Chinese Medical Journal, Publish Ahead of Print

DOI: 10.1097/CM9.0000000000000848

Recommendations for respiratory rehabilitation in adults with COVID-19

Chinese Association of Rehabilitation Medicine; Respiratory rehabilitation committee of Chinese Association of Rehabilitation Medicine; Cardiopulmonary rehabilitation Group of Chinese Society of Physical Medicine and Rehabilitation

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[Abstract] Coronavirus disease-2019 **(**COVID-19) is a highly infectious respiratory disease that leads to respiratory, physical, and psychological dysfunction in patients. Respiratory rehabilitation is an important intervention as well as cure for clinical patients. With increased understanding of COVID-19 and the accumulation of clinical experience, we proposed recommendations for respiratory rehabilitation in adults with COVID-19 based on the opinions of frontline clinical experts involved in the management of this epidemic and a review of the relevant literature and evidence. Our recommendations are as follows: 1. for inpatients with COVID-19, respiratory rehabilitation would relieve the symptoms of dyspnea, anxiety, and depression and eventually improve physical functions and the quality of life; 2. for severe/critical inpatients, early respiratory rehabilitation is not suggested; 3. for patients in isolation, respiratory rehabilitation guidance should be conducted through educational videos, instruction manuals, or remote consultation; 4. assessment and monitoring should be performed throughout the respiratory rehabilitation process; 5. proper grade protection should be used following the present guidelines. These recommendations can guide clinical practice and form the basis for respiratory rehabilitation in COVID-19 patients.

[Keywords] COVID-19; Respiratory rehabilitation; Recommendations

Since December 2019, the coronavirus disease 2019 (COVID-19) that originated from Wuhan in Hubei province has become a public health emergency and has spread to various provinces in China and many other countries. COVID-19 has already been classified as a category B infectious disease according to the Law of the People's Republic of China on the Prevention and Treatment of Infectious Diseases, and control measures for category A infectious diseases have been adopted. The National

Health Commission has also published diagnosis and treatment protocols to guide the clinical diagnosis and treatment. With the accumulating experience of treating COVID-19 patients, particularly severe and critical patients, in clinical practice, our understanding of COVID-19 has continuously deepened. With regard to varying degrees of respiratory, physical, and psychological dysfunction in patients[1], it is vital to standardize respiratory rehabilitation techniques and procedures for respiratory rehabilitation in various regions. Hence, we combined the opinions of frontline epidemic control experts and reviewed the evidence in relevant literature. Based on the "coronavirus disease 2019 respiratory rehabilitation guidelines (first edition),"[2] we organized evidence-based medicine, respiratory and critical care medicine, and rehabilitation medicine experts in China, and invited some experts at the frontline of epidemic control in Wuhan and other cities in Hubei province to jointly draft these recommendations.

I. Methodology

1. Registration: These recommendations were registered at the International Practice Guidelines Registry Platform (http://www.guidelines-registry.org; registration number: IPGRP-2020CN016.

2. Recommendation work group: The recommendation work group was divided into the recommendation drafting group, evidence assessment group, and expert consensus group. The drafting group is responsible for determining the topic and scope of the recommendations, guiding the evidence assessment group in evidence summary, and drafting recommendations. The evidence assessment group is responsible for searching, assessing, and providing a summary of relevant evidence. The expert consensus group is responsible for achieving a consensus from the preliminary recommendations.

3. Literature search: Our recommendations included three infectious diseases (COVID-19, Severe Acute Respiratory Syndrome [SARS], and Middle East Respiratory Syndrome [MERS]), and rehabilitation-related guidelines, systemic reviews, and randomized controlled trials. Two members of the evidence assessment team performed independent computer searches of English databases (PubMed, Ovid, Embase), Chinese databases (Chinese Biological Medical Literature database, China National Knowledge Infrastructure, Chinese Medical Journal Database), relevant online website bulletins on COVID-19 (the World Health Organization [WHO], Elsevier, the Lancet, the New England Journal of Medicine, and the Journal of the American Medical Association [JAMA], COVID-19 database, and the Chinese Medical Journal Network). The search period was from database construction to February 21, 2020. The search terms included the English terms and their Chinese equivalents: "novel coronavirus pneumonia," "NCP," "severe acute respiratory syndrome," "SARS," "Middle East Respiratory Syndrome," "MERS," "influenza," "physical therapy"、"physiotherapy""occupational therapy," "psychological therapy," "guideline," "statement," "recommendation," "randomized controlled trial," and other rehabilitation-related English search terms and their Chinese equivalents included "respiratory rehabilitation," "pulmonary rehabilitation," "physiotherapy," "physical therapy," and "occupational therapy." If the complete article was unavailable, we emailed the corresponding author to obtain it.

4. Paper screening and evidence summary: Two members of the evidence assessment group used the Endnote X9 literature management software to screen the literature independently according to the inclusion and exclusion criteria. Different rehabilitation topics were used for classification and to summarize the results of the included articles. Cross-verification was carried out by two staff members during

screening and during the preparation of the summary. If there was any dispute, a third researcher intervened, discussed, and resolved the dispute.

5. Quality assessment: The evidence assessment group employed the AGREE II tool for methodological quality assessment of the included guidelines, the AMSTAR tool for quality assessment of systematic reviews, and the Cochrane bias risk assessment tool for bias risk assessment of randomized controlled trials.

6. Generation of recommendations and consensus: Based on the evidence summary and quality assessment results, the recommendation drafting group combined all existing recommendations and drafted a preliminary version of rehabilitation recommendations. The recommendations were submitted to the expert consensus group, and a consensus was reached through panel discussions, which was then determined to be the final draft of the recommendations.

II. Basic principles of respiratory rehabilitation

1. Prerequisite: Firstly, the requirements of the "guidelines for COVID-19 prevention and control in medical institutions (1st edition)"[3] printed by the National Health Commission should be strictly complied. All staffs who had a close contact with patients for respiratory rehabilitation assessment and treatment must pass the infection control training and examination in the local hospital before they can resume work.

2. Aim: For COVID-19 inpatients, the aim of respiratory rehabilitation is to ameliorate dyspnea, alleviate anxiety and depression, reduce complications, prevent developed dysfunction, reduce morbidity, recovery function, and improve quality of life as much as possible.

3. Timing: Early respiratory rehabilitation is not recommended for severe and critical patients if their condition remains unstabilized or progressively deteriorates.

The timing of respiratory rehabilitation intervention should exclude contraindications for respiratory rehabilitation and should not worsen clinical infection prevention burdens. The stages of respiratory rehabilitation measures can be employed at the later stages for discharged patients with different sequelae.

4. Methods: For patients in isolation ward, educational videos, self-management booklet, and remote consultation are recommended during respiratory rehabilitation to reduce the usage of protective equipment and avoid cross-infection. Integrated rehabilitation using multiple methods can be employed in patients who meet the recovery criteria and are no longer under quarantine observation based on their indications and condition.

5. Personalization: The principle of personalization must be adhered to regardless of the type of respiratory rehabilitation intervention. In particular, for patients with severe/critical condition, older adults, obesity patients, patients with multiple comorbidity, and patients with one or more organ failure, the respiratory rehabilitation team should customize a respiratory rehabilitation plan based on the unique problems of each patient.

6. Evaluation: Evaluation and monitoring must be conducted from the initiation until the completion of respiratory rehabilitation.

7. Protection (Table 1): The staff must refer to the requirements indicated in the "Recommendations for Airway Management in Adult Severe Coronavirus Disease 2019 Patients (Interim)" and select the type of task to determine the appropriate protective measures[4]:

III. Respiratory rehabilitation recommendations in mild patients during hospitalization (only for cabin hospitals)

The clinical symptoms of the patient are mild and may include fever, fatigue, coughing, and one or more physical dysfunctions [5-6]. During quarantine, patients with confirmed disease will show anger, fear, anxiety, depression, insomnia or aggression, and loneliness, or will be uncooperative due to fear of the disease. The patients will tend to give up on treatment or develop other psychological problems[7]. Respiratory rehabilitation can ameliorate anxiety and depression in patients[8].

[Recommendations]

1. Patient education: (1) Advocacy, videos, and booklet are used to help patients understand the disease and treatment process, (2) the patients are required to take regular rest and have sufficient sleep, (3) they are encouraged to eat a balanced diet, (4) they are advised to stop smoking.

2. Activity recommendations: (1) Exercise intensity: Borg dyspnea score ≤3 points (total score: 10 points), fatigue should be absent on Day 2 preferably; (2) Exercise frequency: twice a day, duration: 15–45 minutes/session, 1 hr after meals; and (3) type of exercise: breathing exercise, Tai chi, or square dancing.

3. Psychological intervention: (1) Self-assessment scales are used to rapidly identify the type of psychological dysfunction. (2) If necessary, a mental health hotline should be provided.

IV. Respiratory rehabilitation recommendations in ordinary patients during hospitalization (only for cabin hospitals)

Isolated is an effective method for reducing the transmission of disease. However, Isolated causes patients to have limited exercise space. In addition, patients experience fever, fatigue, muscle ache, etc.,[6] and the duration of sitting and lying

down is significantly increased for most patients. Prolong bed rest will decrease muscle strength, result in poor expulsion of sputum[9], and significantly increase the risk of deep vein thrombosis.[10] Moreover, anxiety, depression, and fatigue will result in exercise intolerance.[11]

[Recommendations]

1. Intervention timing for respiratory rehabilitation in ordinary patients: Due to the limited understanding of the pathophysiological mechanisms of COVID-19, current clinical observations found that around 3%–5% of ordinary patients develop severe or even critical disease after 7 d–14 d of infection. Therefore, the exercise intensity should not be too high as its objective is to maintain the existing physical status. After the patient is admitted to the cabin hospital, data on the patient's initial consultation time, duration from disease onset to dyspnea, and blood oxygen saturation[12-13] should be assessed to determine if the respiratory rehabilitation can be initiated.

2. Exclusion criteria: Patients (1) with a temperature >38.0°C, (2) with an initial consultation time ≤7 d, (3) in whom the duration from disease onset to dyspnea was ≤3 d, (4) whose chest radiological scans showed >50% progression within 24–48 h, (5) with a blood oxygen saturation level of ≤95%, and (6) with a resting blood pressure of <90/60 mmHg (1 mmHg = 0.133 kPa) or >140/90 mmHg.

3. Exercise termination criteria: Respiratory rehabilitation is immediately discontinued when one of the following conditions develop during rehabilitation: (1) dyspnea index: Borg dyspnea score >3 (total score: 10 points); (2) chest tightness, shortness of breath, dizziness, headache, blurred vision, heart palpitations, profuse sweating, and balance disorder; and (3) other conditions that the clinician determines to be unsuitable for exercise. Assistance should be sought from physicians and nurses.

4. The primary intervention measures for respiratory rehabilitation include airway clearance, breathing control, physical activity, and exercise. (1) Airway clearance: (i) dilation during deep breathing exercise can be used to help mobilization sputum and (ii) a sealed plastic bag should be used when coughing to avoid virus transmission. (2) Breathing control: (i) positioning: A sitting upright position is usually adopted. Patients with shortness of breath should be placed in a leaning forward position; (ii) Maneuvers: During training, the accessory muscles of the shoulders and neck are relaxed, and the patient slowly inhales through the nose and slowly exhales through the mouth. Attention is paid to the expansion of the lower chest. (3) Physical activity and exercise recommendations: (i) Intensity: The recommended exercise intensity is between rest (1.0 metabolic equivalents [METs]) and light exercise (<3.0 METs); (ii) frequency: Exercise is performed twice a day, 1 hour after meal; (iii) duration: The exercise duration is based on the patient's physical status, and each session lasts for 15–45 minutes. Patients who are prone to fatigue or are physically weak should perform intermittent exercise; (iv) type of exercise: breathing exercise, stepping, Tai chi, and ankle pump exercises are recommended to prevent thrombosis; and (v) the management of patients with limited locomotor activity is the same as that for severe patients.

IV. Respiratory rehabilitation treatment for severe and critical patients

Severe and critical patients account for 15.7% of the number of confirmed cases.[6] The latest pathology results show that early- [14] and late-stage pulmonary lesions are mainly due to diffuse alveolar injury, significant fibrosis did not occur, and diffuse lymphocyte infiltration is present between myocardial fibers, and the possibility of comorbid viral myocarditis cannot be excluded[15]. Many COVID-19 patients who are given mechanical ventilation completely lose spontaneous breathing

and have no or weak response to stimuli, and the incidence of delirium in patients under deep sedation and receiving analgesia is high.[16] Respiratory rehabilitation can be initiated at a suitable time and can significantly reduce delirium and mechanical ventilation duration, and eventually improve the patient's functional status.[17]

Before performing the rehabilitation intervention in severe and critical patients, a comprehensive evaluation of the patient's systemic function is required, particularly in terms of cognitive status, respiratory function, cardiovascular function, and musculoskeletal function. Treatment should be initiated as soon as possible in patients who are eligible for respiratory rehabilitation. Before initiating treatment, a consensus from the medical team must be obtained, and sufficient preparations should be made. Reassessment should be carried out in patients who do not fulfill the criteria for respiratory rehabilitation, and respiratory rehabilitation only be performed once they satisfy the criteria. If adverse events occur during rehabilitation, rehabilitation should be discontinued immediately, and the chief physician must be informed. The cause should be determined, and safety should be reevaluated. Due to safety and human resource concerns, only the recommended bed and bedside activities are carried out during rehabilitation in severe and critical patients. Rehabilitation intervention measures must cover three major areas: (1) positioning management, (2) early mobilization, and (3) respiratory management. The therapeutic interventions should be based on the patient's cognitive status and functional status.

Recommendations

1. Timing of intervention: Respiratory rehabilitation can be initiated once all of the following criteria are met[18]: (1) respiratory system: (i) fraction of inspired oxygen (FiO_2) ≤0.6, (ii) blood oxygen saturation (SpO_2) ≥90%, (iii) respiratory rate ≤40 breaths/min, (iv) positive end expiratory pressure (PEEP) ≤10 cmH_2O, (v)

absence of ventilator resistance, and (vi) absence of unsafe hidden airway problems; (2) cardiovascular system: (i) systolic blood pressure ≥90 mmHg or ≤180 mmHg, (ii) mean arterial pressure (MAP) ≥65 mmHg or ≤110 mmHg, (iii) heart rate ≥40 bpm or 120 bpm, (iv) absence of new arrhythmia or myocardial ischemia, (v) absence of shock with lactic acid level ≥4 mmol/L, (vi) absence of new unstable deep vein thrombosis and pulmonary embolism, and (vii) absence of suspected aortic stenosis; (3) nervous system: (i) Richmond Agitation-Sedation Scale (RASS) score: −2 to +2 and (ii) intracranial pressure <20 cmH_2O; and (4) others: (i) absence of unstable limb and spinal fractures, (ii) absence of severe underlying hepatic/renal disease or new progressively worsening hepatic/renal impairment, (iii) absence of active hemorrhage, and (iv) temperature ≤38.5°C.

2. Early rehabilitation is discontinued immediately if the following conditions occur[18]: (1) respiratory system: (i) blood oxygen saturation <90% or decrease of >4% from baseline, (ii) respiratory rate >40 breaths/min, (iii) ventilator resistance, and (iv) artificial airway dislodgement or migration; (2) cardiovascular system: (i) systolic blood pressure <90 mmHg or >180 mmHg, (ii) MAP <65 mmHg or >110 mmHg or >20% change compared with baseline, (iii) heart rate <40 bpm or >120 bpm, and (iv) new arrhythmia and myocardial ischemia; (3) nervous system: (i) loss of consciousness and (ii) irritability; and (4) others: (i) discontinuation of any treatment or removal of monitoring tube connected to the patient; (ii) patient-perceived exacerbation heart palpitations, dyspnea, or shortness of breath, and intolerable fatigue; and (iii) falls in patient.

3. Respiratory rehabilitation intervention measures: (1) positioning management: under conditions permitted by physiological status, anti-gravity posture simulation is gradually increased until the patient can maintain an uprightpostion,

such as raising the head of the bed by 60 degrees; the lower edge of the pillow is placed on one-third of the scapula to prevent head hyperextension. A pillow is placed below the axilla to relax the lower limbs and abdomen. positioning management is carried out in 30-minute sessions and 3 sessions are conducted each day [19]. Prone position is carried out in acute respiratory distress syndrome (ARDS) patients for 12 hrs and above. [20] (2) Early mobilization: Attention should be paid during the entire activity to prevent tubing detachment, and vital signs should be monitored during the entire process. (i) Intensity: Lower strength, duration, or activity scope can be used in patients with poor physical fitness, and patients only need to complete the movements; (ii) Duration: The total training duration for a single session should not exceed 30 minutes nor exacerbate fatigue; (iii) Type of exercise: Firstly, periodic flipping and activities on the bed should be carried out, such as sitting up on bed, movingout of the bed to chair, sitting on the chair, standing up, and stepping. This sequence is gradually advanced. Secondly, active/passive exercise training is performed within the full range of motion (ROM).[21] Thirdly, for patients receiving sedatives or patients with loss of consciousness, cognitive dysfunction, or with limited physiological condition, treatments include bedside lower limb passive stationary bicycle, passive joint movement and stretch exercise, and neuromuscular electrical stimulation.[22] (3) Respiratory management: This mainly includes lung recruitment and sputum expulsion and does not require therapist to have long periods of patient contact. The management should not trigger severe cough and increase the respiratory work. High-frequency chest wall oscillation (HFCWO), active cycles breathing techniques and oscillatory positive expiratory pressure (OPEP) are among the recommended treatment methods.[24]

VI. Respiratory rehabilitation treatment for discharged patients

(1) Mild and ordinary discharged patients

Post-discharge rehabilitation of mild and ordinary patients mainly consists of improving physical fitness and psychological adjustment. Progressive aerobic exercises can be selected so that patients can gradually recover the level of activity observed before disease onset and eventually return to society.

(2) Severe/critical discharged patients

Severe/critical COVID-19 patients with respiratory and/or limb dysfunction after discharge should undergo respiratory rehabilitation. Based on the findings of discharged SARS and MERS patients[25–26] and clinical experience on post-discharge rehabilitation in ARDS patients, COVID-19 patients may have poor physical fitness, post-exertion shortness of breath, muscle atrophy (including respiratory muscles and trunk and limb muscles), [27] and post-traumatic stress disorder. [28] The specialist should be consulted on precautions if the patients have comorbidities such as pulmonary hypertension, myocarditis, congestive heart failure, deep vein thrombosis, and unstable fracture before commencing respiratory rehabilitation treatment.

[Recommendations]

1. Exclusion criteria: Patients with (1) a heart rate of >100 bpm, (2) a blood pressure of <90/60 mmHg or >140/90 mmHg, (3) a blood oxygen saturation of ≤95%, and (4) other diseases that are not suitable for exercise are excluded from the study.

2. Exercise termination criteria: Patients who experience (1) temperature fluctuation (>37.2°C) (2) exacerbation of respiratory symptoms and fatigue that are not alleviated with rest should discontinue exercises immediately. The physician should be consulted if the following symptoms occur: chest tightness, chest pain, dyspnea, severe cough, dizziness, headache, blurred vision, heart palpitations, profuse sweating, and unstable gait.

3. Rehabilitation evaluation: (1) clinical evaluation: physical examination, imaging tests, laboratory tests, lung function test, nutrition screening, and ultrasonography. (2) Exercise and respiratory function evaluation: (i) respiratory muscle strength: maximum inspiratory pressure/maximum expiratory pressure (MIP/MEP); (ii) muscle strength: Medical Research Council (MRC) , manual muscle test (MMT), and other inspiratory muscle tests (IMT); (iii) joint ROM test; (iv) balance functional evaluation: Berg balance scale (BBS); (v) aerobic exercise capacity: 6-minute walk test (6MWT) and cardiopulmonary exercise testing (CPET); and (vi) physical activity evaluation: international physical activity questionnaire (IPAQ) and physical activity scale for the elderly (PASE). (3) Evaluation of activities of daily living (ADL): The Barthel index is used to evaluate ADLs.

4. Respiratory rehabilitation intervention: (1) patient education: (i) boolet and videos should be made to explain the importance, specifics, and precautions of respiratory rehabilitation to increase patient compliance; (ii) healthy lifestyle education; (iii) encouraging patients to participate in family and social activities. (2) Respiratory rehabilitation recommendations: (i) aerobic exercises: aerobic exercises are customized according to the patient's underlying disease and residual dysfunction. These exercises include walking, brisk walking, slow jogging, and swimming, and begins at a low intensity before progressively increasing in intensity and duration. A total of 3–5 sessions are carried out per week, and each session lasts for 20–30 minutes. Patients who are prone to fatigue should perform intermittent exercises. (ii) Strength training: progressive resistance training [25, 29] is recommended for strength training. The training load for each target muscle group is 8–12 repetitions maximum (RM); i.e., each group will repeat 8–12 movements, 1–3 sets/time, with 2-minute rest intervals between sets, with a frequency of 2–3 sessions/week for 6 weeks.

Approximately 5%–10% is increased per week; (iii) balance training: balance training should be carried out in patients with comorbid balance disorders, including hands-free balance training under the guidance of the rehabilitation therapist and balance trainer; (iv) breathing exercise: if shortness of breath, wheezing, and difficulty in expelling sputum occur in patients after discharge, the evaluation results should be used to arrange the targeted deep breathing exercise[30–31] and airway clearance techniques [32]. Breathing exercise: this includes posture management, adjustment of breathing rhythm, thoracic expansion training, mobilization of respiratory muscle groups, etc.; airway clearance techniques: firstly, forced expiratory techniques can be used at the early stages of airway clearance after discharge in chronic airway disease patients to expel sputum and reduce coughing and energy consumption. Secondly, positive expiratory pressure (PEP)/OPEP can be used as aids. (3) ADL guidance: (i) basic ADLs (BADLs): the patient's ability in transferring, getting dressed, toileting, and bathing are assessed, and rehabilitation guidance is provided for these activities[33]; (ii) instrumental ADLs (IADLs): the IADL of the patient is assessed to identify any disorders in tasks. Targeted intervention is carried out under the guidance of the occupational therapist.

IV. Traditional Chinese medicine respiratory rehabilitation

Traditional Chinese medicine respiratory rehabilitation mainly targets mild, ordinary, and discharged patients. If there is no contraindication (limb disorder, altered consciousness, etc.), Baduanjin *qigong* [34–36], 24-form *tai chi chuan* [34–38], guided breathing exercise training [39–40], or 6-character mnemonic [34, 37] can be carried out after assessment by specialists. One or two of these exercises can be used. The recommendations are as follows:

1. Baduanjin *qigong*: During practice, the movements should be relaxed and

natural, correct, and flexible; should combine both training and support; and should be progressive. All eight moves are performed 6–8 times, with a total duration of 30 minutes. One set is performed per day.

2. Twenty-four-form *tai chi chuan*: Gentle movements, with emphasis on conscious breathing in coordination with systemic movements. Each set (which includes pre-training preparatory exercises and relaxation exercises after completion) requires 50 minutes. One set is carried out per day (https://mp.weixin.qq.com/s/NYY5Ts4N09zzZCpiL8nAvg).

3. Guided breathing exercises: This includes six stages of relaxed standing, two *tian*-accupoint breathing, lung and kidney conditioning, body turning, kidney region massage, and *qi* cultivation and training. Each set requires around 30 minutes. One set is carried out per day (https://mp.weixin.qq.com/s/1eNdxRWRoPKoxgIvZ9xpQw).

4. Qigong rehabilitation method: The six-character mnemonic uses different sounds (*xi, he, hu, xu, chui,* and *xi*) to regulate *qi* and blood flow through the organs and meridians. Every character is recited six times for each set. Each set requires around 30 minutes. One set is performed per day (https://mp.weixin.qq.com/s/ibsxWq5cDo40Jxz8mZzv-Q).

VIII. Conclusion

Combining the latest research results and accumulated clinical experience on respiratory rehabilitation and COVID-19 from China and other countries, we cautiously added the timing for respiratory rehabilitation and revised the respiratory rehabilitation protocol targeted at clinical problems at different stages based on the first edition. We hope that this can aid in frontline clinical diagnosis and treatment to maintain the physical function of patients while simultaneously promoting psychological reconstruction and capacity for remodeling activity. With our

deepening understanding of COVID-19 and the increase in the number of cured and discharged patients, the updated third edition will provide more detailed guidelines for home respiratory rehabilitation.

Finally, we would like to express our respect to all frontline epidemic control staff.

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Table 1. Protection categories for respiratory rehabilitation in COVID-19 patients

Protection category	Treatment item	Suggestions for protection gear									
		Disposable cap	Medical face masks	Protective face shield/goggles	Latex gloves	Working gown	Anti-penetration isolation gown	Disposable protective gown	Shoe cover	Full-face respirator/positive pressure headgear	Fast-drying hand sanitizer (75% ethanol)
Primary	Patients who continuously tested negative	+	+	-	+	+	-	-	-	-	+
Grade 2	Confirmed patient, no aerosol generation scenario	+	+	+	+	+	-	+	+	-	+
Grade 3	Confirmed patient, aerosol-generating scenario	+	+	+	+ (2 pairs)	+	+	+	+	+	+

Note: Currently, there is no unified personal protection standard for respiratory rehabilitation in COVID-19 patients, and this table is a summary of the "nosocomial infection management standards" of China and local and overseas guidelines.