

# Monitoring the change in the quality of life of patients with post-COVID syndrome by influence on their functional status

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## Abstract

Coronavirus disease 2019 (COVID-19) is still a major medical concern. Patients who have recovered from the infection from COVID-19 face the ordeal of post-covid syndrome. In these patients, there is a decrease in physical abilities, in particular musculoskeletal complications and post-traumatic stress, depression and chronic fatigue, which impair their quality of life. This necessitates long-term rehabilitation, which supports recovery after hospitalization. Treatment through movement is part of the rehabilitation measures contributing to the functional recovery of patients with post-covid syndrome. To study how the functional capabilities of these patients improve and how their quality of life is affected, we created a set of physical exercises to be performed at home for 6 months. At baseline and at the end of the study, patients completed the SF-36 quality of life questionnaire. The aim of the study was to track the changes in the quality of life of patients with post-covid syndrome by influencing their functional state. Our study found a decline in the quality of life of the examined patients. After the application of the kinesitherapy program, the functional status of the patients improved, their functional independence was optimized, which contributed to the improvement of the quality of life of the post-covid patients syndrome.

## Keywords

Post covid syndrome, quality of life, active treatment

## Introduction

The huge concern raised by SARS-CoV2 pandemic about public health management and social impact is still under debate, particularly because COVID-19 may affect infected

people much longer than expected from a typical air-borne viral disease. The scientific community is actually wondering about the etiopathogenesis and clinical development of this “post-COVID” complex symptomatology, very close to symptoms typically observed in chronic fatigue syndrome,

so recently named as “post-acute sequelae of COVID-19 (PASC)”. This commentary tries to focus on the most recent news about this issue (Tirelli et al. 2021). Many of the patients who recover from the infection from COVID-19 develop complications and long-term physical consequences. In addition to the dangers associated with the complications of the coronavirus, people face the ordeal of post-covid syndrome. The post-covid condition occurs in individuals with suspected coronavirus or a confirmed history of infection, usually within three months of the onset of COVID-19 with symptoms lasting no less than two months (Garri-gues et al. 2020). The exact pathophysiological mechanism of post-COVID-19 syndrome is still unclear, despite many hypotheses and studies suggesting mechanisms of action. As the COVID-19 pandemic continues, it is important to understand patients’ needs for care beyond the acute phase, particularly mechanisms causing persistent symptoms beyond 3 or 4 weeks of acute illness onset (Nalbandian et al. 2021) which negatively affect the quality of life and scares the improvement of overall health with an uncertain prognosis (Oronski et al. 2021). Cohort studies of patients far removed from the initial episode have highlighted an association of symptoms that may fall within the nosological framework defined as “long COVID”. Among these symptoms, we find primarily fatigue and muscle weakness, disturbed sleep and anxiety and depression (Bienvenu et al. 2021) responsible for reducing the quality of life (Carfi et al. 2020). Currently, there are no uniform criteria for effective treatment of post-covid syndrome (Mratskova 2022). Rehabilitation after recovery from coronavirus is necessary for all patients, regardless of the presence and severity of their dysfunctions. But in any case, competent and correct rehabilitation is necessary to overcome the symptoms and improve the functional capacity, respiratory function, to relieve dyspnea and to increase the quality of life (Petrova et al. 2023). Some patients require a multiprofessional rehabilitation program. As for the modalities of this rehabilitation, it can be done by different methods “Rehabilitation at home can be done with self-exercise programs pre-learned and monitored remotely, or by a physiotherapist at home. This rehabilitation should be very gradual, especially when carried out at home “rehabilitation at home can be applied after the acute phase, for gradual and controlled resumption of low-intensity physical activity, continuation of respiratory rehabilitation, resumption of walking and usual functional activities, re-feeding, psychological follow-up, respect for dyspnea, fatigue and patient tolerance (Iqbal et al. 2021).

## Background

As of mid-2021, there is still no commonly accepted definition of post-COVID-19 syndrome. Greenhalgh et al. (2020) were the first to define post-COVID-19 as an extended illness for more than 3 weeks after the acute onset of symptoms. More than 10% of persons with COVID-19 experience prolonged illness. However, the term chronic COVID-19 has been defined as persistent symptoms

extending beyond 12 weeks after the onset of symptoms (Pierce et al. 2022). In patients who have recovered from the infection from COVID-19, in the post-hospitalization phase, there is a decrease in physical abilities, in particular musculoskeletal complications and post-traumatic stress, depression and chronic fatigue, which worsen the quality of life of the patients (Tarnovska et al 2022). Treatment through movement is part of the rehabilitation measures contributing to the functional recovery of patients with post-covid syndrome. To investigate how the functional capabilities of these patients improve and how their quality of life is affected, we created a set of physical exercises to perform at home.

The aim of the study is to track the change in the quality of life of patients with post-covid syndrome by influencing their functional state.

## Materials and methods

### A contingent of patients. Characteristics

In the initial stage of the study, a total of 70 participants, 35 women and 35 men, average age of 50 years, who suffered from moderate and severe COVID-19 and in whom the disease took the form of pneumonia, were selected. In the final stage of research, 51 patients remain, of which 35 are women and 16 are men – average age 48 years.

Due to the incompletely understood etiology of the disease, especially in the initial period of the epidemic, in the acute period of its course, antibiotic therapy was also applied for the treatment of patients, which mainly affects secondary bacterial infections: tetracyclines: mainly Doxycycline as monotherapy or in combination with an aminoglycoside antibiotic, lincosamine, a glycopeptide. Part of the patients took Quinolones, all of the latest 4<sup>th</sup> generation /mainly Levofloxacin/ in the above combinations, in the absence of contraindications, some of the patients were treated with Aminoglycosides: Amikacin and Gentamicin in usual doses, which were not administered as monotherapy. Broad-spectrum beta-lactam antibiotics / Aminopenicillins, Carbapenems, Ureidopenicillins and Cephalosporins/ have been used less often as initial empiric therapy. Macrolides /Azithromycin, Clarithromycin/, Glycopeptides /Vancomycin/, Lincosamides /Clindamycin/ were used in a smaller percentage.

The selection of patients was carried out in the period from January to December 2021. Patients were included in the study 3 months after the acute period of the disease through the use of the electronic register by their general practitioner and a multi-stage telephone survey. All patients signed an informed consent to participate in the study. The study is prospective with a duration of 6 months. In the final stage of the study, 19 patients dropped out.

### Inclusion criteria

The study included patients who experienced a coronavirus infection, had the symptoms of post-covid syndrome and agreed to participate in the study.

## Exclusion criteria

Patients who could not be contacted after 3 phone calls, patients who refused to participate in the study, and patients who died were not included.

## Study design and methods

Each patient fills in at the beginning and at the end of the study /after 6 months/ a questionnaire, SF-36 related to the evaluation of the quality of life related to health. The SF-36 questionnaire contains 36 items measuring eight domains: “physical activity” (physical functioning), “physical limitations” “physical pain” “general health” (general health), “vitality” “social functioning” “emotional limitations”) and “mental health”. Each score ranges from 0 to 100. A high score indicates mild impairment and a low score indicates significant impairment. The questionnaire includes activities that can be performed safely and outdoors, while maintaining the necessary distance and not requiring expensive and inaccessible equipment. This makes the questionnaire easily applicable, accessible and effective for the needs of physiotherapy practice (Ware and Sherbourne 1992; Taboada et al. 2021). In our study, we tracked the change in four areas of the SF-36 questionnaire: “physical functioning”, “physical limitations”, “social functioning” and “general health”, relevant to the patients’ functional recovery. Reporting of changes in the four specified areas was carried out after the implementation of a kinesitherapy program in patients with post-covid syndrome. The suitability of patients for rehabilitation after a coronavirus infection requires that the state of the respiratory system and blood circulation are stable without the risk of aggravation of existing complaints. Contraindications for performing PT procedures are: (1) resting heart rate > 120 beats per minute; (2) blood pressure  $\geq 140/90$  mm/Hg or  $\leq 90/60$  mm/Hg; (3) SpO<sub>2</sub>  $\leq 95\%$ ; (4) other comorbidities that are not suitable for exercise; (5) temperature > 38.2 degrees; (6) difficulty breathing or shortness of breath without relief after rest; (7) chest pain, chest tightness, dyspnea, frequent cough, dizziness, headache, blurred vision, palpitations (Zhu et al. 2020).

Each patient was sent a brochure via e-mail with a set of physical exercises that patients should perform for 6 months at home to improve their functional status. The control of the implementation of the kinesitherapy program was carried out remotely. A kinesitherapy program begins with very low-intensity flexibility and breathing exercises. The recovery program continues with low-intensity physical activity including slow walking, light housework and gardening. Gradually increase the duration by 10–15 minutes daily if the exercises are well tolerated. At these two levels, the patient should be able to hold a normal conversation without difficulty while doing the exercises. The kinesitherapy program continues with aerobic and strength exercises of moderate intensity, such as brisk walking, cycling, climbing and descending stairs. It is recommended to do 2 intervals of 5 minutes of exercise,

with rest time in between. At the end of the active treatment program, aerobic and strength exercises of moderate intensity are included to improve coordination. Running with changes of direction, side steps is applied, but without much difficulty. Two days of training followed by one day of recovery is recommended. Data from baseline and after 6 months of the quality of life questionnaire were processed using the SPSS v.23 program using appropriate statistical methods. The accepted level of statistical significance is  $\alpha = 0.05$ .

## Results and discussion

The demographic factors we examined were gender, age and comorbidities. The most frequent concomitant disease in the patients participating in the study was arterial hypertension. At baseline, 35 women and 35 men, a total of 70 participants, were selected. Mean age  $50.20 \pm 11.312$  years. Of them, 11 (15.71%) had no diseases, and 58 (82.86%) had accompanying diseases, 1 (1.43%) did not report. In the second study, 51 patients remained, of which 35 (68.63%) were women and 16 were men (31.37%). Mean age  $48.88 \pm 10.974$  years. Of them, 9 (17.65%) had no diseases, and 41 (80.39%) had accompanying diseases, 1 (1.96%) did not report.

There is no consensus in which of the two sexes the post covid syndrome occurs more often. A study by Mahmoud et al (2021) indicated that post-covid syndrome occurs more often in men, while another study indicates that gender is a risk factor for certain manifestations of post covid syndrome and in terms of psychiatric and neurological problems, women are more at risk than men (Raj et al. 2022). In our study, we found that gender has no relationship with the development of symptoms in post-covid syndrome, and our finding is confirmed by a study by Batibay et al. (2022).

Examining the initial and final results of the “Physical functioning” scale, we found for both measurements a statistically significant difference from the test value from the literature 70.61 – the averages are smaller (Table 1). The Paired Samples Test showed a statistically significant difference  $P < 0.0001$  between the first and second testing (Table 2).

**Table 1.** One sample T-test for the scale “Physical Functioning”, first and second test.

|                            | t       | df | P     | Test Value = 70.61 |   |        |
|----------------------------|---------|----|-------|--------------------|---|--------|
|                            |         |    |       | Mean difference    | 95% Confidence interval of the difference |        |
|                            |         |    |       |                    | Lower                                     | Upper  |
| First measurement          | -34,564 | 69 | 0,000 | -52,824            | -55,87                                    | -49,78 |
| Measurement after 6 months | -22,022 | 50 | 0,000 | -21,590            | -23,56                                    | -19,62 |

Many survivors of COVID-19 show severe deterioration in physical strength, respiratory function, and quality of life due to persistent symptoms and post-acute sequelae

**Table 2.** Mean values of initial and final results of the scale for “Physical functioning”.

| Phys. function             | N  | Mean  | SD     | SEM   |
|----------------------------|----|-------|--------|-------|
| First measurement          | 70 | 17,79 | 12,787 | 1,528 |
| Measurement after 6 months | 51 | 49,02 | 7,001  | 0,980 |

of SARS-CoV-2 infection. Evidence on rehabilitation after COVID-19 is still scarce, although there is a growing body of literature highlighting the need for rehabilitation strategies (Inzitari et al. 2020). In the present study, we found a large improvement in functional capacity after controlled combined exercise training, which is confirmed by other studies with similar results. Nambi et al. (2022) did a study in post-Covid patients with sarcopenia who showed improvement after 8 weeks of low-intensity rehabilitation. A study by De Souza et al. (2021) reported a significant functional improvement in patients with post covid syndrome after 6 weeks of home rehabilitation. We can conclude that physical exercises are effective in restoring the functional state in patients with post covid syndrome. Analyzing the average values from the initial and final results of the scale “Role of limitations caused by physical health”, we found that in the first measurement the mean (8.21) was statistically significant smaller than the value from the literature source (52.97) –  $P < 0.0001$ . In the second measurement, the mean (55.88) does not differ statistically significantly ( $P = 0.281$ ) from the value from the literature source – 52.97 (Table 3). The Paired Samples Test shows a statistically significant difference  $P < 0.0001$  between the first and second testing (Table 4).

**Table 3.** Mean values of the initial and final results of the scale “Role limitations due to physical health”.

|                            | N  | Mean  | SD     | SEM   |
|----------------------------|----|-------|--------|-------|
| First measurement          | 70 | 8,21  | 20,730 | 2,478 |
| Measurement after 6 months | 51 | 55,88 | 19,097 | 2,674 |

**Table 4.** One sample T-test for the scale “Role limitations due to physical health”, first and second test.

| Test Value = 52.97         |         |    |       |                 |   |        |
|----------------------------|---------|----|-------|-----------------|---|--------|
|                            | t       | df | P     | Mean difference | 95% Confidence interval of the difference |        |
|                            |         |    |       |                 | Lower                                     | Upper  |
| First measurement          | -18,063 | 69 | 0,000 | -44,756         | -49,70                                    | -39,81 |
| Measurement after 6 months | 1,089   | 50 | 0,281 | 2,912           | -2,46                                     | 8,28   |

Using the non-parametric Mann-Whitney test, we examined the correlation of gender with the scales “Physical functioning” and the scale “Role of limitations caused by physical health”. A statistically significant difference in the mean values between the two sexes was found only at the first measurement on the “Physical functioning” scale (Table 5).

The application of physiotherapy in the different stages of recovery from post-COVID syndrome leads to the prevention of complications and a faster return to normal domestic and social activities of patients. Therefore, kinesitherapy should be introduced as a mandatory part

**Table 5.** Differences by gender in scales “Physical functioning” and “Role limitations due to physical health”, first and second test.

| Gende |      | Physical functioning |                     | Role limitations due to physical health |                     |
|-------|------|----------------------|---------------------|---|---------------------|
|       |      | First test           | Test after 6 months | First test                              | Test after 6 months |
| Women | Mean | 22,14                | 48,57               | 7,86                                    | 57,14               |
|       | N    | 35                   | 35                  | 35                                      | 35                  |
|       | SD   | 10,866               | 8,452               | 19,900                                  | 21,498              |
| Men   | Mean | 13,43                | 50,00               | 8,57                                    | 53,13               |
|       | N    | 35                   | 16                  | 35                                      | 16                  |
|       | SD   | 13,216               | 0,000               | 21,814                                  | 12,500              |
|       | P    | 0,001                | 0,499               | 0,961                                   | 0,459               |

of the treatment protocol in patients with post-COVID syndrome, and physical therapy programs should be refined and implemented as early as possible and according to the stage of recovery (Tsvetkova-Gaberska et al. 2022). As a result of the implementation of the kinesitherapy program, our patients have reduced the dysfunctions that limit their physical health and this has contributed to improving their quality of life. Therefore, patients should be encouraged to perform functional and breathing exercises. Aerobic and muscle strength training showed a significant increase in muscle strength, lung function, physical fitness and a reduction in fatigue, which significantly improved the condition of the patients (Fernández-Lázaro et al. 2022).

In our study, we examined the correlation between age and the four Spearman measures. We found a statistically significant weak positive correlation between age and the indicators of the four measurements, found only in the first measurement of the physical functioning scale (Table 6).

**Table 6.** Correlation of age with the results for “Physical functioning” and “Role limitations due to physical health”, first and second test.

|     |    | Physical functioning |                     | Role limitations due to physical health |                     |
|-----|----|----------------------|---------------------|---|---------------------|
|     |    | First test           | Test after 6 months | First test                              | Test after 6 months |
| Age | Rs | 0,281                | 0,048               | -0,186                                  | 0,189               |
|     | P  | 0,019                | 0,738               | 0,123                                   | 0,183               |
|     | N  | 70                   | 51                  | 70                                      | 51                  |

We found that in older patients major dysfunctions are observed, which is the reason why patients develop disabilities, which subsequently do not turn out to be final, but are the reason for a slower recovery of their functional capabilities after the application of the kinesitherapeutic program. Elderly patients who survived COVID-19 improved their functional status, including those who required an intensive care unit stay, as a result of the 30-minute multicomponent therapeutic exercise intervention over 7 days (Udina et al. 2021).

Examining by the non-parametric Mann-Whitney test the influence of comorbidities on the quality of life of patients, our study did not find any statistically significant differences in the mean values of the four measurements according to the presence of comorbidities (Table 7).

**Table 7.** Differences by presence of disease in scales “Physical functioning” and “Role limitations due to physical health”, first and second test.

| Disease          |      | Physical functioning |                     | Role limitations due to physical health |                     |
|------------------|------|----------------------|---------------------|---|---------------------|
|                  |      | First test           | Test after 6 months | First test                              | Test after 6 months |
| No disease       | Mean | 12,73                | 50,00               | ,00                                     | 50,00               |
|                  | N    | 11                   | 9                   | 11                                      | 9                   |
|                  | SD   | 12,321               | 0,000               | 0,000                                   | 0,000               |
| Disease presence | Mean | 18,79                | 50,00               | 9,91                                    | 56,10               |
|                  | N    | 58                   | 41                  | 58                                      | 41                  |
|                  | SD   | 12,852               | 0,000               | 22,429                                  | 19,985              |
|                  | P    | 0,078                | 1,000               | 0,140                                   | 0,345               |

We found no confirmation of our results in the literature. A study by Desgranges et al (2022) indicates that obesity as a co-morbidity is a predictor of persistent post-covid symptoms.

We analyzed the results of the average values of the scale “Social functioning”. This scale includes 2 questions – 20 and 32 questions. The results of the scale “Social functioning” indicate that in both measurements there is a statistically significant difference from the test value from the literature 25.43 – the means are larger (Table 8).

**Table 8.** Mean values of the initial and final results of the scale “Social functioning”.

|                            | N  | Mean  | SD     | SEM   |
|----------------------------|----|-------|--------|-------|
| First measurement          | 70 | 28,04 | 8,886  | 1,062 |
| Measurement after 6 months | 51 | 48,77 | 11,794 | 1,651 |

Our research proves a decrease in the quality of life as a result of a decrease in social activities and shows a statistically significantly lower assessment of the quality of life in the emotional area, which is the reason to a large extent for the limitation of interpersonal contacts necessary to maintain the mental balance of the person. As a result of the implemented kinesitherapy program, we find an improvement in the emotional state of the patients, by increasing their motivation as a result of an improvement in their functional state. In a study, De Oliveira et al. (2023) reported that as a result of applying multicomponent rehabilitation to improve functional mobility and quality of life in people with post-COVID-19 syndrome, positive results were observed. Individuals who underwent the multicomponent physical therapy protocol showed statistically insignificant increases in the variables studied. The Paired Samples Test shows a statistically significant difference  $P < 0.0001$  between the first and second testing (Table 9).

The Paired Samples Test shows a statistically significant difference  $P < 0.0001$  between the first and second testing (Table 10).

Analyzing the average values of the initial and final results of the “General Health” scale, we found in both studies a statistically significant difference from the test value from the literature 21.11 – the mean values are larger (Table 11).

**Table 9.** One sample T-test for the scale “Social Functioning”, first and second test.

|                            | t      | df | P     | Test Value = 25.43 |   |       |
|----------------------------|--------|----|-------|--------------------|---|-------|
|                            |        |    |       | Mean difference    | 95% Confidence interval of the difference |       |
|                            |        |    |       |                    | Lower                                     | Upper |
| First measurement          | 2,453  | 69 | 0,017 | 2,606              | 0,49                                      | 4,72  |
| Measurement after 6 months | 14,136 | 50 | 0,000 | 23,345             | 20,03                                     | 26,66 |

**Table 10.** Mean values of initial and final results of the “General health” scale.

|                            | N  | Mean  | SD    | SEM   |
|----------------------------|----|-------|-------|-------|
| First measurement          | 70 | 36,18 | 4,753 | 0,568 |
| Measurement after 6 months | 51 | 43,82 | 5,966 | 0,835 |

**Table 11.** One sample T-test for the scale “General Health”, first and second test.

|                     | t      | df | P     | Test value = 21.11 |   |       |
|---------------------|--------|----|-------|--------------------|---|-------|
|                     |        |    |       | Mean difference    | 95% Confidence interval of the difference |       |
|                     |        |    |       |                    | Lower                                     | Upper |
| First test          | 26,523 | 69 | 0,000 | 15,069             | 13,94                                     | 16,20 |
| Test after 6 months | 27,190 | 50 | 0,000 | 22,714             | 21,04                                     | 24,39 |

A study assessing the level of physical activity and quality of life among people who underwent rehabilitation due to COVID-19 provides results that may help understand the impact of a pandemic on the health and well-being of patients. As a result of the disease, a decrease in the quality of life is also observed through a negative impact on all spheres of human life (physical, psychological and social) (Baginska et al. 2023). The negative impact on the aforementioned spheres has an impact on the general health of patients with post-Covid syndrome. Our study demonstrates that active treatment of Covid-19 survivors, consisting of moderate combined flexibility exercises, exercises to improve respiratory function, walking, stair climbing and descending, and strength training, is necessary to improve general health. Determining the physiotherapeutic potential of patients is essential in the implementation of rehabilitation procedures. Exercise in these patients reduces resting heart rate and blood pressure and induces complete functional independence (Costa et al. 2022). Our results are similar to those of Ahmed et al. (2020) who also found a significant decrease in quality of life in areas of physical capacity, emotional capacity and social survival at 6 months after relapse.

## Conclusion

In our study, when assessing the quality of life with the SF-36 of patients with post-covid syndrome, a deficit was found in the four investigated areas, the most important of which are in the domains of physical functioning and social functioning. Our study found a decline in the quality of life of the examined patients. At the beginning

of the study, the results of the physical and social dimensions assessed by the SF-36 were reduced, but after the application of the kinesitherapy program, the functional status of the patients improved and they did not develop dysfunctions that would lead to definitive disabilities in their daily activities. Active treatment helped to optimize patients' functional independence and social activities by improving their functional capacity as a result of supervised exercise training. The result of the implementation of the kinesitherapeutic program is an improvement in the quality of life of patients with post-covid syndrome. The results of our study are confirmed by similar studies

(Nambi et al. 2022; Mayer et al. 2019). The results of our study and the recommendations regarding the functional recovery of patients with post-covid syndrome can be useful in creating programs to influence the physical health of patients who have recovered from COVID-19.

## Limitations of the study

The main limitations of the study are the lack of a control group to evaluate the effect of the kinesitherapeutic program, as well as the small number of patients participating in the study.

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