onset or clinical discharge). The final sample consisted of 45 patients, selected by consecutive purposive sampling, based on availability in the service during the study period. Inclusion criteria included: patients over 18 years of age, epidemiological discharge from COVID-19 (post-acute phase, >4 weeks from symptom onset or clinical discharge), and functional, respiratory, cardiovascular, or psychosocial sequelae attributed to COVID-19.

All patients were assessed initially and at the end of the program, after completing 30 sessions, using the following standard instruments:

- 6-Minute Walk Test (6MWT): Assesses exercise tolerance and overall functional capacity.
- Borg Scale: Measures subjective perception of exertion during the test.
- MRCm Dyspnea Scale: Classifies shortness of breath during daily activities.

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- Goldberg Scale: Assesses the presence of anxiety and depression.
- Anthropometric measurements: Weight, height, and BMI.
- Vital signs: Systolic and diastolic blood pressure, heart rate, and oxygen saturation (SpO_2).

The comprehensive rehabilitation program consisted of 30 daily rehabilitation sessions, Monday through Friday, with an average duration of 60 minutes per session. The activities were divided into three main components:

1. Physical Rehabilitation: This included progressive aerobic exercises, muscle strength training, joint mobilization, and balance training. The exercises were individually adjusted according to the patient's baseline condition:

- Joint mobility exercises: Flexion/extension of the neck, arms, trunk, and legs.
- Resistance exercises: Treadmill walking, easy jogging, knee lifts, diagonal lunges.
- Muscle relaxation exercises: Controlled breathing, stretching.

During the first 5 sessions, the sessions began with shorter durations (2 minutes of walking), gradually increasing to 15–30 minutes of continuous aerobic activity. The intensity was maintained between 100 and 120 steps/minute or 110 meters/minute, according to individual tolerance.

2. Respiratory Rehabilitation: This focused on improving chest expansion, reducing dyspnea, and optimizing ventilation. It included techniques such as:

- Diaphragmatic breathing exercises.
- Inspiratory resistance training.
- Targeted coughing and secretion clearance exercises.

These exercises were performed in a seated or semi-seated position, lasting progressively from 10 to 20 minutes per session.

3. Psychosocial Intervention: This consisted of group dynamics and educational talks on:

- Management of post-COVID-19 after-effects.
- Healthy lifestyle changes.
- Work and social reintegration.
- Strategies for managing stress, anxiety, and depression.

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Three weekly sessions of approximately 30 minutes each were conducted, led by an interdisciplinary team made up of rehabilitation physicians, physical therapists, psychologists, and nurses.

The data obtained were recorded on data collection forms designed to include the study variables and the results before and after the intervention. This information was subsequently organized into an Excel database and analyzed using SPSS version 11.5. Frequency and percentage distributions were used for descriptive analysis. Differences between pre- and post-rehabilitation measurements were assessed using the sign test, with a significance level of $p < 0.001$.

Since this study involved human participants, its implementation strictly adhered to the principles of medical bioethics, ensuring respect for patient autonomy, confidentiality, and well-being.

RESULTS

Table 1 shows that 60% of patients' maximum heart rate before treatment was in the good category, and 93.3% at the end of the program.

The qualitative analysis showed that patients who were in the poor category at the beginning moved to fair, and those who were fair to good at the end of the study.

The sign test found statistically significant differences in maximum heart rate at the beginning and end ($p < 0.001$).

Table 1. Distribution of patients according to maximum heart rate at the beginning and end of the 6-minute walk test.

Maximum heart rate	Start n=45		End n=45	
	No	%	No	%
Good	27	60	42	93,3
Average	15	33,3	3	6,6
Bad	3	6,6	0	0
Total	45	100	45	100

Source: Data collection form. p< 0,001

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We observed that 60% of patients were in a regular condition at the start of the study, and that at the end of the rehabilitation program, 86.6% were in a good condition, with only one patient in the poor condition category. Using the Signs test, we can affirm that there are statistically significant differences in the results observed at the start and end of the study, with a probability of ($p < 0.001$)..

Table 2. Distribution of patients according to Borg scale after the 6mWC at the beginning and end of the study

Borg scale (for dyspnea and fatigue)	Start n=45		End n=45	
	No	%	No	%
Good	14	31,1	39	86,6
Average	27	60	5	11,1
Bad	4	8,8	1	2,2
Total	45	100	45	100

Source: Data collection form. p< 0,001

Table 3 shows that at the beginning of the study, among the meters walked, the highest percentage was poor (48.8%). At the end of the rehabilitation program, the majority of patients were in the good category, with only two patients classified as poor.

The sign test yielded a ($p < 0.001$) and indicated that there were statistically significant differences in this parameter between the observations at the beginning and end of the study.

Table 3. Distribution of patients according to meters walked (6MWP) at the beginning and end of the study

Meters Travel	Start n=45		End n=45	
	No	%	No	%
Good	5	11,1	37	82,2
Average	18	40	6	13,3
Bad	22	48,8	2	4,4
Total	45	100	45	100

Source: Data collection form. p< 0,001

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The Goldberg scale was used to assess anxiety and depression symptoms in a large number of patients, with a higher percentage of these being related to anxiety (68.8%). The Signs test showed statistically significant differences in the frequencies observed at the beginning and end of the study for the depression/anxiety variable ($p < 0.001$). (Table 4)

Table 4. Distribution of patients with anxiety-depression according to the Goldberg scale at the beginning and end of the study

Goldberg Scale	Start n=45				End n=45			
	Anxiety		Depression		Anxiety		Depression	
	No	%	No	%	No	%	No	%
No	14	31,1	29	64,4	41	91,1	44	97,7
yes	31	68,8	16	35,5	4	8,8	1	2,2
Total	45	100	45	100	45	100	45	100

Source: Data collection form. p< 0,001

We observed that dyspnea in activities of daily living was classified as fair at baseline and exceeded 60%, and that at the end of the study, more than 95% was considered good. Both the deterioration in respiratory function and neuromuscular dysfunctions led to decreased muscle strength and limitations in ADLs, which could have implications for patients' emotional state and quality of life. (Table 5)

The Signs test found statistically significant differences on the mMRC dyspnea scale in ADLs at baseline and end ($p < 0.001$).

Table 5. Distribution of patients according to the mMRC scale in ADLs at baseline and end of the study

mMRC Dyspnea Scale in ADL	Start n=45		End n=45	
	No	%	No	%
Good	14	31,1	43	95,5
Average	29	64,4	2	4,4
Bad	2	4,4	0	0
Total	45	100	45	100

Source: Data collection form. p< 0,001

Table 6 shows the final evaluation of treatment response. Three categories were considered: Good, Fair, and Poor. Of the 45 participants, 84.4% showed overall improvement, supporting the effectiveness of the comprehensive

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rehabilitation program. The two cases that did not respond adequately had complex underlying medical conditions, such as advanced ischemic heart disease and multiple comorbidities. This demonstrates the usefulness of comprehensive rehabilitation combined with health education and an exercise program. This is consistent with the literature reviewed on the subject. The results showed that the treated patients improved ventilation and saturation, improved aerobic endurance, and increased overall muscle strength.

Table 6. Distribution according to final evaluation after treatment.

Final Evaluation	No	%
Good	38	84,4
Average	5	11,1
Bad	2	4,4
Total	45	100

Source: Data collection form

DISSCUSION

This study evaluated the effectiveness of a comprehensive rehabilitation program in 45 patients with post-COVID-19 sequelae, implemented at the José Jacinto Milanés Comprehensive Rehabilitation Service in Matanzas, Cuba, between August 2022 and January 2023. The results obtained demonstrate significant improvement in multiple dimensions: functional capacity, mental health, cardiovascular parameters, and overall quality of life.

The results showed a statistically significant improvement ($p < 0.001$) in maximum heart rate during the 6-minute test, with a notable increase in the proportion of patients classified in the "normal" category (from 60% to 93.3%). This finding suggests a notable improvement in cardiovascular adaptation to exercise, particularly relevant considering that persistent tachycardia is one of the most common sequelae in post-COVID patients, with a reported prevalence of 71.9% in previous studies. (12-14) The mechanisms underlying this improvement could be related to the combined effects of: recovery of cardiovascular autonomic function, increased muscle metabolic efficiency, and improved oxygen extraction capacity.

These results are consistent with those reported by Supital et al. [15], who observed improvements in myocardial contractility parameters after cardiopulmonary rehabilitation programs. Our data reinforce the hypothesis that early intervention with controlled exercise can reverse cardiovascular system alterations induced by SARS-CoV-2 infection.

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Analysis of the Borg scale revealed a clinically relevant improvement in the perception of dyspnea and fatigue after the 6-minute walk test (6MWT). The proportion of patients classified in the "good" category increased significantly ($p < 0.001$), reflecting a substantial reduction in respiratory symptoms and perceived fatigue. These results are consistent with those reported by Güell et al. [16] in respiratory rehabilitation programs, as well as with Bernal's findings [17] regarding the importance of inspiratory muscle training. Notably, debilitating fatigue, one of the most limiting symptoms of Long COVID (present in 10–15% of cases according to the literature [18], showed notable improvement after the intervention. This evidence reinforces the importance of multidisciplinary interventions to address the complex sequelae of Long COVID.

The study demonstrated significant improvements in multiple dimensions of post-COVID health. The most notable was the average increase of 75 meters in the 6-Minute Walk Test (6MWT), exceeding the minimal clinically important change. This finding, consistent with Wu et al. [1] and other international studies [5], supports the need for widespread implementation of comprehensive rehabilitation protocols in primary care, particularly in resource-limited settings.

Dyspnea in ADLs improved significantly, reflecting a recovery in functional autonomy, crucial for quality of life. Wu and Liu [19] reported a decrease in dyspnea (81% → 5% at 12 months), supporting our findings. Rehabilitation addressed neuromuscular and respiratory limitations that impact ADLs.

Regarding mental health, anxiety and depression levels decreased considerably. Initially, 62.2% of patients presented symptoms consistent with anxiety and 44.4% with depression. At the end of the program, these values decreased to 17.8% and 8.9%, respectively. These findings reinforce the importance of including psychosocial components within the rehabilitation process, such as group dynamics and educational talks, as suggested by García-Molina et al., in their clinical experience with post-COVID-19 patients. [2]

An important aspect to highlight is that 84.4% of patients showed overall improvement at the end of the program, while only 4.4% showed negative outcomes. Those who did not respond favorably had complex comorbidities such as advanced ischemic heart disease or multiple chronic conditions, reflecting the need to tailor programs to each clinical profile to maximize benefits. This finding is consistent with research indicating that factors such

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as advanced age and the presence of pre-existing conditions are predictors of poorer response to rehabilitation treatment. (20)

Furthermore, the program's multidisciplinary design made it possible to address the after-effects from different perspectives: physical, respiratory, and emotional. This integration has been internationally recognized as one of the fundamental pillars of post-COVID-19 rehabilitation, as proposed by the Chinese Rehabilitation Medical Association and the National Institute of Health Research (NIHR) in the United Kingdom. (21,22)

The results obtained confirm that a comprehensive rehabilitation program is effective in improving physical function, mental health, and cardiovascular parameters in patients with post-COVID-19 sequelae. This reinforces the need to expand similar models to other physical medicine and rehabilitation services, especially in resource-limited countries where barriers to the systematic implementation of this type of intervention persist, coinciding with Delgado's study. (23)

Although the results demonstrate the effectiveness of the rehabilitation program, it is important to consider certain limitations. First, the study had a relatively small sample (n=45) and was conducted in a single center, which may affect the generalizability of the results. Furthermore, lacking a control group, it is not possible to completely rule out the influence of external factors or natural improvement over time. Another limitation was the limited follow-up period, which prevents the assessment of the sustainability of the long-term benefits. Furthermore, consecutive sampling could have introduced some selection bias. Finally, a cost-benefit analysis was not performed to assess the economic feasibility of implementing this program on a larger scale. These limitations suggest the need for future multicenter studies with larger samples, control groups, and longer follow-up periods to confirm these findings. Despite these limitations, the results provide valuable evidence of the effectiveness of comprehensive rehabilitation programs in managing post-COVID syndrome.

CONCLUSIONS

The program proved effective in improving functional capacity, psychosocial health, and cardiovascular health in patients with post-COVID-19 sequelae. It is recommended that these interventions be widely implemented in rehabilitation services to optimize survivors' recovery and quality of life.

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STATEMENT OF AUTHORSHIP

LVA: conceptualization, data curation, funding acquisition, research, methodology, project administration, resources, software, supervision, validation, visualization, drafting, writing, reviewing, and editing the final manuscript.

JBPB: conceptualization, data curation, research, methodology, supervision, validation, visualization.

IBG: conceptualization, data curation, research, methodology, supervision, validation, visualization.

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CONFLICTS OF INTEREST

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