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# Clinical and functional independence differences in post-COVID-19 patients with and without stay in intensive care

## Diferencias clínicas y de funcionalidad en pacientes pos-COVID-19 con y sin estancia en cuidados intensivos

Jhonatan Betancourt-Peña,* Valeria Perez-Hortua,[‡,§] Jenifer Rodríguez-Castro,[¶] Juan Carlos Ávila-Valencia,*[,||] Vicente Benavides-Córdoba[‡]

*Facultad de Salud y Rehabilitación, Institución Universitaria Escuela Nacional del Deporte. Cali, Colombia; [‡]Facultad de Salud, Universidad del Valle; [§]Grupo de Investigación Ejercicio y Salud Cardiopulmonar, Cali, Colombia; [¶]Fundación Universitaria de Ciencias de la Salud, Bogotá, Colombia. Semillero de Investigación Cardiorrespiratorio, Cali, Colombia; [||]Clínica de Occidente S.A., Cali, Colombia.

**ABSTRACT. Introduction:** people with COVID-19 can develop multisystemic complications that require hospitalization and sometimes admission to the intensive care unit, causing cognitive impairment, functional compromise, increased anxiety and depression. **Objective:** to describe the sociodemographic, clinical and functional differences, functional independence and anxiety/depression in post-COVID-19 patients with and without intensive care unit stay. **Material and methods:** observational study in patients with a diagnosis of COVID-19 confirmed by real-time polymerase chain reaction (RT-PCR) test who required hospital management in the year 2021. All participating patients signed the informed consent form. Sociodemographic and clinical variables, fatigue, dyspnea, functional independence and anxiety/depression were taken into account. Two groups were formed for the analysis, one group with ICU stay (stay longer than 72 hours) and another group without ICU stay. $\chi^2$ test and t-test for independent samples were used and a statistically significant p-value $< 0.05$ was obtained. **Results:** there were 112 patients with an average age of 51 years old, mostly female (61.6%). The 71.4% required stay in ICU presenting greater comorbidities, number of days hospitalized and use of invasive mechanical ventilation value-p-value $\leq 0.05$. Functional independence presented a mean difference in the constant care domain $0.525 \pm 0.208$ p-value $= 0.013$ and daily activities mean difference $0.575 \pm 0.212$ p-value $= 0.008$ presenting greater limitation in the group with ICU stay. **Conclusion:** post COVID-19 patients with ICU stay present greater comorbidities, use of invasive mechanical ventilation and require more days in hospital; in turn, these patients presented greater limitations in functional independence with the PCFS scale.

**RESUMEN. Introducción:** personas con COVID-19 pueden desarrollar complicaciones multisistémicas que requieren hospitalización y en ocasiones ingresar a la unidad de cuidados intensivos, ocasionando deterioro cognitivo, compromisos funcionales, mayor ansiedad y depresión. **Objetivo:** describir las diferencias clínicas y de funcionalidad en pacientes pos-COVID-19 con y sin estancia en la unidad de cuidados intensivos. **Material y métodos:** estudio observacional en pacientes con diagnóstico de COVID-19 confirmados por prueba de reacción en cadena de polimerasa en tiempo real (RT-PCR) que requirieron manejo hospitalario en el año 2021. Todos los pacientes participantes firmaron el consentimiento informado. Se tuvo en cuenta variables sociodemográficas, clínicas, fatiga, disnea, independencia funcional y ansiedad/depresión. Se conformaron dos grupos para el análisis, un grupo con estancia en la unidad de cuidados intensivos (estancia mayor a 72 horas) y otro grupo sin estancia en la unidad de cuidados intensivos. Se utilizó la prueba $\chi^2$ y la prueba t para muestras independientes; se consideró un valor de $p < 0.05$ como estadísticamente significativo. **Resultados:** se vincularon 112 pacientes con edad promedio de 51 años, en su mayoría mujeres (61.6%). El 71.4% requirió estancia en la unidad de cuidados intensivos, presentando mayores comorbilidades, número de días hospitalizados y uso de ventilación mecánica invasiva ($p \leq 0.05$). La independencia funcional presentó una diferencia de medias en el dominio de cuidado constante $0.525 \pm 0.208$ ($p = 0.013$) y actividades diarias diferencia de medias $0.575 \pm 0.212$ ($p = 0.008$), presentando mayor limitación en el grupo con estancia en la unidad de cuidados intensivos. **Conclusión:** pacientes pos-COVID-19 en la unidad de cuidados intensivos presentan mayores comorbilidades, uso

*Correspondence:*
**Valeria Perez-Hortua, MD**
Facultad de Salud, Escuela de Rehabilitación Humana, Universidad del Valle. Cali, Colombia.
**E-mail:** valeriaperezhortua35@gmail.com

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de ventilación mecánica invasiva y requieren más días hospitalizados; estos pacientes presentaron mayores limitaciones en la independencia funcional de acuerdo con la Escala de Estado Funcional pos-COVID-19.

**Keywords:** COVID-19, post-COVID conditions, functional status, intensive care unit, symptoms.

**Palabras clave:** COVID-19, condiciones pos-COVID, estado funcional, unidad de cuidados intensivos, síntomas.

**Abbreviations:**

COVID-19 = Coronavirus disease 2019.
FAS = Fatigue Assessment Scale.
HADS = Hospital Anxiety and Depression Scale.
mMRC = Modified Medical Research Council scale.
PCFS = Post-COVID-19 Functional Status Scale.
ARDS = Acute Respiratory Distress Syndrome.
ICU = Intensive Care Unit.
IMV = Invasive Mechanical Ventilation.

## INTRODUCTION

People with COVID-19 can develop major complications such as acute respiratory failure, acute respiratory distress syndrome (ARDS), acquired muscle weakness, delirium, neurological syndromes, and multi-organ dysfunction.[1,2] Between the year 2019 and 2020, Raymond et al. in their systematic review estimate that 12,437 patients with COVID-19 were admitted to the Intensive Care Unit (ICU); of these, 6,857 required invasive mechanical ventilation (IMV), with an average hospital stay of 7.78 days and 10.12 days for patients with IMV.[3]

60% of patients admitted to the ICU due to COVID-19 survive and experience post-ICU and post-COVID-19 complications.[4] Muscle weakness is considered to be present during the first six months after critical illness and can be resolved one year after the event; there are also limitations in the performance of activities of daily living due to compromises in walking speed, balance problems and the ability to exercise, in addition to a reduction in quality of life for two to five years after hospital discharge.[4,5]

In turn, there is evidence of a decrease in the functionality of patients who required mechanical ventilation; this is associated with greater presence of comorbidities, advanced age and a prolonged stay in the ICU compared to people who did not need an ICU presenting a higher Barthel index score.[6] However, this aspect has only been at the patient's discharge in the first stage and not in the long term.

In 2020,[7] the post-COVID-19 Functional Status Scale (PCFS) was designed as a tool to evaluate the functional limitations caused after COVID-19 infection, which was translated and adapted into Colombian Spanish in 2021[8] and validated in 2023,[9] allowing the patient to be evaluated and followed up in the medium and long term after discharge.

Consequently, knowing the functional, physical and mental status of these people in the medium and long term, allows identifying factors that influence the recovery processes and, in the same way, proposing treatment approaches that involve the person in different fields of action.[5] This study makes use of this scale and aims to describe the clinical and functional differences in post-COVID-19 patients with and without ICU stay.

## MATERIAL AND METHODS

Observational study conducted under the recommendations of Strengthening the Reporting of Observational studies in Epidemiology (STROBE).[10] Participants were adults diagnosed with COVID-19 who required hospital treatment between March and December 2021 in Cali, Colombia. All participating patients understood and signed the informed consent form. This research is endorsed by the institutional ethics committee Act (#126.01.05.02). The inclusion criteria were: people over 18 years of age who have received a positive diagnosis of COVID-19 by means of the polymerase chain reaction (PCR) technique and who experience symptoms associated with the disease; additionally, for the ICU group, they had to present a stay of more than 72 hours. The exclusion criteria were: cognitive or mental difficulties that make it difficult to understand or answer the questionnaires, as well as presenting a new hospital admission due to COVID-19-related events after being discharged from the clinic.

**Instruments.** A sociodemographic and clinical questionnaire was designed and applied to post-COVID-19 patients that included the variables: gender, age, socioeconomic stratum (lower strata do not have the ability to pay and require subsidies), comorbidities, hospitalization for COVID-19, stay in the ICU for COVID-19, oxygen use, use of IMV, risk factors and symptoms.

The 10-question Fatigue Assessment Scale (FAS) was also administered. This scale allows for the selection of up to five categories of options, including: never, sometimes, regularly, often, and always;[11] the modified Medical Research Council (mMRC) scale, to assess dyspnea during activities of daily living;[12] the Hospital Anxiety and Depression Scale (HADS);[13] and the PCFS, which consists of five possible scores classified into: no functional limitations, minimal functional limitations, mild functional limitations, moderate functional limitations, and severe functional limitations.[8,14]

**Procedure.** After hospital discharge from the clinic in Cali, contact was established with patients, both those who were in the ICU due to COVID-19 and those who did not require intensive care. At eight weeks, an invitation to participate in the study was extended. A face-to-face

meeting was held in the clinic, explaining the purpose of the research, participants expressed their consent by signing the informed consent form. Then, a physiotherapist administered the different questionnaires and scales, starting with the sociodemographic and clinical questionnaire, followed by the FAS, mMRC, HADS questionnaires and finally the PFCS scale.

**Statistic analysis.** A database was established in Excel 2010 through the work of an external typist: it was subsequently exported for analysis in SPSS version 26 to perform information processing.

Two groups were formed for the analysis, one group with an ICU stay (stay longer than 72 hours) and another group without an ICU stay. The results obtained were analyzed descriptively, expressing the qualitative variables in frequency and percentages. Regarding the quantitative variables, the Kolmogorov-Smirnov statistical test was applied, and they were presented by means and standard deviation. Subsequently, the groups were divided into intensive care stays and no intensive care stays. In this way, we compared the variables between the groups using the $\chi^2$ test for qualitative variables and the t test for independent samples in the quantitative ones, and considered a p value $< 0.05$ as statistically significant.

## RESULTS

In the period between March and December 2021, 120 patients were diagnosed with COVID-19 and subsequently discharged. All patients were contacted by telephone and eight patients reported not being able to have time to answer the questionnaires, so in the end 112 patients with post-COVID-19 were linked to the study, of which 80 required a stay in the ICU and 32 without a stay in the ICU.

Regarding the sociodemographic characteristics, the average age of the patients was 51.43 years, being mostly female 69 (61.6%). The predominant socioeconomic stratum was the low average 50 (44.6%), followed by the low 31 (27.7%), high average 16 (14.3%), very low 11 (9.8%) and high four (3.6%).

Regarding comorbidities, 31 (27.7%) patients reported presenting some comorbidity; the group with the most patients with comorbidities was those who required an ICU stay with a total of 20 (12.5%) cases. High blood pressure was the comorbidity present in all patients 31 (100%), followed by cardiovascular disease and pulmonary disease with nine (29%) for each, and hypothyroidism with three (9.67%).

An average of 19.12 ± 10.02 days of hospitalization occurred. During hospitalization, 53 (47.3%) of the 80 patients admitted to the ICU required IMV and 72 (64.3%) of all patients required supplemental oxygen after hospital discharge, presenting statistically significant differences between the groups ($p < 0.05$).

After hospital discharge, persistent symptoms in all patients were: myalgia 51 (45.5%), headache 45 (40.2%), difficulty falling asleep 44 (39.8%), cough 39 (34.8%), fatigue 11 (9.8%) and odynophagia 10 (8.9%). Likewise, sedentary lifestyle 68 (60.7%) was the main risk factor, followed by overweight/obesity 47 (42%), cigarette consumption 13 (11.6%) and alcohol consumption 10 (8.6%), despite what was previously reported, there were no statistically significant differences between the groups ($p > 0.05$) *(Table 1)*.

The assessment of the FAS scale in the mental field presented an average of 12.28 ± 5.49, in the physical aspect 12.04 ± 5.46, for a total average score of 24.32 ± 10.67, being higher in the ICU stay group 25.14 ± 11.37; the mMRC scale presented an average in the entire population of 1.01 ± 1.19, and was higher in the ICU stay group 1.38 ± 1.173. The HADS scale in depression presented an average of 3.49 ± 4.01 and in the anxiety item 4.79 ± 4.38, with the ICU group having the highest scores. However, there were no statistically significant differences between the groups ($p < 0.05$) *(Table 2)*.

Regarding the application of the PCFS scale in the characteristics of functional independence, 34 (30.4%) of the patients presented slight functional limitations, followed by minimal functional limitations with 22 (19.6%) patients, without functional limitations 20 (17.9%), moderate functional limitations 18 (16.1%) and severe 18 (16.1%). In the ICU stay group, the most frequent rating was slight functional limitations (33.8%) and for the group without ICU stay it was minimal functional limitations (34.4%), $p < 0.005$ *(Table 2)*.

Patients who entered the ICU compared to those who did not, showed statistically significant differences in variables such as age, number of days hospitalized, constant care and activities of daily living (ADL), *(Table 3)*.

## DISCUSSION

This study aimed to determine the clinical and functional differences in post-COVID-19 patients with and without ICU stay. Sociodemographic, clinical, fatigue, dyspnea, anxiety/depression, and functional independence characteristics were analyzed in post-COVID patients 19. It should be noted that these results have been previously explored in other research, which highlights a growing interest in delving into these aspects that have a significant impact on the quality of life and the ability to carry out activities of daily living in these patients.[15,16]

In relation to the sociodemographic characteristics of patients in the variables gender and socioeconomic stratum, similar results are presented regardless of the context or region.[6,17,18]

The average age in patients with post-COVID-19 was 51.46 years, very similar to that reported by other authors

**Table 1:** Socio-demographic and clinical characteristics.

| Variables | Total N = 112 n (%) | With ICU stay N = 80 n (%) | Without ICU stay N = 32 n (%) | p |
|---|---|---|---|---|
| Age (years)* | 51.46 ± 15.94 | 47.96 ± 15.38 | 60.22 ± 14.02 | **0.000** |
| Gender | | | | 0.759 |
| Male | 43 (38.4) | 30 (37.5) | 13 (40.6) | |
| Female | 69 (61.6) | 50 (62.5) | 19 (59.4) | |
| Socioeconomic stratum | | | | 0.371 |
| Very low | 11 (9.8) | 10 (12.5) | 1 (3.1) | |
| Low | 31 (27.7) | 24 (30.0) | 7 (21.9) | |
| Lower middle | 50 (44.6) | 33 (41.3) | 17 (53.1) | |
| Upper middle | 16 (14.3) | 11 (13.8) | 5 (15.6) | |
| High | 4 (3.6) | 2 (2.5) | 2 (6.3) | |
| Comorbidities | | | | **0.019** |
| Yes | 31 (27.7) | 20 (12.5) | 11 (34.4) | |
| No | 81 (72.3) | 60 (87.5) | 21 (65.6) | |
| Diagnosed disease | | | | |
| Arterial hypertension | 31 (100.0) | 20 (100.0) | 11 (100.0) | 0.316 |
| Cardiovascular disease | 9 (29.0) | 8 (40.0) | 1 (9.1) | 0.227 |
| Pulmonary disease | 9 (29.0) | 7 (35.0) | 2 (18.1) | 0.660 |
| Hypothyroidism | 3 (9.67) | 2 (10.0) | 1 (9.1) | 0.853 |
| Number of days hospitalized* | 19.12 ± 10.02 | 21.11 ± 9.87 | 1,322 ± 8.05 | **0.000** |
| ICU stay | | | | **0.000** |
| Yes | 80 (71.4) | 80 (100.0) | – | |
| No | 32 (28.6) | – | 32 (100.0) | |
| Required IMV | | | | **0.000** |
| Yes | 53 (47.3) | 52 (65.0) | – | |
| No | 59 (52.7) | 28 (35.0) | 32 (100.0) | |
| Required supplemental oxygen after discharge from the hospital | | | | 0.280 |
| Yes | 72 (64.3) | 61 (76.3) | 11 (34.4) | |
| No | 40 (35.7) | 19 (23.7) | 21 (65.6) | |
| Persistent symptoms | | | | |
| Myalgias | 51 (45.5) | 39 (48.8) | 12 (37.5) | 0.223 |
| Headache | 45 (40.2) | 35 (43.8) | 10 (31.3) | 0.126 |
| Difficulty falling asleep | 44 (39.3) | 35 (43.8) | 9 (28.1) | 0.950 |
| Cough | 39 (34.8) | 28 (35.0) | 11 (34.4) | 0.920 |
| Fatigue | 11 (9.8) | 8 (10.0) | 3 (9.4) | 0.507 |
| Odynophagia | 10 (8.9) | 8 (10.0) | 2 (6.3) | 0.272 |
| Ageusia | 9 (8.0) | 5 (6.3) | 4 (12.5) | 0.111 |
| Anosmia | 5 (4.5) | 2 (2.5) | 3 (9.4) | 0.872 |
| Choking | 4 (3.6) | 3 (3.8) | 1 (3.1) | **0.006** |
| Fever | 3 (2.7) | – | 3 (9.4) | 0.853 |
| Lumbar pain | 3 (2.7) | 2 (2.5) | 1 (3.1) | 0.525 |
| Tinnitus | 1 (0.9) | 1 (1.3) | – | |
| Risk factors | | | | |
| Overweight/obesity | 47 (42.0) | 34 (42.5) | 13 (40.6) | 0.856 |
| Cigarette smoking | 13 (11.6) | 11 (13.8) | 2 (6.3) | 0.263 |
| Alcohol consumption | 10 (8.9) | 9 (11.3) | 1 (3.1) | 0.173 |
| Sedentary lifestyle | 68 (60.7) | 47 (58.8) | 21 (65.6) | 0.501 |

ICU = Intensive Care Unit. IMV = invasive mechanical ventilation.
* Values expressed as mean ± standard deviation.

**Table 2:** Characteristics of functional independence, dyspnea, fatigue, anxiety and depression.

| Variables | Total N = 112 Mean ± SD | With ICU stay N = 80 Mean ± SD | Without ICU stay N = 32 Mean ± SD | p |
|---|---|---|---|---|
| Mental FAS | 12.28 ± 5.49 | 12.75 ± 5.867 | 11.09 ± 4.306 | 0.151 |
| Physical FAS | 12.04 ± 5.46 | 12.39 ± 5.830 | 11.19 ± 4.395 | 0.240 |
| Total FAS | 24.32 ± 10.67 | 25.14 ± 11.370 | 22.28 ± 8.463 | 0.202 |
| mMRC | 1.01 ± 1.19 | 1.38 ± 1.173 | 1.03 ± 1.231 | 0.170 |
| HADS depression | 3.49 ± 4.01 | 3.93 ± 4.745 | 2.90 ± 2.749 | 0.255 |
| HADS anxiety | 4.79 ± 4.38 | 5.34 ± 4.933 | 4.06 ± 3.492 | 0.203 |
| PCFS scale | | | | |
| Survival | 0.00 ± 0.00 | 0.00 ± 0.00 | 0.00 ± 0.00 | 0.999 |
| Constant care | 0.50 ± 1.32 | 0.65 ± 1.485 | 0.13 ± 0.707 | **0.013** |
| ADL | 0.54 ± 1.36 | 0.70 ± 1.529 | 0.13 ± 0.707 | **0.008** |
| IADL | 0.94 ± 1.59 | 1.06 ± 1.679 | 0.63 ± 1.338 | 0.152 |
| Role participation | 1.17 ± 1.34 | 1.25 ± 1.383 | 0.97 ± 1.257 | 0.321 |
| Symptoms | 1.30 ± 0.85 | 1.38 ± 0.877 | 1.13 ± 0.793 | 0.165 |
| Final score | 1.93 ± 1.31 | 2.05 ± 1.330 | 1.63 ± 1.238 | 0.122 |
| PCFS classification, n (%) | | | | 0.098 |
| No functional limitations | 20 (17.9) | 14 (17.5) | 6 (18.8) | |
| Minimal functional limitations | 22 (19.6) | 11 (13.8) | 11 (34.4) | |
| Slight functional limitations | 34 (30.4) | 27 (33.8) | 7 (21.9) | |
| Moderate functional limitations | 18 (16.1) | 13 (16.3) | 5 (15.6) | |
| Severe functional limitations | 18 (16.1) | 15 (18.8) | 3 (9.4) | |

ADL = activities of daily living. FAS = fatigue assessment scale. HADS = hospital anxiety and depression scale. IADL = instrumental activities of daily living. mMRC = modified medical research council. PCFS = Post-COVID-19 functional status scale.

such as Muñoz et al.,[6] Rosa et al.,[19] Becerra et al.;[20] however, there are significant differences in the ICU group due to a lower age of patients not admitted to the ICU, it is believed that this is due to the fact that the ICU group presented greater diseases prior to COVID-19 infection compared to the group of No admission to the ICU. Fernández and his team[21] describe that there is a relationship between the underlying diseases, the risk factors of people and their admission to the ICU, in addition to being more likely to be infected by the virus and that the development of the disease is severe.

Within the clinical variables, it was observed that the majority of patients had admission to the ICU and also required IMV, which increases the possibility of presenting post-COVID-19 syndrome.[22]

Regarding the evaluation of the FAS, mMRC and HADS scales, low scores are reported, being a good indicator for the perception of the sensation of fatigue both physically and mentally, depression and anxiety; being contrary to what was demonstrated by Ostrowska and his group,[12] Carod[22] and Tabacof et al.,[11] who comment that persistent symptoms related to COVID-19 infection affect cognitive and physical function and the sensation of dyspnea in daily activities; the incidence of anxiety is described in 17.4% and depression in 13.7%.

Regarding the burden of comorbidities present in COVID-19 patients who traveled through the ICU, they are associated due to a faster and more aggressive progression of the disease, which implies much more exhaustive clinical decision-making with aggressive treatments, which prolongs the ICU stay, causing gradual physical deconditioning and implying greater functional dependence specifically on basic care due to prolonged immobility in this service, this is demonstrated in the study by Rodríguez M and associates and Salinas-Aguirre and colleagues, in 2022, with similar results where patients who required ICU had one or more comorbidities, presenting greater functional dependence and prolonged stays or deaths due to complications.[23-25]

This study shows that the majority of patients required admission to intensive care and even IMV, a circumstance that has been described by other authors.[26,27] This situation leads to muscle dysfunction, lethargy, pain and difficulty breathing, significantly deteriorating the patients' functionality in the short and medium term.[28]

Regarding functional status, significant differences were found in the domains of constant care and activities of daily living (ADL) with worse results in patients staying in the ICU, a situation already described by other authors who affirm that, although hospitalization in the ICU provides the

appropriate environment for the treatment and recovery of patients, the infectious process, prolonged immobility and risks related to physical deconditioning cause greater dependence on caregivers and family members in activities of daily living.[29] In addition, the loss of strength and functionality could also be related to high doses of sedatives, neromuscular blockers[6] and steroids[30] for the management of patients with COVID-19 in the ICU.

One limitation considered in this study was the lack of external validity criteria. In addition, the findings of this investigation require follow-up at 12 months to definitively determine the condition of functional independence. However, the use of various instruments that provide a more detailed view of the general condition of post-COVID-19 patients is highlighted. This study makes it possible to understand the differences between patients who were admitted to the ICU due to COVID-19 and those who were not, allowing the identification of their needs after hospital discharge. In addition, it orients towards patient-centered intervention strategies, proposing a medium- and long-term follow-up in a cost-effective manner.

## CONCLUSION

Post-COVID-19 patients with ICU stay have greater comorbidities, use of IMV and require longer hospitalization days. In turn, these patients recorded higher scores in the domains of constant care and activities of daily living in functional independence with the PCFS scale. The need to implement the use of cost-effective measurement instruments, such as the PCFS scale, focused on the patient to know their evolution and follow-up objectively during their intervention and recovery process in the medium and long term is highlighted.

**Table 3:** Differences in means of the variables.

| Variables | Differences in means | p |
|---|---|---|
| Age | –12.25 ± 3.140 | **0.000** |
| Number of days hospitalized | 7.890 ± 2.105 | **0.000** |
| PCFS Scale | | |
| Constant care | 0.525 ± 0.208 | **0.013** |
| ADL | 0.575 ± 0.212 | **0.008** |
| IADL | 0.438 ± 0.302 | 0.152 |
| Role participation | 0.281 ± 0.282 | 0.321 |
| Symptoms | 0.250 ± 0.179 | 0.165 |
| Final score | 0.425 ± 0.273 | 0.122 |
| Mental FAS | 1.656 ± 1.145 | 0.151 |
| Physical FAS | 1.200 ± 1.014 | 0.240 |
| Total FAS | 2.856 ± 2.225 | 0.202 |
| mMRC | 0.344 ± 0.249 | 0.170 |
| HADS depression | 1.024 ± 0.891 | 0.255 |
| HADS anxiety | 1.277 ± 0.993 | 0.203 |

ADL = activities of daily living. FAS = fatigue assessment scale. HADS = hospital anxiety and depression scale. IADL = instrumental activities of daily living. mMRC = modified medical research council. PCFS = post-COVID-19 functional status scale.

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