DOI: 10.12923/cipms-2025-0015 Curr. Issues Pharm. Med. Sci., Vol. 38, No. 2, Pages 95-100

Current Issues in Pharmacy and Medical Sciences
Formerly ANNALES UNIVERSITATIS MARIAE CURIE-SKLODOWSKA, SECTIO DDD, PHARMACIA

journal homepage: https://czasopisma.umlub.pl/curipms

Quality of life of post-COVID-19 patients before and after rehabilitation

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ARTICLE INFO

Received 03 May 2024
Accepted 12 December 2024

Keywords:
quality of life,
rehabilitation,
COVID-19.

ABSTRACT

Quality of life is an important indicator that should be treated on par with medical health indicators. Among COVID-19 survivors, a decline in quality of life is often observed due to persistent, long-term symptoms affecting physical and mental functioning, as well as social activity. A major factor improving the quality of life and health of patients is multidimensional rehabilitation. The aim of the presented study was to analyze changes in quality of life and self-assessment of health status influenced by rehabilitation, the quality of life of patients after rehabilitation, and the health problems experienced by COVID-19 survivors. A self-authored questionnaire and the WHOQOL-BREF scale were employed in the study. Questionnaires were collected from a total of 166 patients who had been diagnosed with a positive COVID-19 test and had undergone rehabilitation after recovery. It was found that the respondents most frequently experienced cognitive, musculoskeletal and respiratory disorders. Moreover, a positive impact of rehabilitation on the quality of life ($p<0.001$) and health status ($p<0.001$) of recovered patients was demonstrated. Rehabilitation, with particular emphasis on therapeutic exercises and respiratory rehabilitation, is therefore an important factor in improving the functioning of patients and their ability to perform daily activities.

INTRODUCTION

Quality of life (QOL) plays an increasingly important role in health and medical research as a complement to medical therapy [1]. Understanding a patients' subjective assessment of their health leads to improved treatment and care. Moreover, it allows for predicting their future condition and even survival [2]. This term has not been explicitly defined yet. The World Health Organization (WHO) describes quality of life as an individual's self-assessment of their position in life, taking into account their life goals and values [3]. In turn, Felc and Perry proposed a definition of quality of life combining subjective and objective indicators, distinguishing physical, material, emotional and social well-being, as well as the development and activity of a given person [4]. Other authors also emphasize the multidimensional nature of quality of life, considering the dynamic differences in its assessment both between individuals and throughout an individual's lifetime [5-6].

On March 11, 2020, the World Health Organization (WHO) declared the SARS-CoV-2 virus, responsible for COVID-19 to be a global health emergency, and officially announced it as a pandemic [7]. Scientific research has been and continues to be conducted on the short- and long-term effects of the disease and difficult recovery [8-10]. Although there are risk factors that predispose to longer-lasting consequences of the disease, such as obesity, high blood pressure, mental health disorders, female gender or older age [9,11,12], long-lasting symptoms may also occur in younger patients without co-existing conditions [8,13] after either a severe or a mild course of the disease [8,10,14]. Among the persistent symptoms following COVID-19, there are, among others, loss of smell, loss of taste, difficulties with concentration and memory, fatigue, anxiety, depression, shortness of breath, hypoxia, headaches, joint pain, chest pain, pain during deep breaths and reduced work capacity [9,10,12,13,15-17]. COVID-19 can, therefore, lead to a significant deterioration in quality of life, which has also been confirmed in numerous studies [11,15,18-23].

In light of the above, the significant role of rehabilitation in improving the health of COVID-19 survivors is emphasized [12,18,24-29], with attention also drawn to the necessity of multidimensional care [24,26]. It has been

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demonstrated that patients' health and quality of life significantly improve as a result of therapeutic exercises [25,28,29] or pulmonary rehabilitation [27]. In Poland, independent rehabilitation after COVID-19 is recommended, in accordance with WHO recommendations [30], and patients are offered various treatments in healthcare facilities [31].

AIM

The aim of the study was to assess the quality of life and health status of COVID-19 survivors before and after rehabilitation, and to examine how this assessment changes as a result of using rehabilitation. Another objective was to analyse the quality of life of the patients after rehabilitation in four possible dimensions, i.e. physical, psychological, social and environmental functioning. In addition, the purpose was to identify the most common health problems after COVID-19.

MATERIALS AND METHODS

The research tool applied in the study was a self-designed questionnaire used to collect demographic data and additional questions necessary to carry out the study. The second questionnaire utilized in the research was the abbreviated version of the World Health Organization Quality of Life Assessment (WHOQOL-BREF), validated in Polish by Jaracz K. *et al*. [32]. It consisted of 26 questions so as to assess the quality of life and health in the physical, psychological, social and environmental spheres.

The assessment of quality of life in the psychological domain includes the following components: joy of life, sense of life purpose, meaning of life, attention span, and the experience of negative feelings. For the physical domain, it includes: physical pain and discomfort, dependence on medication and treatment, energy for life, mobility, sleep, the ability to lead a normal daily life, and work capacity. For the social domain, it contains: personal relationships, sexual life, and social support. For the environmental domain, it involves: sense of security, physical environment, neighborhood, financial resources to meet needs, access to information, free time, and living conditions. Responses to the WHOQOL-BREF are scored on a 5-point scale, with a maximum score of 4 to 20 points in each of the above areas wherein the higher the scores obtained in particular areas, the higher the quality of life. The tool also includes two separate statements to be analysed, which focus on the individual's overall perception of quality of life and the individual's perception of overall health. The points for each domain are determined by calculating the arithmetic mean of each item from the individual domains.

The WHOQOL-BREF questionnaire was completed by respondents regarding their quality of life after rehabilitation, and the respondents were additionally asked to retrospectively assess their overall quality of life and also to self-rate their health status before rehabilitation.

The study was conducted among adults residing in the Lublin Voivodeship who had undergone COVID-19 infection, subsequently participated in post-COVID-19 rehabilitation, and provided informed consent to participate in the research. The questionnaire was anonymous and completed online using a Google Form. The collection period started in November 2023 and ended in June 2024. Participants were informed about the purpose of the study and how to complete the survey.

The study involved 166 people who suffered from COVID 19 and attended rehabilitation after the illness. The data show that the vast majority were women (88.0%), the remaining 12% were men. The youngest respondent was 23 and the oldest was 69, while the average age of the respondents was 43.7±11.9. A similar proportion of participants were rural residents (53.6%) and urban residents (46.4%). The majority of respondents had higher education (65.1%) and very good (32.5%) or good (55.4%) socio-economic conditions. The largest proportion of participants were married (59.6%) and those for whom employment was the primary source of income (79.5%). The average length of illness with COVID-19 was 14.27±9.60 days, and the average time since diagnosis was 2.74±0.95 years. Respondents used rehabilitation on average 6.52±4.40 months after the disease. The participants underwent rehabilitation for a period ranging from 1 to 62 weeks, with an

Table 1. Characteristics of the respondents

Variables		M±SD	Me (Min; Max)
Age		43.7±11.9	42.0 (23.0;69.0)
Time since diagnosis of COVID 19 (in years)		2.74±0.95	3.0 (0.5;4.0)
Duration of illness with COVID 19 (in days)		14.27±9.60	13.0 (3.0;62.0)
Period of rehabilitation after COVID 19 (in months)		6.52±4.40	6.0 (1.0;24.0)
Duration of rehabilitation (in weeks)		6.61±8.71	4.0 (1.0;68.0)
Time since completion of rehabilitation (in years)		2.26±0.74	2.0 (0.5;4.0)
Variables		N	%
Sex	Woman	146	88.0%
	Man	20	12.0%
Place of residence	Countryside	89	53.6%
	City	77	46.4%
Education	Secondary	52	31.3%
	Higher	108	65.1%
	Vocational	6	3.6%
	Primary	0	0.0%
Marital status	Unmarried	14	8.4%
	In an informal relationship	38	22.9%
	Divorced	13	7.8%
	Widowed	2	1.2%
	Married	99	59.6%
Socio-economic conditions.	Very good	54	32.5%
	Good	92	55.4%
	Average	20	12.0%
	Bad	0	0.0%
	Very bad	0	0.0%
Source of income	Employment	132	79.5%
	Social benefits	1	0.6%
	Pension	9	5.4%
	Maintenance by other family members	24	14.5%

average rehabilitation time of 6.61±8.71 weeks. On average, more than two years have passed since the rehabilitation (2.26±0.74 years). Detailed characteristics of the study population are presented in Table 1.

Statistical analysis

Preliminary analysis used the measurements of descriptive statistics. Continuous variables were reported as means (M) standard deviation (SD), median (ME) and minimum (MIN)–maximum (MAX) range. Qualitative variables were presented in the form of frequencies and percentages. The Wilcoxon test was applied to examine two dependent samples, i.e. quality of life and self-assessment of health before and after rehabilitation. The nonparametric test was chosen due to the ordinal nature of the dependent variable. Statistica 13.3 [TIBCO Software Inc. (2017). Statistica (data analysis software system), version 13. http://statistica.io.] and Microsoft Excel 365 were employed to develop the research results. Statistical significance was set at $p<0.05$.

RESULTS

The largest proportion of respondents (72.9%) reported experiencing changes in the cognitive system (brain fog, problems with concentration, memory, sleep, chronic fatigue syndrome) as a consequence of COVID-19, while 56.5% had changes in the musculoskeletal system (muscle and joint pain), and slightly fewer respondents reported respiratory system issues (pneumonia, breathing problems). In addition, the respondents complained of gastrointestinal disturbances, mental disorders such as post-traumatic stress disorder, depression and anxiety (38% each), as well as skin and hair problems (36.1%). Other disorders occurred less frequently (Table 2).

Table 2. Post-COVID-19 ailments among the studied patients

Intensification or changes in individual body systems as a consequence of COVID-19	N	%
Cardiovascular system (myocarditis, rhythm and conduction disorders, heart failure, acute coronary syndrome, inflammatory changes in blood vessels, thromboembolic complications and blood pressure variability)	44	26.5
Thromboembolic incidents (pulmonary embolism, heart attack, ischemic stroke, embolism in lower limb vessels, liver and kidney damage, myocardial ischemia and damage, cortical changes)	21	12.7
Respiratory system (pneumonia, breathing problems)	91	54.8
Excretory system and kidneys – vascular damage (microemboli) – kidneys damage	6	3.6
Skin and hair – rashes, skin eruptions, persistent changes in blood flow in hands and feet (COVID toes – red-purple lesions on the fingers and toes with blisters and ulcers), hair loss	60	36.1
Dryness syndrome	57	34.3
Gastrointestinal disturbances	63	38.0
Nervous system – strokes, seizures, Guillain–Barré syndrome, neuropathies, post-infectious encephalitis, development of Parkinson's disease and Alzheimer's or vascular dementia; persistent problems with smell and taste	28	16.9
Cognitive function disturbances – brain fog, problems with concentration, memory, sleep, chronic fatigue syndrome	121	72.9
Mental health – post-traumatic stress syndrome, depression and anxiety	63	38.0
Musculoskeletal system – muscle and joint pain	94	56.6

The most common sources of information about the possibility of participating in post-COVID-19 rehabilitation for the respondents were healthcare professionals (45.2%), mass media (21.7%) and friends (19.9%). Upon analyzing the place of rehabilitation, it turned out that home (47%) and outpatient (36.1%) conditions were indicated most often, and only 16.9% of those surveyed had so in a rehabilitation center or in a hospital ward. Among the types of rehabilitation used by the respondents, the most common were individual inhalation therapy (67.5%), outdoor therapy and walking trainings (66.3%), relaxation exercises (48.2%), kinesiotherapy (47.6%) and therapeutic massages (41%). In the remaining forms of rehabilitation, the respondents participated much less frequently. Among the additional types of rehabilitation, the respondents opted for physical exercises (84.3%) and dietary counseling (67.5%), while 44% chose psychological support and 18.1% selected occupational therapy (Table 3).

Table 3. Characteristics of rehabilitation in the group of studied patients after COVID-19

Sources of information about the possibility of participating in rehabilitation after COVID-19	N	%
Mass media	36	21.7
Healthcare professionals	75	45.2
Friends	33	19.9
Family	10	6.0
Informational leaflets	12	7.2
Location of rehabilitation	N	%
At home	78	47.0
In outpatient care	60	36.1
In a rehabilitation center or hospital ward	28	16.9
Types of rehabilitation	N	%
Kinesiotherapy	79	47.6
Chest percussion and tapping, postural drainage	45	27.1
Individual inhalations	112	67.5
Outdoor therapy, walking training	110	66.3
Balneotherapy	2	1.2
Therapeutic massage	68	41.0
Hydrotherapy	20	12.0
Physical therapy	6	3.6
Relaxation trainings	80	48.2
Additional types of rehabilitation	N	%
Physical exercises	140	84.3
Psychological support	73	44.0
Dietary counselling	112	67.5
Occupational therapy	30	18.1

The overall quality of life of the studied patients improved significantly after undergoing rehabilitation ($Z=6.12$; $p<0.001$). More than three times fewer respondents described their quality of life as poor after rehabilitation, while the percentage of respondents reporting very good quality of life more than doubled. It can also be observed that after completing rehabilitation, a significantly greater number of surveyed patients considered their quality of life as good (Figure 1).

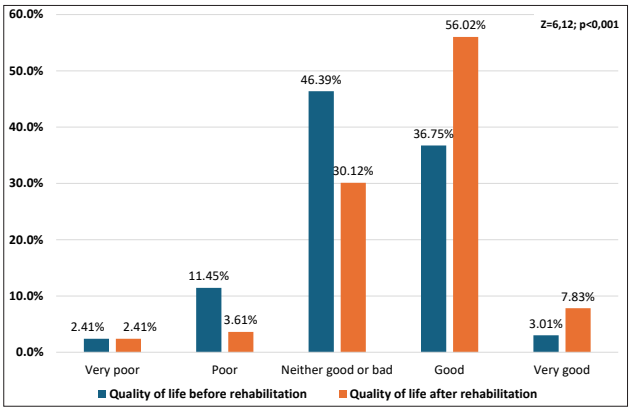

Figure 1. Overall quality of life among the surveyed patients after COVID-19 before and after rehabilitation

Patients after rehabilitation rated their health status significantly better than patients before rehabilitation (Z=5.84; p<0.001). The percentage of individuals who were very satisfied with their health condition doubled, while after rehabilitation, none of the patients selected the answer "very dissatisfied". It was also observed that significantly more respondents declared satisfaction with their health, while considerably fewer were neutral (neither satisfied nor dissatisfied) (Figure 2).

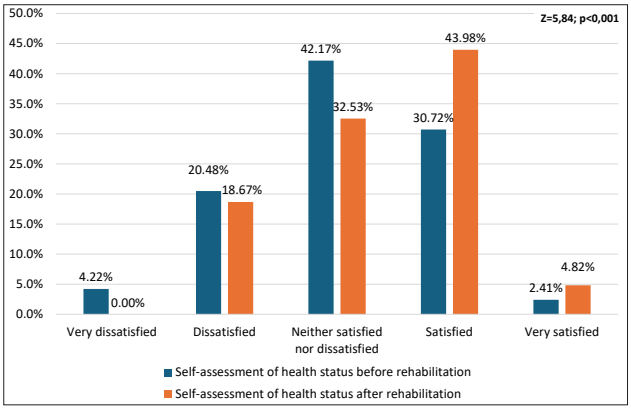

Figure 2. Self-assessment of health status among the studied patients after COVID-19 before and after rehabilitation

Table 4 and Figure 3 present the quality of life after rehabilitation across four domains of functioning: physical, psychological, social, and environmental. Respondents could obtain scores ranging from 4 to 20 points. We can observe that the average scores in the analyzed areas of life quality for the surveyed patients were around 13-14 points - slightly above the midpoint of the scale. This indicates an average quality of life of COVID-19 survivors in these four areas.

Table 4. Quality of life of the surveyed patients after recovering from COVID-19 who underwent rehabilitation

WHOQOL-BREF	N	M	SD	Min	Max	Me
Physical Domain	166	13.64	2.30	8.0	19.0	13.1
Psychological Domain	166	13.75	2.78	6.7	19.3	13.67
Social Domain	166	13.61	3.36	4.0	20.0	14.67
Environmental Domain	166	14.05	2.69	4.5	20.0	14.00

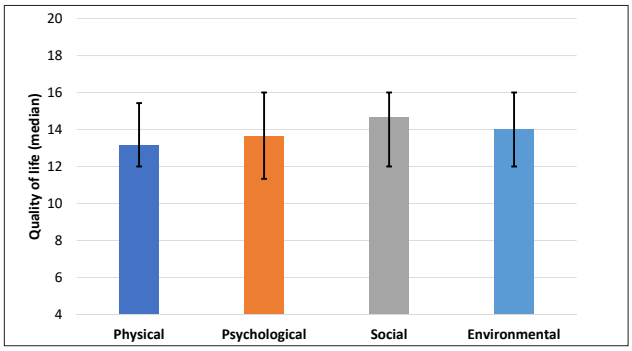

Figure 3. Quality of life of the surveyed patients after COVID-19 who underwent rehabilitation

DISCUSSION

The aim of the presented study was to analyze the change in quality of life and self-assessment of health as a result of rehabilitation, to analyze the quality of life of patients after rehabilitation in four dimensions: physical, psychological, social, and environmental, and to identify the most common health issues among COVID-19 survivors. To achieve the stated research objectives, a self-authored questionnaire was employed, as well as the standardized WHOQOL-BREF questionnaire in a Polish version [32].

The results of the study indicate that rehabilitation significantly improves both quality of life (Z=6.12; p<0.001) and self-assessment of health status (Z=5.84; p<0.001) after recovering from COVID-19. Moreover, patients who rated their quality of life as very poor or poor constitute only 6.02% of COVID-19 survivors after rehabilitation. However, it is worth noting that approximately one-fifth of the respondents are still dissatisfied with their health condition (18.67%). In turn, the quality of life in the dimensions of physical, psychological, social and environmental functioning is average, however, there is a predominance of positive answers. The most common consequences of COVID-19 were changes in the cognitive system (brain fog, problems with concentration, memory, sleep, chronic fatigue syndrome), which affect as many as 72.9% of patients, as well as changes in the musculoskeletal system (muscle and joint pain) and the respiratory system (pneumonia, breathing problems), which affect more than half of the respondents.

Studies by other authors confirm the results of the presented study, namely, the beneficial impact of rehabilitation on quality of life and health after recovering from COVID-19. Udina *et al*. indicate improved functioning in elderly people as a result of therapeutic exercise, including in patients who stayed in intensive care units and were often immobilized as a result [29]. A meta-analysis of 23 studies by Zheng *et al*. also highlighted the role of exercise-based rehabilitation in long COVID therapy [33]. The effectiveness of therapeutic exercise is also described by Fernández-Lázaro *et al*., pointing to improvements in strength, respiratory functions, physical fitness and quality of life of patients [25]. Another review paper confirming that there is sufficient evidence for the efficacy of appropriately tailored physical training in the multi-system therapy of post-COVID syndrome for various symptoms is the article by Jimeno-Almazán *et al*. [28]. Other studies indicate that a

combination of respiratory muscle training, targeted breathing, and strength training significantly improves exercise tolerance, reduces fatigue, decreases shortness of breath, and enhances functionality and quality of life in COVID-19 survivors [34]. Moreover, a meta-analysis by Oliveira *et al*. also confirms the increase in exercise capacity and reduction in fatigue following respiratory rehabilitation in patients with post-COVID-19 syndrome [35].

COVID-19 survivors who participated in the study exhibit an average quality of life, despite the extended length of time since their illness (an average of 2.74±0.95 years). Of note, one-fifth of them are not satisfied with their health condition. The study by Pérez Catalán *et al*. confirms that the quality of life remains reduced one year after COVID-19 treatment, with patients still experiencing issues in both physical and mental health domains [20]. Zięba *et al*. also indicate that nearly half of the patients experience a lower quality of life and worse health status after recovering from COVID-19 [18]. Indeed, a significantly reduced quality of life has been demonstrated in COVID-19 survivors even two years after the illness, as reported by d'Ettorre *et al*. [11]. Persistent fatigue, memory and concentration problems, symptoms of depression and anxiety, as well as a deteriorated quality of life, were also described in an article by Calabria *et al*. [36].

The presented analysis of the survey results indicated that COVID-19 survivors most commonly experience cognitive function disorders, including fatigue, muscle and joint pain, as well as respiratory problems. Other researchers also point to fatigue, memory and concentration problems, pain, shortness of breath, and difficulty breathing as common consequences of recovering from COVID-19. However, the percentage of patients affected by these issues varies significantly across different studies [14-15,36-41]. The analysis conducted by Aiyegbusi *et al*. identified ten most common symptoms that persist in patients after recovering from COVID-19 [42]. Among these, fatigue, muscle and joint pain, and respiratory problems were also reported, as well as diarrhea and disorders of smell and taste. Gastrointestinal and nervous system disorders were reported less frequently in the present study. In the study by Román-Montes, hair loss was reported much more often, with the percentage of patients experiencing this issue reaching as high as 60% [37].

To sum up, patients after COVID-19 experience a variety of symptoms that often persist long after recovery and reduce the quality of life and deteriorate the health of recovered patients in many dimensions. Rehabilitation, with particular emphasis on therapeutic exercises and respiratory rehabilitation, is an important factor in improving the functioning of patients and their ability to perform daily activities. Therefore, further research in this area is necessary.

Limitations of the study

The research was conducted after COVID-19 patients had undergone rehabilitation, and therefore the assessment of quality of life prior to rehabilitation is limited. Additionally, the analysis of quality of life only took into account the subjective feelings of the patients, without considering objective indicators, such as medical tests.

CONCLUSIONS

1. The overall quality of life and self-assessment of health among patients who have recovered from COVID-19 significantly improve after undergoing rehabilitation.
2. The quality of life of COVID-19 survivals after rehabilitation in terms of physical, psychological, social, and environmental functioning is at an average level.
3. The most common consequences of COVID-19 include changes in the cognitive, musculoskeletal, and respiratory systems.

Due to the long-term and varied health effects of recovering from COVID-19, further studies on the quality of life of COVID-19 survivors are necessary. Research in this area will contribute to increasing knowledge about the quality of life of COVID-19 survivors and the need for rehabilitation in the healing process.

ACKNOWLEDGEMENTS

The authors give special thanks the participants for their invaluable support, guidance, and educational insight.

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