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Abstract

Objective. Many survivors of COVID-19 experience ongoing signs and symptoms affecting multiple body systems that impair function and negatively affect participation and quality of life. The purpose of this review was to identify and synthesize outpatient rehabilitation assessment and treatment recommendations for adults in postacute COVID-19 stages.

Methods. MEDLINE (Ovid), EMBASE (Ovid), Central, CINAHL, and Scopus were searched from January 1, 2020, to December 7, 2020. Teams of 2 reviewers independently assessed study eligibility and extracted data. All study designs that included rehabilitation recommendations were included. Study design, country, study population, purpose, and rehabilitation recommendations were recorded. The Appraisal of Guidelines for Research and Evaluation (AGREE II) instrument was used to evaluate the quality of consensus guidelines.

Results. Forty-eight articles fit the inclusion and exclusion criteria (11 systematic reviews, 1 scoping review, 6 original research studies, 4 consensus guidelines, 26 narrative reviews, and editorials/commentaries). Recommended outcomes included exercise tolerance, respiratory function, muscle strength, and activities of daily living (ADL) or functional independence. Recommended treatments included respiratory rehabilitation, exercise therapy, education, psychological support, ADL and gait training, traditional Chinese medicine, and cognitive and vocational rehabilitation.

Conclusion. There were incongruities between what is known about postacute COVID-19 and what was recommended in the literature. Given the relatively large proportion of survivors who experience ongoing symptomatic COVID-19 or post–COVID-19 syndrome, it is important to quickly develop tools for self-management and access to rehabilitation specialists in multidisciplinary teams.

Impact. Physical therapists, occupational therapists, and respiratory therapists have an important role to play. Clinicians should focus on epidemiological evidence and emerging information on late sequelae of COVID-19 to inform rehabilitation programming and future research.

[H1]Introduction

As of April 1, 2021, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) associated with the COVID-19 pandemic has infected more than 128 million people world-wide and claimed the lives of more than 2.8 million.[1] The clinical presentation of patients with COVID-19 ranges from asymptomatic to critically ill.[2] Patients with mild illness may experience a myriad of symptoms including fever, cough, fatigue, muscle pain, and gastrointestinal complaints.[2] At the other end of the spectrum, those with severe and critical levels of illness demonstrate low oxygen saturation, high respiratory rates, lung infiltrates, septic shock, and/or multiple organ dysfunction.[2] COVID-19 is a multi-system disease that affects the respiratory, neurological, cardiovascular, musculoskeletal, renal, hepatic, and immune systems.[3-6] Adults with chronic medical conditions such as cardiovascular disease (including hypertension), chronic lung disease, diabetes, cerebrovascular disease, obesity, cancer and chronic kidney disease are at greater risk of being severely affected in the acute stages of COVID-19.[7,8] Patients who require treatment in the intensive care unit (ICU) are also at risk of developing post-traumatic stress disorder (PTSD) and post-intensive care syndrome (PICS).[9]

It is becoming increasingly apparent that many patients, including those who experienced relatively mild disease, experience persistent signs and symptoms and/or new signs and symptoms beyond the initial period of acute infection and illness associated with COVID-19.[10-13]

Many of these signs and symptoms impair function and negatively affect participation and quality of life, which suggests the need for rehabilitation intervention. However, given the novelty of COVID-19 and its associated stages of recovery, physical therapists, occupational therapists, and respiratory therapists have little experience and background to guide their practice. Systematic examination, summarization, and dissemination of emerging rehabilitation literature, such as through a scoping review, are important to provide direction in the assessment and treatment of post-acute COVID-19 patients by rehabilitation professionals.

The National Institute for Health and Care Excellence (NICE) in partnership with the Scottish Intercollegiate Guidelines Network and the Royal College of General Practitioners recently published a guideline on clinical considerations for people with long-term effects of COVID-19.[13] The guideline includes definitions for timeframes associated with the recovery. The acute signs and symptoms of COVID-19 typically last for up to 4 weeks. "Ongoing symptomatic COVID-19" describes the condition when symptoms last from 4 to 12 weeks, and "post-COVID-19 syndrome" occurs when symptoms persist for more than 12 weeks and cannot explained by an alternative diagnosis. "Long COVID" is used to describe both post-acute stages, ie, ongoing symptomatic COVID-19 and post-COVID-19 syndrome.[13]

Symptoms reported by patients experiencing post-acute COVID-19 are highly variable and relatively little related research exists to date. One study conducted in Italy in April to May 2020 reported that 87% of patients experienced continuing symptoms approximately two months after the onset of COVID-19, and 55% of the sample had three or more persistent symptoms.[10] This study enrolled 143 patients with a mean age of 56.5 years, and mean length of hospital stay 13.5 days (77 patients received oxygen therapy, and 7 required invasive ventilation). The most common continuing symptoms were fatigue (53%) and dyspnea (43%). Another study conducted in France that included 120 patients 111 days following hospital admission (96 ward patients, 24

ICU patients) reported ongoing fatigue (55%), dyspnea (42%), loss of memory (34%), problems with concentration (28%) and sleep disorders (31%).[11] A study conducted in the United Kingdom (n = 100, mean 48 days post hospital discharge) reported similar results.[12] Other common persistent and/or new symptoms include gastrointestinal illnesses, cardiovascular symptoms (eg, chest tightness, palpitations), muscle and joint pain, and dizziness.[13] While studies such as these provide important information about the course of disease after discharge from hospital, severity of disease does not predict the development of post-acute COVID-19 and a large number of people who had relatively mild disease are also affected.[13]

The recently released NICE guidelines suggest clinician-supported self-management and individually-prescribed multidisciplinary rehabilitation as the foundation for treatment of individuals post-acute COVID-19.[13] The guidelines advocate for including physical therapists, occupational therapists, rehabilitation medicine specialists, and clinical psychologists on the healthcare teams treating these patients.[13,14] They also recommend that experts "share knowledge, skills and training between services to help practitioners in the community provide assessments and interventions".[13(Section 8.3)] The purpose of this study was to conduct a scoping review to identify and synthesize outpatient rehabilitation assessment and treatment recommendations for adults continuing to experience signs and symptoms post-acute COVID-19. The following research questions were posed: (1) What processes were used to develop the rehabilitation recommendations? (2) What outcomes and outcome measures are recommended for patients experiencing post-acute signs and symptoms related to COVID-19? (3) What rehabilitation treatments are recommended for these patients?

[H1]Methods

[H2]Study Design

This scoping review followed the methodological framework outlined by Arksey and O'Malley.[15] We also considered refinements to scoping review methodology as discussed by Levac et al.[16] The PRISMA Extension for Scoping Reviews (PRISMA-ScR) checklist guided reporting.[17]

[H2]Protocol and Registration

We developed a protocol outlining the methodology for our scoping review entitled, "A scoping review of rehabilitation recommendations for people post-acute COVID-19." The protocol was published on Open Science Framework on September 22, 2020.[18] (https://osf.io/9ucag).

[H2]Identifying relevant studies

[H3]Search strategy

We developed the search strategy in consultation with a health sciences librarian using a combination of controlled vocabulary (eg, MeSH headings) and free text terms. The following bibliographic databases were searched by the same health sciences librarian: MEDLINE (Ovid), EMBASE (Ovid), Central, CINAHL, and Scopus. All study designs were included in the database searches. Searches were limited from January 1, 2020 to December 1, 2020. Only papers written in English were included because English is the research team's first language. No grey literature was searched. For details on the search strategy for the MEDLINE (Ovid) database please see Supplementary Appendix.

[H2]Study selection

Level one (title and abstract) and level two (full text) inclusion criteria consisted of the following: (1) adults (≥18 years of age); (2) primary diagnosis of COVID-19 (patients may or

may not have also had pre-existing conditions) but patients now in post-acute (or post-subacute or chronic or ongoing symptomatic or post-COVID-19 syndrome or long COVID) stage; (3) assessment/treatment occurring as outpatient and/or via tele-rehabilitation in a community setting (including residential care); (4) recommendations for rehabilitation that address impairments, activity/participation restrictions, and quality of life; and (5) focused on physical therapy, occupational therapy, and/or respiratory therapy for patients with COVID-19 (not for people negatively affected by physical distancing). Articles were excluded in either level one or two screening for the following reasons: (1) people were receiving critical/acute/sub-acute inpatient care or palliative care, (2) patients were children, (3) patients had secondary diagnoses of COVID, (4) papers described only the general role of rehabilitation therapists in the pandemic, (5) papers focused on treatment delivery processes (tele-rehabilitation) versus the actual treatment itself, and (6) protocol papers, clinical trial registrations, and conference abstracts. The research team decided to exclude protocols and clinical trial registrations in November 2020 and December 2020 respectively, because they did not provide results nor offer any rehabilitation treatment recommendations. Three teams of two trained reviewers used Rayyan (https://www.rayyan.ai/) to independently conduct level one and level two screening. Conflicts in either level one or two screening were resolved by consensus or by a third reviewer.

[H3]Data charting

A data extraction form was developed *a priori* in Excel which included content fields specific to article title and authors, date of publication, target discipline for recommendations, country of publication (corresponding author), purpose of the paper, study design and general process for developing recommendations, patients targeted, and recommendations related to assessment (including outcome measures) and specific treatment techniques. The data extraction form was pilot tested on 7 articles and data extracted were reviewed with the entire extraction team to

ensure consistency with this process. The first author checked the accuracy of extracted data against the full text of these 7 articles. We found no major discrepancies between reviewers during this exercise, so extraction continued with 3 teams of 2 independent reviewers completing data extraction. When articles included information about both acute and post-acute care, we only extracted details relevant to rehabilitation assessment and treatment in the outpatient and/or community setting. Similarly, some articles included multiple purpose or objective statements, but only those relevant to post-acute care were extracted in our study. We classified review articles as commentaries if they did not provide details about how the literature search was conducted.

[H2]Quality Assessment of Recommendations

The Appraisal of Guidelines for Research and Evaluation Instrument (AGREE II)[19] was used to evaluate the quality and transparency of development of guidelines and recommendations in the included studies because the AGREE II is easy to utilize, valid and reliable.[20,21] We utilized select questions from the AGREE II because we anticipated that several sources of recommendations would not be traditional clinical practice guidelines due to the urgency to provide information to rehabilitation professionals quickly in the time of the pandemic. As such, we felt that many of the AGREE II questions would not be relevant to the sources we would find. The two lead researchers on the project independently reviewed all questions contained in the AGREE II and selected those thought to be most relevant to our sources and most appropriate to provide information about the quality of the recommendations. The researchers met, discussed their selection of questions, and agreed on a final set of questions. Three teams of 2 independent reviewers completed the quality appraisal, and the results of the quality appraisal of the guidelines and recommendations were also included on the data extraction form. Conflicts were

resolved by consensus or by a third reviewer. The quality appraisal included the following sections from the AGREE II instrument[22]:

Domain 2: Stakeholder Involvement

(1) The guideline development group includes individuals from all relevant professional groups.

(2) The views and preferences of the target population (patients, public, etc.) have been sought.

Domain 3: Rigor of Development

(3) Systematic methods were used to search for evidence (eg, named electronic databases, time-period of the search, search terms).

(4) The strengths and limitations of the body of evidence are clearly presented (eg, a formal instrument or strategy was applied to grade recommendations).

(5) The methods for formulating the recommendations are clearly described (eg, steps used in modified Delphi technique, voting procedures, extent to which consensus was reached, details regarding how the process influenced resulting recommendations).

(6) The guideline has been externally reviewed by experts prior to its publication.

Domain 4: Clarity of Presentation

(7) Key recommendations are easily identifiable.

[H2]Synthesis of results

Descriptive statistics were used to detail the characteristics of the literature, ie, the number of included studies, the types of study designs, and the countries of origin. We utilized narrative

synthesis to describe the rehabilitation assessment and treatment recommendations for people who required rehabilitation post-acute COVID-19. A narrative synthesis is a systematic and transparent data analysis approach that examines and summarizes text to explain the findings of studies included in a review.[23] The collating and summarizing phase was an iterative process and the two lead researchers met virtually to discuss and ensure consensus with the findings.

[H1]Results

[H2]Study Selection

The literature search yielded 20,442 citations that were filtered through removal of duplicates and screening with our inclusion and exclusion criteria (Figure). The most frequent reason for excluding articles at the full-text stage occurred because the paper described only a general role for rehabilitation with post-acute COVID-19 patients and did not provide specific recommendations for assessment and treatment. We extracted data relevant to our research questions from 48 full-text articles that met eligibility criteria. Many of these papers did not define the post-acute period in terms of the number of weeks since the onset of COVID-19, however, we included information if it pertained to an outpatient setting and/or was reported as being suitable for patients who had been discharged from hospital after admission related to COVID-19.

[H2]Characteristics of Included Studies

Eleven papers were systematic reviews,[24-34] 1 was a scoping review,[35] 6 described original research,[36-41] 4 were consensus guidelines,[42-45] 5 were narrative reviews[46-50] and 21 were editorials/commentaries.[4-6,51-68] The majority of studies came from Italy (n = 13),[24-32,44,51,53,62] the United Kingdom (n = 11),[33,34,36,42,47,56,58-60,65,66] and China (n = 7),[37,41,45,48,49,67,68] with authors of the other studies working in the United States of America (n = 4),[5,50,57,64] Canada (n = 2),[6,63] the

Netherlands (n = 2),[43,61] Turkey (n = 2),[54,55] Australia (n = 1),[40] Bangladesh (n = 1),[35] Brazil (n = 1),[4] Morocco (n = 1),[52] Nigeria (n = 1),[46] Russia (n = 1),[38] and Singapore (n = 1).[39] A number of studies reviewed included recommendations for both acute and post-acute stages of COVID-19. We focused data extraction on details that pertained to post-acute patients which included both ongoing symptomatic COVID-19 and post-COVID-19 syndrome.[13] Details of the original research articles and the consensus guidelines are included in Tables 1 and 2, respectively. Table 3 summarizes findings of our critical appraisal for the four consensus guidelines. Details of the systematic/scoping reviews, narrative reviews, and editorials/commentary pieces are included in Supplementary Tables 1 to 3, respectively.

Findings of the scoping review are presented below according to the research questions.

[H3]Question 1. *What processes were used to develop the rehabilitation recommendations?*

Many papers included in the review were narrative reviews and editorials/commentaries (n = 26) which based recommendations on previous literature and expert opinions (see Suppl. Tab. 2 and 3). None of the systematic reviews (n = 11, Suppl. Tab. 1) included a meta-analysis as results were not amenable to this type of analysis. The original research articles included three case reports,[38-40] one prospective cohort study,[41] one observational cohort study[36] and one open randomized controlled trial (RCT)[37] (Tab. 1). While we did conduct a critical appraisal of all included studies as described in our methods, most studies scored very poorly as they were not designed to provide systematically and rigorously developed guidelines per se. Critical appraisal of the four consensus guidelines included in the review demonstrated variable results (Tab. 3). All four studies[42-45] were authored by teams that included expertise from relevant healthcare fields, provided details of the recommendation development processes and how the processes influenced resultant recommendations, and clearly presented the recommendations in the publication. None of the guideline groups sought the views of the target population of people

with post-acute COVID-19 and only one study[45] reported that recommendations were externally reviewed prior to journal submission.

[H3]Question 2. *What outcomes and outcome measures are recommended for patients experiencing post-acute signs and symptoms related to COVID-19?*

Table 4 provides details about the outcomes and outcome measures specified in the included studies. Overall, 15 categories of outcomes were identified. The most recommended outcomes included assessing exercise tolerance (n = 18), respiratory function (n = 17), muscle strength (n = 13), and activities of daily living (ADLs) or functional independence (n = 12). Papers also cited the relevance for monitoring vital signs (n = 8), evaluating balance (n = 7), assessing anxiety and depression (n = 6), psychological distress (n = 6), quality of life (n = 7), fatigue (n = 5), and physical activity (n = 4). Less frequently, authors reported that cognition (n = 3), joint range of motion (n = 3), sleep (n = 2) and gait (n = 1) should be evaluated. Outcome measures included both patient-reported scales and objectively measured tests. Authors generally identified a greater number of specific outcome measures for the categories of outcomes that were more frequently distinguished as being important. For example, 6 to 10 specific outcome measures were named for the categories of exercise tolerance, respiratory function, muscle strength, and ADLs, whereas 0 to 4 outcome measures were suggested for other outcomes. The 6-minute walk test (6-MWT) was recommended in 10 papers, assessment using spirometry and pulmonary function tests were recommended by eight authors, and careful monitoring of peripheral capillary oxygen saturation (SpO2) was specified in 6 papers.

[H3]Question 3. *What rehabilitation treatments are recommended for these patients?*

Table 5 provides details about recommended rehabilitation treatments identified in the included studies. Overall, eight categories of treatment priorities were recognized. Most frequently authors reported on the need to provide respiratory rehabilitation (n = 25) and exercise therapy (n = 25)

to patients experiencing post-acute COVID-19. Papers also discussed the importance of education (n = 13), psychological support (n = 13), ADL/gait training (n = 11), Traditional Chinese Medicine (n = 5), cognitive rehabilitation (n = 3) and vocational rehabilitation (n = 2). While several papers provided recommendations for the general types of treatment that should be included in rehabilitation, many did not elaborate on specific components of treatment or specific prescriptions for treatment delivery.

The two treatment areas that received the most detailed recommendations were aerobic exercise and resistance exercise. Nine papers provided guidance on aerobic exercise prescription (Tab. 5). In general, the recommendations for aerobic exercise were consistent among studies with the following guidelines for patients experiencing post-acute signs and symptoms related to COVID-19:

Type of activity – walking, jogging and/or swimming[32,35,40,45,47,67]

Intensity – light aerobic exercise, gradually increasing as tolerated[47]; 50% to 70% heart rate reserve and Borg's Rating of Perceived Dyspnea 3 to 4/10[64]; target heart rate 124 beats per minutes, Borg's Rating of Perceived Dyspnea 2/10, oxygen saturation ≥ 90%[67]

Duration – 5 to 30 min/session as tolerated, increasing time gradually[32,35,40,45,67]

Frequency – 3 to 6 times/week[32,35,40,45,67]

Of note, Torjesen[65] reported that the National Institute for Health and Care Excellence (NICE) has cautioned healthcare practitioners about using graded exercise therapy to treat post-viral fatigue in people recovering from COVID-19. This area requires further study as patients recovering from COVID-19 may not respond similarly to those with chronic fatigue syndrome. In their consensus statement targeting active individuals (eg, military personnel and athletes),

Barker-Davies et al[42] recommend that people perform low-level stretching and low intensity resistance exercises for one week prior to beginning specific aerobic exercise sessions.

Ten papers provided guidance on prescribing resistance exercise (Tab. 5). These recommendations included:

Type of activity – progressive resistance training for large muscle groups[32,40,45,57,67,68]; using body weight, resistance bands, and/or dumbbells[40,68]; using neuromuscular electrical stimulation[6,63]

Intensity – increase training load 5% to 10% per week[32,35,45,67]; loads 70% to 80% of 1 RM or 8 RM;[64] loads 8 to 12 RM[35,45,67]; medium and high intensity load training[68]

Duration – 1 to 3 sets[35,40,45]

Frequency – 2 to 3 times/week[32,35,45,67,68]

[H1]Discussion

This scoping review focused on papers that provided recommendations for rehabilitation assessment and treatment of patients with ongoing symptomatic COVID-19 and post-COVID-19 syndrome. Forty-eight articles were identified that fit our inclusion and exclusion criteria, the majority being narrative reviews and editorials/commentaries (n = 26). A large proportion of these studies came from Italy, the United Kingdom, and China (31/47), countries hit-hard in the first months of the COVID-19 pandemic. The search identified only six studies reporting original research, and these included only one RCT and two cohort studies. The quality of the 4 identified consensus guidelines was variable (Tab. 3); only two studies reported they used a formal instrument to grade recommendations,[42,45] and only one study reported results of this evaluation.[42]

Clinicians and researchers do not yet have a comprehensive understanding of the etiology and pathophysiology of post-acute effects of COVID-19. Persistent sequelae of COVID-19 may

result from a combination of factors related to the acute disease and its treatment (eg, long-term effects on organs, severe deconditioning related to ICU stay), ongoing disease (eg, persistent hyper-inflammatory state, maintained viral activity), pre-existing conditions (eg, presence of comorbidities, poor aerobic fitness) and lifestyle changes related to living with restrictions imposed by the pandemic.[7] There is strong evidence linking severity of acute COVID-19 to multimorbidity in adults.[7,8] Given the relatively high proportion of individuals left with persistent signs and symptoms, a large percentage of survivors will include people with 1 or more chronic conditions. As emphasized in the review by Demeco and colleagues,[32] rehabilitation assessments and treatments need to be individualized and integrate lifestyle behavior practices to address underlying comorbid conditions and risk factors.

Some patients with COVID-19 experience similar residual effects as seen in survivors of the Severe Acute Respiratory Syndrome-related Coronavirus (SARS-CoV) outbreak in 2002 and the Middle East Respiratory Syndrome (MERS) outbreak in 2012.[12,34,69] Systematic reviews studying clinical outcomes in survivors of SARS and MERS reported complications present 3-12 months after hospitalization included: reduced lung diffusion capacity for carbon monoxide (27%); reduced exercise capacity; and relatively high prevalence of PTSD (39%), depression (33%) and anxiety (30%).[34,70] Quality of life scores often remained below that of healthy individuals and below that for people with chronic conditions beyond 6 months post-discharge.[70] Current literature suggests that long-term cardiovascular, pulmonary, renal, hematologic, gastrointestinal, neuromusculoskeletal, and central nervous system complications may occur in patients with post-acute COVID-19, along with PICS and psychological manifestations.[71] While some of the persistent signs and symptoms reported in post-acute COVID-19 mirror those seen in SARS/MERS, others differ. The most common complaints reported by people experiencing

post-acute COVID-19 are fatigue and dyspnea.[10-13] The next most common symptoms vary by report and include "brain fog",[13] psychological distress,[12] memory loss,[11] and joint pain.[10]

Many of the outcome measures reported for survivors of SARS correspond with those cited in the post-acute COVID-19 literature (eg, FEV_1, pulmonary function tests, 6-MWT, cardiopulmonary exercise test, Impact of Events Scale-Revised, Hospital Anxiety and Depression Scale, SF-36, St. George's Respiratory Questionnaire) and represent evaluations typically found in comprehensive respiratory rehabilitation programs.[72,73] Similarly, a few studies we reviewed also suggested monitoring heart rate and oxygen saturation at rest and during exertion for patients with post-acute COVID-19.[35,40,44,57] However, it is disconcerting to note the discrepancies between what is currently known about post-acute COVID-19 and what has been recommended in the rehabilitation literature. For example, fatigue is the most commonly reported persistent symptom, yet only 5[4,40,44,58,62] of the 48 studies we reviewed recommended directly measuring this important outcome. Correspondingly, only three studies[35,40,44] recommended specific outcome measures to monitor levels of dyspnea, and few emphasized the need to assess cognitive function, levels of psychological distress, or pain.

Previous studies in patients experiencing long-term effects from SARS and MERS indicated that the respiratory impairment was usually primarily restrictive in nature,[70,74] and preliminary information suggests this is true regarding the pulmonary effects of COVID-19 as well.[75] Respiratory rehabilitation programs that include aerobic, resistance, and breathing exercises, as well as inspiratory muscle training have been shown to have positive effects on lung function, dyspnea, aerobic capacity, daily physical activity, and health-related quality of life in patients with restrictive lung disease.[73,76,77] Recommended interventions identified in this scoping review largely focused on respiratory rehabilitation and exercise components which could address fatigue and dyspnea, the most common persistent symptoms. However, education and

psychological support, important to address "brain fog", psychological distress, and memory loss, as well as behavior change strategies to impact risk factors and chronic conditions were infrequently recommended. These incongruities between what we know about post-acute COVID-19 and what is being recommended for rehabilitation may relate to use of a classic biomedical single-disease framework in considering assessment and treatment strategies for these patients. However, given the myriad of body system complaints and underlying conditions that likely co-contribute to signs, symptoms and functional limitations associated with post-acute COVID-19, a more holistic, multimorbidity focus may be more appropriate.[78]

Physical therapists and occupational therapists endorse the World Health Organization's International Classification of Function, Disability and Health that encourages consideration of patients' abilities to engage in functional activities and participate more broadly in society within the context of environmental and personal factors.[79] Respiratory therapists also provide client-centered care and work on multidisciplinary teams in various settings including the community to help patients meet health goals.[80] Physical therapists, in particular, have been called to ensure that health promotion and non-communicable disease prevention are practiced consistently (ie, by providing counselling on physical activity and exercise, sedentary behavior, weight, basic nutrition, managing stress, sleep hygiene and smoking cessation regardless of patients' presenting complaints and/or diagnoses).[81,82] As such, physical therapists, occupational therapists, and respiratory therapists all have roles to play in helping people manage post-acute COVID-19 syndrome given the numerous body systems that may be affected, and the scope of activity limitations and participation restrictions that may result. Many patients will present with risk factors for, or manifestations of non-communicable diseases,[11,12] therefore positive lifestyle practices will be important in improving outcomes post-acute COVID-19. This means that rehabilitation will need to encompass typical respiratory rehabilitation practices, as well as

cardiac and diabetes rehabilitation, and musculoskeletal assessment and treatment related to fatigue, weakness and pain. Given uncertainty about the effectiveness of vaccines over time, and the link between multimorbidity and severe COVID-19 illness, it will be important for everyone to reduce their susceptibility to SARS-CoV-2 by reducing risk factors associated with common chronic conditions.

In the absence of clinical trials documenting the efficacy of comprehensive rehabilitation programs for people with post-acute COVID-19, therapists may rely on consensus guidelines to direct their practice. The Stanford Hall consensus statement for post-COVID-19 rehabilitation[42] provides thorough and clearly documented recommendations for pulmonary, cardiac, exercise, psychological, musculoskeletal, and neurological rehabilitation and summarizes consequences of COVID-19 that affect other body systems (eg, gastrointestinal, liver, kidneys, and endocrine systems). While the guideline targets an active population (eg, military personnel and athletes), the recommendations are applicable to a wide range of patients, which will make them useful to clinicians seeing patients with enduring and new COVID-19-related impairments in the community.

Ongoing symptomatic COVID-19 and post-COVID-19 syndrome are multisystem conditions that require a multi-faceted approach delivered by a multidisciplinary team to address sequelae of COVID-19.[14] The Leeds Teaching Hospital National Health System Trust in the UK is one of the largest teaching hospital organizations in Europe.[83] Clinicians in this organization have developed an integrated rehabilitation pathway using telemedicine and in-person visits to address consequences of COVID-19 in discharged patients and in those seen through primary care services.[83] A telephone screening tool is used to determine the most appropriate care for individual patients. Options include access to self-help educational resources and referral to individual services (eg, respiratory medicine follow-up, respiratory therapy, community

rehabilitation (physical therapy and occupational therapy), psychology, speech, and language therapy) or to the multidisciplinary team (when needs cannot be met by referral to one or two individual services). Roles noted for physical therapists and occupational therapists in the care pathway include respiratory rehabilitation, improving stamina and endurance, increasing independence in ADL's, managing fatigue, as well as cognitive and vocational rehabilitation.

As of late December 2020, there were 69 clinics established in the United Kingdom to treat patients experiencing ongoing shortness of breath, fatigue, cognitive dysfunction, and anxiety and depression after COVID-19.[84] Similar clinics have been created across the United States (eg, Center for Post-COVID Care at Mount Sinai Health Systems hospitals, COVID-19 Rehabilitation through Johns Hopkins outpatient clinics) and are beginning to be developed in Canada.[85] The establishment of these clinics will provide patients with access to much needed rehabilitation and enhance opportunities to further our understanding of risk factors that influence the development of post-COVID-19 syndrome as well as the trajectory of the syndrome. Additionally, these clinics will make it possible to conduct research to determine the clinical effectiveness of different intervention strategies and evaluate different service models of delivery.[13]

[H2]Limitations

This review was limited to literature published in English during the first 11 months of 2020. Knowledge and literature about COVID-19 is changing quickly which makes it difficult for scoping reviews such as this to stay current. We did not search for information on the websites of national professional organizations for physical therapy, occupational therapy or respiratory therapy and therefore did not capture assessment and treatment recommendations offered through these outlets. Our results provide a summary of recommendations as they are currently available, however, most of these recommendations do not come from original research studies and may not be supported by strong evidence. The main recommendations for treatment focus on respiratory rehabilitation and exercise, both of which were supported in consensus guidelines[42-45] and original research

studies.[37,39,40] Some findings reported in original research studies were repeated in the narrative and systematic reviews that we included. It was not our purpose to investigate modes for treatment delivery, however, there is a body of emerging literature regarding benefits and short-comings related to using tele-rehabilitation.[86] Methodological strengths of this review include the comprehensive literature search developed by a health sciences librarian and the fact that teams of two researchers independently carried out all stages of screening, critical appraisal and data extraction for included studies (with a third team member available to reach a majority decision when required).

[H1]Conclusions and Implications

The emergence of this new set of patients with ongoing symptomatic COVID-19 or post-COVID-19 syndrome demands that governments and health authorities organize services to provide tools for self-management, the option of supported self-management, and access to rehabilitation specialists as well as integrated multidisciplinary rehabilitation programs to address patients' ongoing and varied needs.[13] Current data suggest that approximately one-third of survivors of COVID-19 continue to experience symptoms more than 7 weeks after hospital discharge, and it is difficult to track the prevalence in those who recovered from the initial infection without requiring hospitalization.[10-12,83] Physical therapists, occupational therapists and respiratory therapists will be essential in providing rehabilitation services. To date, much of the relevant rehabilitation literature consists of previous studies of related conditions (eg, SARS, MERS, pulmonary fibrosis), a small number of original research studies, four consensus guidelines and a relatively large number of expert opinion pieces. Published recommendations for assessment and treatment of these patients do not adequately reflect even the most common persistent complaints in patients with this multi-system condition. Post-acute COVID-19 syndrome is complex, and effective evaluation and treatment will require concurrent attention to ongoing signs and symptoms as well as underlying conditions that may co-contribute to activity limitations and participation restrictions. Rehabilitation professionals should focus on the

epidemiology of COVID-19 and post-acute COVID-19, as well as emerging information concerning sequelae following infection to better inform effective rehabilitation programming and future research in this area.

Authors Contributions

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Disclosures

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

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Figure. PRISMA diagram outlining study selection.

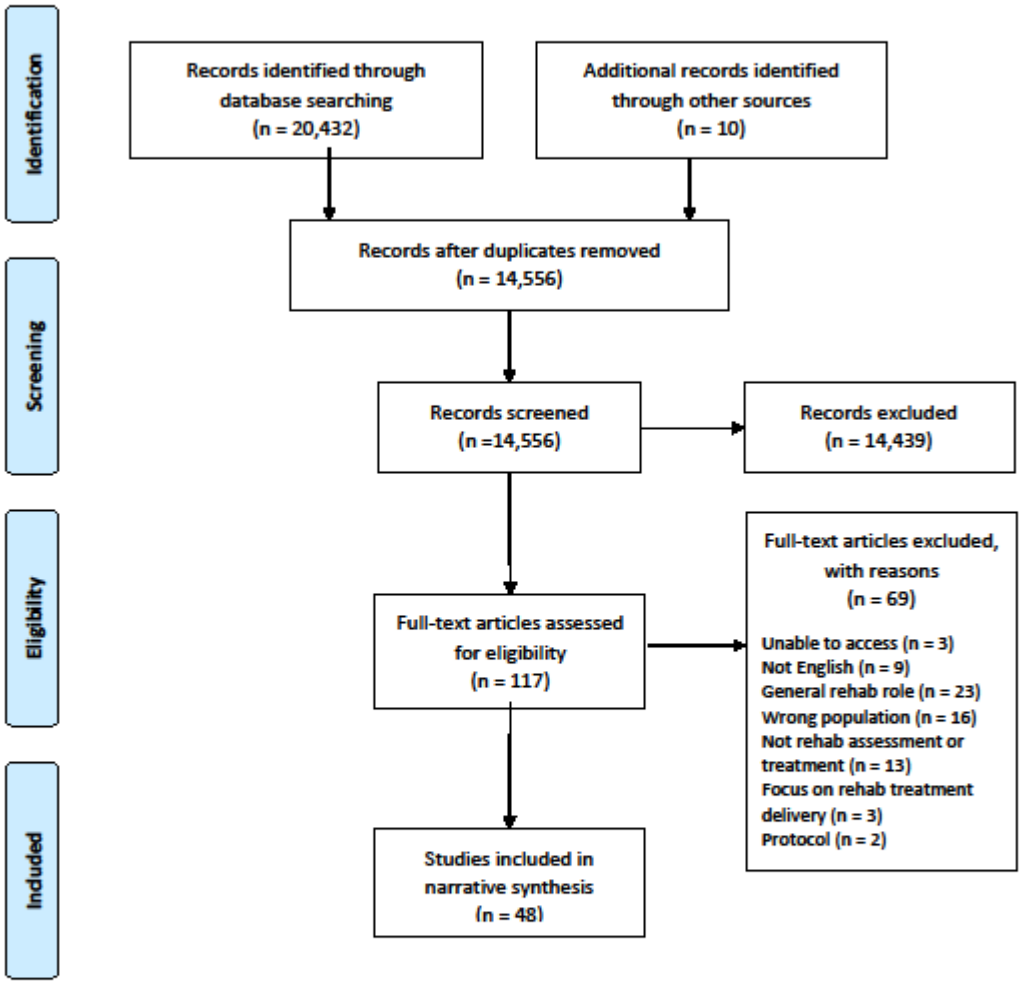

Table 1. Original Research Articles (n = 6)[a]

Study (Country)	Design	Purpose	Population, Age, Sample Size	Assessment and/or Treatment(s) Utilized	Main Findings
Daynes et al[36]	Observational	To examine	Patients admitted	Outcome measure: The	52% of patients had

(United Kingdom)	cohort study	use of CAT delivered over the phone for patients recovering from COVID-19	to hospital with primary diagnosis of COVID-19, now discharged home, mean time to survey post discharge was 32 d, median length of hospitalization was 10 d, (mean age = 60 y), n = 131	CAT provided important information about severity of symptom burden (cough, phlegm, chest tightness, breathlessness, activity limitation, confidence to leave home, sleep, energy) following hospitalization for COVID-19.	CAT scores ≥ 10 (patients with pre-existing lung disease had higher scores compared to those without pre-existing lung disease). Breathlessness, activity limitation and energy scores indicated mild-to-moderate symptoms and were higher than scores typically seen in healthy individuals.
Liu et al[37] (China)	Open (non-blinded) randomized controlled trial (RCT)	To investigate effects of 6 wk (12 session) outpatient respiratory rehabilitation program in older adults post-acute COVID-19	Patients with primary diagnoses of COVID-19, now discharged from hospital, (mean age = 69 y), n = 72 (n = 36 intervention participants and n = 36 control participants)	Outcome measures included: FEV_1, FVC, FEV_1/FVC%, DLCO% and 6-MWT, SF-36, Self-Rating Anxiety Scale, Self-Rating Depression Scale, FIM. The outpatient respiratory rehabilitation program consisted of respiratory muscle training (hand-held resistance device), active coughing, resisted diaphragmatic training, respiratory muscle stretching and home pursed lip breathing and coughing exercises.	Intervention group participants demonstrated improved FEV_1, FVC, FEV_1/FVC%, DLCO% and 6-MWT compared to controls. SF-36 and Self-Rating Anxiety Scale scores also improved pre-post in the intervention group. FIM and depression scores did not change in either group.
Meshcheryakova et al[38] (Russia)	Case studies	To describe the effects of a respiratory rehabilitation program through two case examples	Patients post COVID-19 in a respiratory rehabilitation program (Patient K, 39 y, hospitalized 9 days, then discharged; Patient A, 52 y, treated for COVID-19 at home)	Outcome measures: subjective reports of symptoms. Each patient received 10 sessions of outpatient therapy consisting primarily of high-frequency oscillation of the chest and inspiratory muscle training.	Patients' complaints of coughing, chest congestion/chest tightness, and fatigue abated with the rehabilitation treatment.
Ramalingam et al[39] (Singapore)	Case report	To describe the rehabilitation experience for one patient from ICU to discharge home	A 64-y-old man with no significant past medical history, admitted to hospital for treatment of COVID-19 (intubated and spent almost 2 mo in the ICU).	Outcome measures: FIM, hand grip and 6-MWT. The home-based rehabilitation program consisted of: (1) calisthenics, walking, stair-climbing; (2) range of motion exercises; (3) strengthening exercises; (4) energy conservation techniques; (5) diaphragmatic breathing exercises; (6) and assistive devices for walking. The patient connected with the rehabilitation team 2-3 times/week via telephone or Zoom video calls.	After in-patient rehabilitation on the ward (10 d), the patient was discharged home with printed material to continue rehabilitation. No further evaluations were conducted.

Wootton et al[40] (Australia)	Case series	To describe an outpatient COVID-19 telehealth rehabilitation program and discuss the management of 3 cases	Three males, 59, 73 and 80 years of age, 2 with short stays in ICU, days in hospital were 12, 9 and 15, respectively.	Outcome measures included: 5STS; 1 min STS; modified Medical Research Council dyspnea scale; Fatigue Severity Scale; and heart rate, SpO2 and dyspnea–at rest and with exertion (post 1 min STS); HADS, MoCA. Patients used a pulse oximeter to monitor SpO2 at home during the rehabilitation program. They were instructed to stop exercise if desaturation ≥ 3% occurred. Individualized programs included: breathing exercises and energy conservation; unsupervised exercise (walking 5-10 min, 4 d/wk progressing to 30 min, 6 ds/wk OR aerobic intervals; strengthening exercises for large muscle groups, 2 × 10 repetitions) and education about resumption of general physical activity.	With 6 wk of telehealth rehabilitation at home, all 3 cases improved in 5STS and in 1 min STS. Changes in dyspnea, fatigue, depression were variable.
Zha et al[41] (China)	Prospective cohort study	To present exercises used in rehabilitation tailored to patients who have mild COVID-19	Patients admitted to hospital with mild symptoms associated with COVID-19 (no CT evidence of pneumonia). Patients (n = 60, median age 54 y) were followed prospectively and assessed on admission, on discharge from hospital and at 2 and 4 wk post-discharge. Time in hospital was not reported.	Patient-reported respiratory symptoms were used as outcomes: dry cough, productive cough, difficulty with expectoration, dyspnea. The rehabilitation exercises were chosen from Chinese martial art Eight-section Brocade and consisted of: (1) overhead chest and shoulder stretch with breath holds, (2) standing heel raises and upper body acupressure, (3) upper body thoracic rotation and patting lateral side of thorax, and (4) hand acupressure massage. Exercise prescription: 6-8 repetitions for each exercise, 2×/d.	Based on the descriptive results presented, the largest changes in self-reported dry cough, productive cough, difficulty with expectoration, and dyspnea occurred between hospital admission and discharge. Changes post-discharge were very small and possibly not significant.

[a]CAT = chronic obstructive pulmonary disease assessment test; DLCO = diffusing capacity for carbon monoxide; FEV_1 = forced expiratory volume in 1 second; FIM = Functional Independence Measure; FVC = forced vital capacity; HADS = Hospital Anxiety and Depression Scale; ICU = intensive care unit; MoCA = Montreal Cognitive Assessment; SF-36 = Short-Form 36; STS = sit-to=stand test; y = years, 5STS = 5 times sit-to-stand test; 6-MWT = 6-minute walk test.

Table 2. Consensus Guidelines (n = 4) [a]

Study (Country)	Purpose and Patients Targeted	Process for Developing Guidelines	Assessment and/or Treatment Recommendations
Barker-Davies et al[42] (United Kingdom)	To provide guidance on rehabilitation for COVID-19 survivors (specifically-active population, including military personnel and athletes)	Seven teams appraised evidence of rehabilitation needs post-COVID gathered from PubMed, Google Scholar and COVID-19 repositories. A writing committee prepared consensus statements and applied Oxford levels of evidence to each recommendation. Authors reported their level of agreement with each recommendation and attended an agreement meeting where recommendations were modified until high agreement was achieved.	COVID-19 pathology is reviewed, and 36 rehabilitation assessment and treatment recommendations are presented under the following headings: general rehabilitation (5), pulmonary (3), cardiac (6), exercise (5), psychological (4), musculoskeletal (4), neurological (5), medical sequelae (4). Each recommendation is presented with level of evidence and level of agreement data.
Spruit et al[43] (The Netherlands)	To develop interim recommendations for rehabilitation for patients with COVID-19 in hospital and COVID-19 survivors post-discharge	The Convergence of Opinion on Recommendations and Evidence (CORE) process was used with a multinational task force. Seventy-six experts (primarily physiotherapists and pulmonologists) completed 13 multiple choice questions (developed through small team of experts and after seeking global input online). Agreement of directionality was tabulated for each question and 70% agreement was required to make consensus recommendations. More than 705 agreement was reached on all questions in the first round.	13 recommendations put forward, 2 related to in-hospital rehabilitation, 1 related to nutritional support, and 10 pertaining to rehabilitation 6-8 wk post-discharge: patients should (1) do regular daily activities, (2) do low/moderate intensity physical activities/exercise, (3) have a formal assessment of physical and emotional functioning to identify rehabilitation needs, (4) be evaluated using the core outcomes set for survivors of acute respiratory failure, (5) be assessed for measures of respiratory function and (6) measures of exercise capacity, (7) receive a comprehensive general rehabilitation program if indicated, (8) receive respiratory rehabilitation if pre-existing/ongoing lung function impairment, (9) receive a muscle strengthening program if indicated, (10) receive a formal psychological assessment if suffering from psychological distress.
Vitacca et al[44] (Italy)	To develop respiratory rehabilitation recommendations for patients with COVID-19 in the post-acute hospital setting and after discharge from hospital	A scoping review was conducted to identify literature on epidemiology, causes, clinical manifestations, diagnosis and pandemic control related to COVID-19 between December 2019 and April 6, 2020 (PubMed, Google Scholar, WHO official websites and reference lists of identified articles). Twenty international experts (physiotherapists, pulmonologists from 5 countries) participated in a 2-round Delphi process to determine level of agreement with recommendations that were developed based on literature and steering committee opinion. Final recommendations were then re-reviewed by the experts.	119 recommendations were developed related to 4 topics: personal protection equipment (PPE), phenotypes, assessment, interventions. Assessment recommendations relevant to rehabilitation include: (1) the need to evaluate exercise tolerance, spirometry results, functional status (ADLs), physical performance, neuromyopathy, oxygen saturation with activity and ICU-acquired weakness, (2) maximal cardiopulmonary exercise tests are not recommended in first 6-8 wk post-discharge, (3) fatigue and dyspnea should be measured (eg, Borg scale, visual analog scale), (4) heart rate, blood pressure, SpO2, respiratory rate should be monitored, (5) evaluation of anxiety, depression, sleep, post-traumatic stress disorder. Intervention recommendations include

			respiratory rehabilitation programs and exercise training like what is used for patients with other chronic lung diseases (eg, aerobic exercise, resistance training, respiratory muscle training if indicated).
Zhao et al[45] (China)	To provide recommendations regarding respiratory rehabilitation in hospital and for discharged patients to address respiratory, physical, and psychological dysfunction in COVID-19 patients.	An evidence-assessment team searched PubMed, Ovid, EMBASE, Chinese Biological Medical Literature, China National Knowledge Infrastructure, Chinese Medical Journal databases and relevant online website bulletins to February 21, 2020, for rehabilitation literature related to COVID-19, severe acute respiratory syndrome (SARS), and Middle East respiratory syndrome (MERS). An evidence summary was prepared, and quality assessment was conducted using the Appraisal of Guidelines for Research & Evaluation II tool, the Assessment of Multiple Systematic Reviews tool, and the Cochrane risk of bias assessment tool. Preliminary recommendations were drafted and submitted to an expert consensus group. Consensus was reached through panel discussions.	The following conditions preclude participation in exercise post-discharge from hospital: heart rate > 100 beats/min, blood pressure <90/60 or < 140/90, SpO2 ≤ 95%. Assessment should include evaluation of respiratory muscle strength (inspiratory pressure/expiratory pressure), general muscle strength (UK Medical Research Council test, manual muscle testing, isokinetic testing), balance (Berg Balance scale), aerobic capacity (6-MWT, cardiopulmonary exercise testing), physical activity (International Physical Activity Questionnaire, Physical Activity Scale for the elderly), ADLs (Barthel Index). Interventions should focus on (1) education; (2) aerobic exercise (eg, 3-5 ×/wk; 20-30 min/session); (3) strength training (8-12 RM, 1-3 sets, 2-3 sessions/wk, increasing 5%-10%/wk; (4) balance exercises; (5) breathing exercises to address dyspnea and sputum; (6) ADL and instrumental ADL training. Traditional Chinese Medicine techniques such as Tai Chi and guided breathing exercises may also make up part of a respiratory rehabilitation program.

[a]ADLs = activities of daily living; ICU = intensive care unit; RM = repetition maximum; SpO2 = oxygen saturation (pulse oximeter), 6-MWT = 6-Minute Walk Test.

Table 3. Critical Appraisal of Consensus Guidelines (n = 4)[a]

Study (Country)	Make-up of Development Group is Comprehensive	Target Population Views Sought	Literature Search Details Provided	Used Instrument or Strategy to Grade Recommendations	Details of Development Process Provided	Outcomes of Development Steps Included	Details Included regarding how Process Influenced Recommendations	Recommendations Externally Reviewed Prior to Journal Submission	Recommendations Easily Identified in Publication
Barker-Davies et al[42] (United Kingdom)	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes

Spruit et al[43] (The Netherlands)	Yes	No	No	No	Yes	Yes	Yes	No	Yes
Vitacca et al[44] (Italy)	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes
Zhao et al[45] (China)	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes

Table 4. Recommended Outcomes and Outcome Measures[a]

Outcome	Outcome Measure(s)
Exercise tolerance[6,32,33,35,37,39,40,43-45,55,57-59,62-64,67]	6-MWT,[6,33,35,37,39,45,57,59,63,64] cardiopulmonary exercise testing,[6,45,59,63] Borg Rating of Perceived Exertion,[35,57,58] 1-min STS,[35,40] 1- or 2-min walk test,[35,57] 1-min step test[67]
Respiratory function[6,32,33,35-37,40,43-45,50,55,58,62,64,67,68]	Spirometry and pulmonary function tests,[33,35,37,44,50,58,62,64] CAT,[35,36] Medical Research Council dyspnea scale,[35,40] Borg Rating Perceived Dyspnea Scale,[44] respiratory muscle strength,[45] breath hold test[67]
Muscle strength[6,32,35,39,40,44,45,55,57,63,64,67,68]	5STS,[35,40,57] manual muscle testing,[45,64] hand grip,[39] UK Medical Research Council test,[45] isokinetic testing,[45] bilateral thigh girth,[57] hand-held dynamometry,[64] squat test[67]
ADL's, functional capacity, functional independence[6,32,35,37,39,44,45,57,60,63,64,68]	FIM,[37,39] Barthel Index,[45,63] Duke Activity Status Index,[35]TUG,[57] Extra Short Musculoskeletal Function Assessment,[60] Katz index of Independence in ADL,[64] Lawton IADL,[64] WHO Disability Assessment Schedule 2.0,[68] Brief Model Disability Survey,[68] Generic functioning domains (VB40)[68]
Vital signs[4,32,35,40,44,45,57,58]	SpO2,[4,35,40,44,45,57] heart rate,[40,44,45,58] blood pressure,[44,45] respiratory rate[44]
Balance[6,32,45,55,57,63,64]	Berg Balance scale,[6,45,63,64] single leg stance,[57] Activities-specific Balance Confidence Scale[64]
Quality of life[33,35,37,55,57,60,68]	SF-36,[33,37,57] St. George's Respiratory Questionnaire,[33,35] Health-Related Quality of Life and Interventions[60]
Anxiety and depression[33,37,40,44,62,64]	HADS,[33,40,64] Self-Rating Anxiety Scale and Self-Rating Depression Scale[37]
Psychological distress[33,43,44,58,64,68]	Impact of Events Scale,[33] Impact of Events Scale-Revised[64]
Fatigue[4,40,44,58,62]	Fatigue Severity Scale,[40] Visual analog scale[44]
Physical activity[45,57,59,63]	International Physical Activity Questionnaire,[45,63] PASE,[45,63] pedometers/accelerometers[57,59]
Cognition[40,64,68]	MoCA[40,64]
Joint range of motion[6,32,63]	
Sleep[44,58]	

Gait[64]	4-min walk test,[64] Functional Gait Assessment[64]

[a]CAT = chronic obstructive pulmonary disease assessment test; HADS = Hospital Anxiety and Depression Scale; IADL = Instrumental activities of daily living; FIM = Functional Independence Measure; MoCA = Montreal Cognitive Assessment; PASE = Physical Activity Scale for the Elderly; SpO2 = oxygen saturation (pulse oximeter); SF-36 = Short-Form 36; STS = sit-to-stand; TUG = Timed Up and Go; WHO = World Health Organization; 5STS = 5 times sit-to-stand test; 6-MWT = 6-minute walk test.

Table 5. Recommended Treatments[a]

Type of Treatment	**Specific Components of Treatment**	**Specific Treatment Prescription**
Respiratory rehabilitation[6,27,32,35,37-40,42-45,47,48,51-53,55-57,62,63,66-68]	Breathing exercises (+/- pursed lip breathing, +/- diaphragmatic breathing)[32,35,37,39,40,45,47,56,57,67,68]	
	Sputum expectoration exercises/coughing[32,35,37,38,45,52,53,57,67]	3 × 10 active coughs,[37] high frequency chest oscillation using vibration-compression therapy with 13 Hz frequency for 30 min[38]
	Respiratory muscle training[32,37,38,44,52,67,68]	Commercial hand-held device (Threshold PEP: Philips Co.) 3 × 10 repetitions at 60% maximal expiratory mouth pressure,[37] 30 maximal voluntary diaphragmatic contractions in supine position with 1-3 kg on abdominal wall,[37] inspiration against breathing device with initial resistance of 40 mm H_2O (20 breaths, 3×/d)[38]
	Respiratory muscle stretching/Thoracic expansion exercises[37,67]	Specific upper extremity/trunk stretching movements[37]
Exercise[4,6,28,32,35,39,40,43-45,47,48,52-57,60,63-68]	Aerobic exercise[4,6,32,35,39,40,42,44,45,47,52-54,56,57,63-68]	Walking, jogging, swimming gradually increasing intensity and duration to 3-5×/wk for 20-30 min[32,35,45]; walking 5-10 min for 4 d/wk progressing to 30 min

		for 6 d/wk or shorter aerobic intervals[40]; perform gentle stretching and low-level resistance exercises for 1 wk prior to progressing to aerobic exercise[42]; patients not admitted to hospital should start with 4-6 wk of light aerobic exercise (walking, Pilates)[47]; aerobic exercise at 50%-70% heart rate reserve, Borg's Rating of Perceived Dyspnea score 3-4[64]; graded exercise therapy may not be appropriate for managing post-viral fatigue related to COVID-19[65]; walking or other aerobic exercise (10-30 min, 3-5×/wk, Borg Rating of Perceived Dyspnea score 2, target heart rate 124 /min, SpO2 ≥ 90%)[67]
	Resistance exercise[4,6,32,35,39,40,43-45,48,52-54,56,57,60,63,64,66-68]	Progressive resistance training, 2-3×/wk for 6 weeks, increase 5%-10%/wk[32]; strength training for large muscle groups 2 × 10 reps[40]; 8-12 RM, 1-3 sets, 2-3 sessions/wk, increase 5%-10%/wk[35,45]; specific exercises to target large muscles in lower extremities, upper extremities and core[57]; neuromuscular electrical stimulation[6,63]; loads of 70%-80% 1 RM[64]; resistance bands, loads 8-12 RM, increase 5%-10%/wk;[67] medium and high intensity load training[68]
	Balance training[32,35,45,48,53,54,56,57,63,64,67]	Weight shift and single leg stance;[57] hands-free balance training under balance trainer[35]
	Flexibility exercises[4,54,57,63,64,67,68]	Stretches into shoulder

		flexion, knee to chest, gastrocs, hamstrings[57]
	Range of motion exercises[39,48,52,64]	
Education[32,35,39,40,42,43,45,47,51,55,56,65,66]	Energy conservation[39,40,56,65]	
	Resumption of physical activity[40,43,51]	
	Healthy lifestyle[32,35,45]	
	Behaviour modification[47]	
	Self-management[66]	
Psychological support[6,28,35,42,51-53,55,56,63,64,66,68]	Psychological interventions[35,42,63,68]	Trauma focused cognitive behavioral therapy, cognitive processing therapy or eye movement desensitization and reprocessing for those with acute stress disorder[42]
ADL/iADL and/or gait training[6,32,35,39,45,53,54,63,64,66,68]	Targeted ADL/iADL practice[32,35,45,53,64,66]	
	Assistive devices for walking[39,64]	
	Gait training[54,64]	
Traditional Chinese Medicine[41,45,49,67,68]	Baduanjin qigong[45,67,68]	
	Tai Chi[45,67]	
	Chinese Martial Arts Eight-section Brocade[41]	Overhead chest and shoulder stretch with breath holds, standing heel raises and upper body acupressure, upper body thoracic rotation and patting lateral side of thorax, and hand acupressure massage. Exercise prescription: 6-8 repetitions for each exercise, 2×/d[41]
	Acupuncture[49]	
Cognitive rehabilitation[4,6,63]		
Vocational rehabilitation[56,64]		

[a] gastrocs = gastrocnemius; reps = repetitions, RM = repetition maximum; SpO2 = oxygen saturation (pulse oximeter),