Recommendations and Effects of Rehabilitation Programs in Older Adults After Hospitalization for COVID-19

A Scoping Review

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Abstract: The aims of this review were to identify studies on physical rehabilitation programs and describe the potential effects on functional outcomes in patients older than 60 yrs at discharge from acute care post-COVID-19. The literature search was conducted in the MEDLINE, Cochrane CENTRAL, EMBASE, PEDro, LILACS, CINAHL, SPORTDiscus, Web of Science, and The Living OVerview of Evidence (L-OVE) COVID-19 databases. Studies with patients older than 60 yrs, hospitalized with COVID-19, and admitted to a rehabilitation program after discharge from acute care were included. Ten studies were included with a total of 572 patients. The prevalence of patients who received post–intensive care rehabilitation was 53% (95% confidence interval, 0.27–0.79; $P = 0.001$). The rehabilitation program included physiotherapy in nine studies, occupational therapy in three studies, and psychotherapy in two studies. The rehabilitation programs increased aerobic capacity, functional independence in basic activities of daily living, muscle strength, muscle mass, dynamic balance, physical performance, pulmonary function, quality of life, cognitive capacity and mental health. Multidisciplinary rehabilitation programs are necessary for older adults after hospitalization for COVID-19, especially those coming from intensive care units, as rehabilitation has a positive effect on important clinical outcomes.

Key Words: COVID-19, Post–Acute COVID-19 Syndrome, Physical Therapy Rehabilitation, Physical Function, Older Adults

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The COVID-19 or severe acute respiratory syndrome coronavirus 2 (disease caused by SARS-CoV-2 virus) has been responsible for a large global pandemic. The latest number of confirmed cases of COVID-19 is >7.5 million globally, resulting in >6.5 million deaths and requiring >4 billion people to stay confined to their homes.[1] Usually, people with COVID-19 experience mild to moderate illness, but around 15% progress to severe pneumonia, and about 5% develop acute respiratory distress syndrome,[2] leading to serious complications that require admission to an intensive care unit (ICU).[3]

Hospitalization in patients with COVID-19 has been shown to be a risk factor for decreased functionality and increased mortality in older adults and has been associated with worse mobility, even in the absence of hospitalization.[4] Similarly, prolonged hospitalization can affect the physical function of patients, especially in the older population, producing long-term symptoms such as muscle weakness, fatigue, and worsening in aerobic capacity.[5–7] Many individuals continue to experience symptoms, or develop new ones, after the initial COVID-19 acute infection period has passed. The presence of ongoing symptoms after coronavirus infection has been defined as "post-COVID syndrome" or "long covid."[8–10] According to the World Health Organization, post-COVID syndrome is characterized by symptoms after 3 mos from the onset of COVID-19 symptoms and that last for at least 2 mos without an alternative diagnosis.[1,11] Evidence has shown that the most common symptoms of post-COVID-19 syndrome include muscle weakness, exertional desaturation, fatigue, shortness of breath, cough, chest pain, muscle pain, headaches, anxiety, and functional decline.[12,13]

Physical and respiratory rehabilitation has been proposed by some studies as a treatment to improve the functional impairment caused by coronavirus infection.[14,15] However, although there is a guideline for post-COVID-19 rehabilitation, most of the evidence included is based on different interventions with a population other than COVID-19 patients.[15,16] Therefore, the characteristics and effects of rehabilitation programs on older adults with post-COVID-19 syndrome have not yet been broadly studied.

The aims of this scoping review were (i) to identify the studies on rehabilitation programs for older adults 60 yrs or older after hospitalization for COVID-19 and (ii) to describe

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the potential effects of physical rehabilitation on functional outcomes in this population upon discharge from acute care.

METHODS

Protocol

A scoping review was performed based on the PRISMA-ScR declarations and statement (see Supplementary Checklist, Supplemental Digital Content 1, http://links.lww.com/PHM/B944).[17]

Data Sources and Searches

A systematic search of the MEDLINE (via PubMed), Cochrane CENTRAL, EMBASE, PEDro, LILACS, CINAHL, SPORTDiscus, Web of Science, and The Living OVerview of Evidence (L-OVE) COVID-19 platforms from inception until February 2022 was conducted. The search strategy used included a combination of the following medical subject heading (MeSH) terms: "Coronavirus"; "Coronavirus infections"; "COVID-19"; "SARS-CoV-2"; "Exercise Therapy"; "Physiotherapy"; "Rehabilitation." These were combined with the following free-text terms: "Physical activity" *and* "Exercise program." To identify the studies, a literature search was conducted independently by two reviewers. The search process is described in Figure 1.

Two authors used a standardized form to independently extract data on outcomes for each study. The following data were extracted from the original reports: (i) authors, country and (ii) study characteristics (aim, sample size, age, length of stay, number of sessions, and type of therapy).

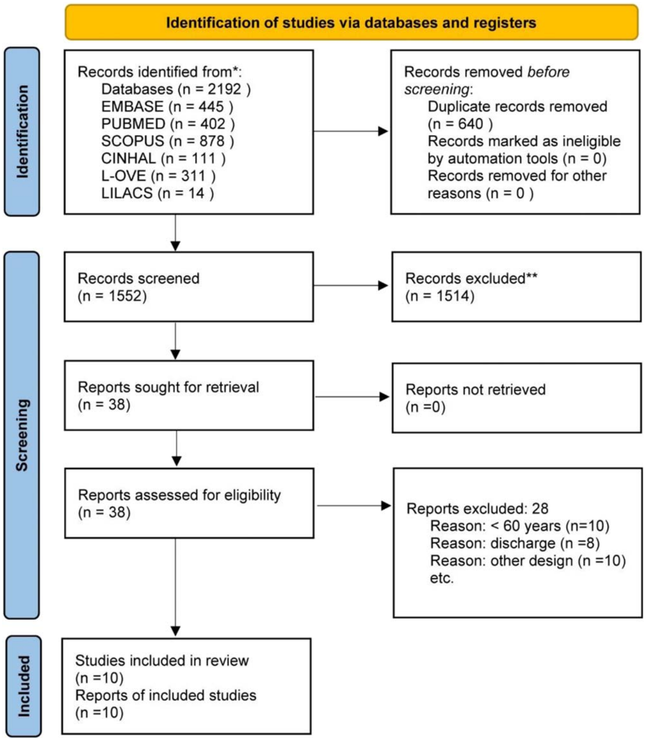

FIGURE 1. Flow chart diagram.

Eligibility Criteria

Primary studies were considered eligible if they included older adults 60 yrs or older hospitalized with COVID-19 and admitted to rehabilitation programs after discharge from acute care. Study protocols and conference proceedings were excluded.

Critical Appraisal of Individual Studies

The risk of bias of observational studies was determined using the ROBINS-I Tool.[18] This tool assesses the risk of bias according to the following seven domains: confounding, selection of participants into the study, classification of interventions, deviations from intended interventions, missing data, measurement of outcomes, and in selection of the reported result. For the randomized clinical trial, the assessment was performed using the Risk of Bias II Cochrane tool.[19] Each domain could be considered as "low," "unclear or some concerns," or "serious or critical" risk of bias. Data extraction and quality assessment were independently performed by two reviewers. If a consensus could not be reached, a third reviewer was involved.

Statistical Analysis

Descriptive analyses were conducted for those studies that presented insufficient data for overall pooling, and narrative synthesis was performed following the Cochrane Collaboration guidelines.[20] To perform the meta-analyses, the DerSimonian-Laird random effect method ($I^2 > 70\%$) was used, and the prevalence estimate was calculated with the proportion of individuals who received rehabilitation after intensive care with respective 95% confidence intervals. Forest plot analysis was performed using the jamovi software (version 1.6).[21]

RESULTS

Study Characteristics

A total of 1552 unique records were identified through database searching, resulting in 10 articles[3,5–13] (Fig. 1). Nine studies had a observational design[3,5–8,10–13] and one study[9] was a randomized control trial. The kappa agreement rate between reviewers was 0.93.

A summary and description effect of the included studies is shown in Table 1 and Supplemental Table 1 (Supplemental Digital Content 2, http://links.lww.com/PHM/B945). The review sample spanned a diverse range of populations, including six studies from Europe, two from Asia, and two from North America involving 572 participants (male, 62%). In addition, of the individuals who underwent rehabilitation, 53% (95% confidence interval, 0.27–0.79; $P = 0.001$) had been hospitalized in an ICU and the length of stay in this unit varied from 4 to 36 days[4,7,9,10] (Fig. 2).

Results of Critical Appraisal of Individual Studies

From the nine observational studies included, two (22.2%) were scored as "low risk,"[10,11] three (33.3%) were scored as "some concerns,"[4,7] and four studies (44.4%) were scored as "high risk" of bias.[3,6,12,13] Only one randomized clinical trial was scored as "high risk" of bias[9] (Fig. 3).

TABLE 1. Descriptive characteristics of included studies

Author	Country	Design	Sample Size, n	Female, n	Age, Years	Hospitalized	Rehabilitation Program: Modality F	O	Intervention PR	PP	OI	Team PT	OT	MT	Outcomes Measures
Bellinger et al. (2021)[3]	United States	Observational	35	23	68.7	Acute care	X		X					X	Inpatient rehabilitation facility patient ($P < 0.001$) Daily life activities (Barthel index; $P < 0.001$) Cardiorespiratory functional capacity (6MWT; $P < 0.001$) Orientation Log ($P < 0.05$) Cognitive Log ($P < 0.001$)
Bertolucci et al. (2021)[5]	Italy	Prospective observational	39	24	67.8 ± 10.8	Acute care	X		X	X		X			Daily life activities (Barthel index; $P < 0.001$) Functional ambulation ($P < 0.001$)
Bonizzato et al. (2022)[6]	Italy	Observational	12	7	71.3 ± 10.1	Acute care	X		X		X			X	Cognitive function (Montreal Cognitive Assessment; $P = 0.065$) Anxiety and Depression Short Scale ($P = 0.072$) Symptoms and behavioral related to dementia (Neuropsychiatry Inventory Scale; $P = 0.02$)
Curci et al. (2020)[7]	Italy	Cross-sectional observational	32	22	72.6 ± 29.3	Acute care	X		X	X	X	X			Daily life activities (Barthel index; $P = 0.15$) Cardiorespiratory functional capacity (6MWT; $P = 0.53$)
Gobbi et al. (2022)[8]	Italy	Observational	48	26	68.7 ± 11.8	Acute care	X		X	X	X			X	Bioimpedance (phase angle; $P = 0.008$) Functional mobility (timed up and go; $P < 0.001$) Dynamometry (handgrip strength; $P = 0.011$)
Groah et al. (2022)[13]	United States	Retrospective observational	88	44	59.4 ± 15.7	Acute care	X		NR			NR			Functional Assessment Self-care Efficiency (mean, 0.9 ± 0.62) Functional Assessment-Mobility Efficiency (mean, 16.4 ± 8.69)
Liu et al. (2020)[9]	China	Randomized controlled trial	36	24	69.4 (8.0)	Acute care	X		X	X		X			Forced expiratory volume (FEV1; $P < 0.05$) Forced vital capacity (FVC; $P < 0.05$) Relation FEV1/FVC ($P < 0.05$)
Sakai et al. (2020)[10]	Japan	Observational retrospective	43	31	65 (21–95)	Acute care and intensive care	X	X	X			X			Daily life activities (Barthel index; $P < 0.001$) Mobility score ($P < 0.001$)
Spielmanns et al. (2021)[11]	Switzerland	Prospective observational	99	57	67.7 ± 10.2	Acute care	X		X	X	X	X			Functional Independence Measurement ($P < 0.0001$) Cardiorespiratory functional capacity (6MWT; $P < 0.0001$)
Zampogna et al. (2021)[12]	Italy	Observational retrospective	140	95	71.0 (61.5–78.0)	Acute care	X		X	X	X			X	Short Physical Performance Battery ($P < 0.0001$) Daily life activities (Barthel index; $P < 0.0001$)

F indicates face-to-face rehabilitation; O, online rehabilitation; PR, pulmonary rehabilitation; PP, physical rehabilitation; OI, other intervention; PT, physiotherapist; OT, occupational therapist; MT, multidisciplinary team; NR, not reported; 6MWT, 6-min walk test.

Rehabilitation Program Modalities

The description of rehabilitation programs was explained in nine studies.[3,5–11,13] Six studies included previous information about hospitalization in the ICU.[4,7–11] Face-to-face rehabilitation was the modality most used in the literature. Around 85% of the individuals included in this review (*n* = 489) received face-to-face rehabilitation,[3,4,6–9,11–13] 3% received a home exercise program (*n* = 18),[4,6–8] and 17% received a combined modality program (*n* = 99).[4,6,11,12] In addition, the rehabilitation program included a multidisciplinary team made up of physiotherapy[3,4,6–11,13] occupational therapy,[3,6,8] and psychotherapy.[6,8]

Physical Rehabilitation Exercises

Most of the rehabilitation programs included physical rehabilitation.[3,4,6–11,13] Postural changes (seating, standing position, and bed-to-chair transfers),[3,6,7] passive and active-assisted exercises,[3,4,7,8,13] upper and lower limb stretching,[4,7,8,13] strengthening,[4,7,8,10,13] progressive aerobic exercise,[8–11] gait training,[3,4,9–11] and coordination and balance exercises[4,11] were the most adopted interventions in the physical rehabilitation programs.[3,4,6–11,13]

Physical Rehabilitation Prescription

Strengthening was included in five studies,[4,7,8,10,13] and the prescription varied from 8 to 12 repetitions, one to three sets, two to six sessions per week for 2 to 3 wks. Progressive aerobic exercise was included in four studies,[8–11] using a cycle and arm-ergometer or treadmill. The prescription varied from low to moderate intensity based on heart rate, 20 to 45 mins per session, two to six sessions per week for 2 to 3 wks. Gait training,[3,4,9–11] coordination, and balance exercises[4,11] were prescribed increasing the complexity to perform the motor task.

Respiratory Physiotherapy

Respiratory physiotherapy was included in five studies.[4,6,8,10,11] The most used interventions were chest expansion, abdominal coordination exercise, controlled breathing, and diaphragmatic reeducation,[4,7,9,11] and coughing exercises, postural drainage, clapping, and vibration were the most used airway clearance techniques.[4,7,9,11,12]

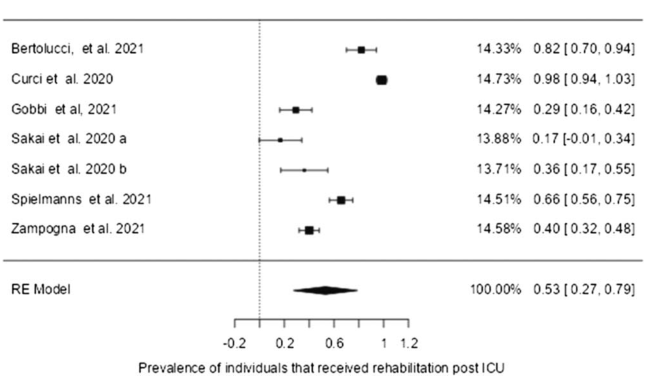

FIGURE 2. Forest plot prevalence of individuals who received rehabilitation post-ICU.

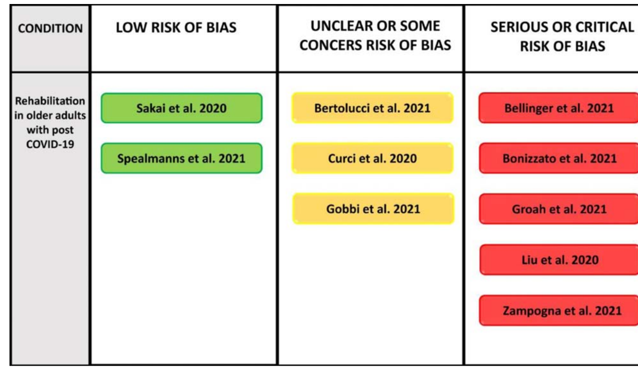

FIGURE 3. Risk of bias of included studies.

Other Rehabilitation Programs

Swallowing rehabilitation was included in one study,[4] using sensory-motor stimulation, change in food consistency, progressive introduction of foods of different consistency, and oral hygiene. Psychologic support and cognitive stimulation were included in two studies,[6,8] using cognitive behavioral therapy to reduce posttraumatic stress symptoms, general stimulation, temporal and spatial orientation, and exercises of general attention and some executive functions. One study[11] included educational sessions with information about self-management, coping skills, self-medication, management of infections and exacerbations, dyspnea, use of oxygen, and nutrition interventions.

Outcome Measurements

Most of the studies reported improvements in physical and cognitive function.[3,4,6–13] The rehabilitation programs increased aerobic capacity,[3,7,9,11] functional independence in basic activities of daily living,[3,4,7,10–13] muscle strength,[8] muscle mass,[8] dynamic balance,[8] physical performance,[13] pulmonary function,[9] quality of life,[9] cognitive capacity, and mental health[3,6,9] (Supplemental Table 1, Supplemental Digital Content 2, http://links.lww.com/PHM/B945). The main clinical improvements with the different rehabilitation programs, with the quality analysis and the sample size, are described in a bubble chart (Fig. 4). The area of the circle shows the sample size of the study, considering as reference study the smallest sample size (Bonizzato et al.,[6] *n* = 12). The color of the bubble represents the risk of bias of each study analyzed with the scale corresponding to each study design. Improvements in aerobic capacity were observed in four studies, one of them with low risk of bias (low bias in selection of participants into the study, classification of interventions, due to deviations from intended interventions, low bias due to missing data, in measurement of outcomes and in selection of the reported result.)[11] and one with some concerns (high risk due to confounding, due to missing data and in selection of the reported results).[7]

The performance of functional activities of daily living improved in six studies, most of them with low to moderate risk of bias. Two studies with moderate or some concerns[5,7] (high risk due to confounding, due to missing data and in selection of the reported results) and three studies with serious or critical risk of bias[3,12,13] (high risk due to confounding, due to deviations from intended interventions, bias due to missing data, bias in classification of intervention).

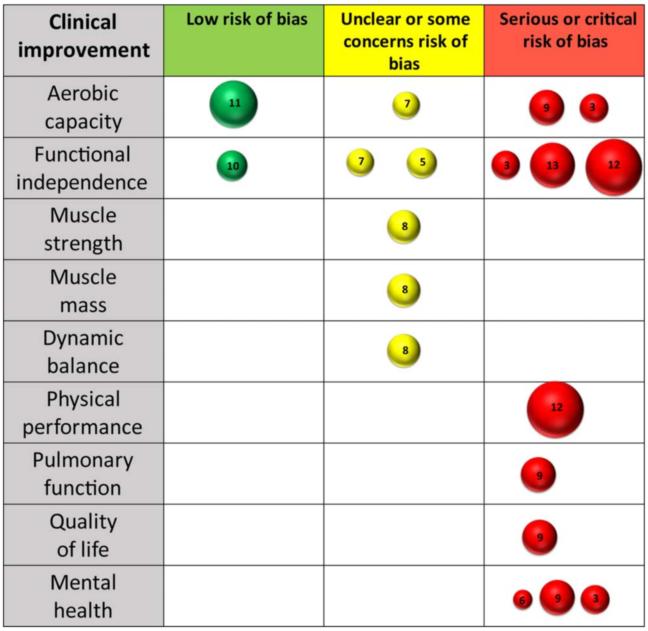

FIGURE 4. Main clinical improvements of the different rehabilitation programs according to risk of bias and sample size of the included studies. Notes: The bubble represents the study and the color the risk of bias of the study. Additionally, the size of the bubble is given by the sample size and the reference number can be seen within the bubble (e.g., Bonizzato et al.,[6] $n = 12$). The difference in the number of bubbles for each clinical improvement is due to whether the study evaluated and reported results on that outcome.

Improvements in muscular strength, muscle mass, and balance were found in only one study with unclear or some concerns for risk of bias[8] (high risk due to confounding, due to missing data and in selection of the reported results).

There was scarce evidence and with a serious or critical risk of bias reported for benefits on physical performance, pulmonary function, and quality of life[9,12] (high risk due to confounding, due to deviations from intended interventions, bias due to missing data, bias in classification of intervention).

Improvement in mental health was presented in three studies, but with a serious risk of bias[3,6,9] (high risk due to confounding, in selection of participants into the study due to deviations from intended interventions, bias due to missing data, bias in classification of intervention).

Physical function was mainly measured using the 6-min walk test,[3,7,9,11] short physical performance battery,[12] timed up-and-go test, and handgrip strength.[8] The Barthel index was the most used scale to measure performance in basic activities of daily living.[3,4,7,10] Mental health was measured using the Montreal Cognitive Assessment, anxiety and depression short scale,[6] and quality of life using the Short Form patient-reported survey of health (SF-36).[9]

DISCUSSION

In this scoping review, rehabilitation programs for older adults at discharge from acute care for COVID-19 were analyzed and the potential effects on functional variables were described. According to the search, most of the rehabilitation programs included physical and respiratory face-to-face rehabilitation for 2 to 3 wks, including individuals with persistent symptoms after discharge for hospitalization from intensive care (53%) with a range of stay length from 4 to 36 days. Even though rehabilitation protocols were very different in the studies included in this review, this study's results highlighted that rehabilitation programs have positive effects on physical function, quality of life, muscle strength, aerobic capacity, and cognitive health in older adults hospitalized for COVID-19. Therefore, considering the negative impact on physical and mental health after COVID-19, a multidisciplinary rehabilitation is necessary to recover the functional capacity and quality of life.[22]

According to a recent systematic review, the pooled global prevalence of post-COVID-19 symptoms is around 43%, which can increase in those individuals after hospitalization from 44% to 63%,[23,24] with decline in quality of life (55%), psychiatric sequelae (56%), fatigue (58%), muscle weakness (52%), dyspnea (43.4%), malnutrition (36%), joint pain (27.3%), attention disorder (27%), and chest pain (21.7%) being the most reported persistent symptoms after discharge for hospitalization for COVID-19.[25–29] The persistence of these symptoms at least 2 mos after SARS-CoV-2 infection has been defined as post-COVID-19 condition.[22] Therefore, a multidisciplinary evaluation is important to identify and treat the different long-term symptoms in individuals who were infected with COVID-19.[30] For this reason, to monitor post-COVID-19 condition, the International Consortium for Health Outcomes Measurement COVID-19 Working Group has proposed to asses five domains: functional status and quality of life, mental functioning, social functioning, clinical outcomes, and symptoms.[31] On the other hand, the European Respiratory Society has developed a multidisciplinary statement to optimize clinical follow-up care in patients with post-COVID-19 condition that includes an intervention to improve quality of life and functional performance in daily life activities.[30] Likewise, the Stanford Hall consensus statement for post-COVID-19 rehabilitation has proposed a multidisciplinary intervention for the rehabilitation of these patients, including physical therapy, psychologic therapy, and nutritional advice.[25] In this scoping review, the findings were consistent with these previous statements[25]; most of the included studies reported different multidisciplinary treatment programs, such as physiotherapy,[3,4,6–11,13] occupational therapy,[3,6,8] psychotherapy,[6,8] and multidimensional therapy.[3,6,8]

Regarding the rehabilitation program, the combination of physical, respiratory physiotherapy, and swallowing rehabilitation has been shown to improve physical condition in older adults.[4,7,9,11,12] However, the distribution of the time of the session between physical or respiratory rehabilitation depends on the priority and need of the patient, considering the sequalae left by the coronavirus and the hospital stay in ICU.[4,7–11] Therefore, physical rehabilitation was included in most of the studies; however, respiratory physiotherapy and swallowing rehabilitation were frequently used in those rehabilitation programs that included a higher proportion of older adults from the ICU.[4,7,9,11,12] For example, in one study that used respiratory physiotherapy and swallowing rehabilitation, 82% of the individuals included were from the ICU.[4] In contrast, in the rehabilitation program of Sakai et al.,[10] 16% of the individuals were derived from the ICU; for this reason, only physical rehabilitation was prescribed. Therefore, the necessity of swallowing and rehabilitation was important in those studies that included a higher proportion of older adults from the ICU, where more respiratory sequelae and swallowing issues were observed. These findings reinforce the idea of creating individualization algorithms in rehabilitation protocols based on specific patient characteristics.

Previous evidence has reported the subacute and long-term clinical and functional effects of COVID-19.[26] Cellular damage, inflammatory cytokines, procoagulant state induced by COVID-19, and prolonged time on mechanical ventilation may contribute to various extrapulmonary sequelae.[32] Older patients with COVID-19 are characterized by spending a prolonged time on mechanical ventilation, which is a factor associated with physical, respiratory, and dysphagia disturbances.[33] A systematic review reported an incidence of postextubation dysphagia of 41% in individuals from the ICU.[34] For this reason, it was observed that swallowing and respiratory rehabilitation was used in cases of prolonged mechanical ventilation.[4]

On the other hand, sarcopenia and malnutrition are frequently observed in patients hospitalized for COVID-19.[35] Both conditions are factors related to frailty, which is associated with worse prognosis, disability, and mortality in older adults with COVID-19.[35] Nevertheless, none of the studies included in this scoping review assessed the presence of frailty or sarcopenia within their participants and the impact that the intervention had on these geriatric syndromes. A recent study observed that rehabilitation could reverse sarcopenia and malnutrition after hospitalization for COVID-19.[36] This fact explains the relevance of rehabilitation programs for older adults hospitalized for COVID-19, given that physical rehabilitation has been shown to be beneficial in multiple diseases, geriatrics syndromes, and clinical conditions in older adults, which share similarities with post-COVID-19 syndrome in terms of functional impact and its possible pathogenic mechanisms. Therefore, it is important to consider the potential effect that rehabilitation programs would bring in the recovery of these patients.[23]

As a clinical recommendation, based on the studies that showed a lower risk of bias,[10,11] rehabilitation programs for older adults hospitalized with COVID-19 must include multimodal exercise considering strength, endurance, and functional exercises, because they have reported benefits on different functional and clinical outcomes.[3,4,6–13] In this regard, progressive strength training with body weight, elastic bands or free weights, or functional exercises based on activities of daily living are highly recommended owing to their easy clinical application. In addition, endurance exercise on a cycle ergometer (for upper or lower limbs), treadmill training, or walking around the hospital could be safe and effective forms of intervention in older people hospitalized for COVID-19. However, it is recommended that the multidisciplinary rehabilitation team establish inclusion/exclusion criteria for participation in interventions with exercise, owing to the different sequelae of the post-COVID-19 syndrome.[23] In addition to a correct exercise prescription, to protect patient safety, it is suggested to establish criteria for stopping intervention with exercise. For example, some studies have suggested the use of parameters focused on respiratory rate, heart rate, blood pressure, fever, oxygen saturation, nausea, or angina.[7,10] Finally, it is also important to consider educational strategies for symptom control and rehabilitation exercises at home.[11]

Despite the benefits reported by the interventions and the need for rehabilitation in patients hospitalized for COVID-19, the results reported in this review should be analyzed with caution as most studies presented a high risk of bias, as well as the noninclusion of randomized clinical studies that evaluate the benefit of the intervention *vs.* a control group. In addition, there are other limitations to this study. First, although eight databases were searched and articles in three different languages (English, Spanish, and Portuguese) were included, articles relevant to the search could have been missed. Second, the recommendations should be interpreted with caution in relation to the limited strength of available evidence. Therefore, future randomized clinical trials are necessary in this field.

CONCLUSION

In summary, this scoping review observed that physical exercise, pulmonary exercise, swallowing stimulation, psychologic support, and cognitive rehabilitation were the main interventions included in multidisciplinary rehabilitation programs, which have a positive effect on the physical function, quality of life, muscle strength, aerobic capacity, and cognition in older adults with post-COVID-19 sequelae, especially in those individuals discharged from the ICU. Finally, this scoping review shows that more high-quality research focusing on post-COVID-19 recovery is needed to provide physician and clinical care with clear evidence-based guidelines.

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