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Recommendations for Hospital-Based Physical Therapists Managing Patients With COVID-19

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Objective. The COVID-19 pandemic is rapidly evolving and has led to increased numbers of hospitalizations worldwide. Hospitalized patients with COVID-19 experience a variety of symptoms, including fever, muscle pain, tiredness, cough, and difficulty breathing. Elderly people and those with underlying health conditions are considered to be more at risk of developing severe symptoms and have a higher risk of physical deconditioning during their hospital stay. Physical therapists have an important role in supporting hospitalized patients with COVID-19 but also need to be aware of challenges when treating these patients. In line with international initiatives, this article aims to provide guidance and detailed recommendations for hospital-based physical therapists managing patients hospitalized with COVID-19 through a national approach in the Netherlands.

Methods. A pragmatic approach was used. A working group conducted a purposive scan of the literature and drafted initial recommendations based on the knowledge of symptoms in patients with COVID-19 and current practice for physical therapist management for patients hospitalized with lung disease and patients admitted to the intensive care unit. An expert group of hospital-based physical therapists in the Netherlands provided feedback on the recommendations, which were finalized when consensus was reached among the members of the working group.

Results. The recommendations include safety recommendations, treatment recommendations, discharge recommendations, and staffing recommendations. Treatment recommendations address 2 phases of hospitalization: when patients are critically ill and admitted to the intensive care unit, and when patients are severely ill and admitted to the COVID ward. Physical therapist management for patients hospitalized with COVID-19 comprises elements of respiratory support and active mobilization. Respiratory support includes breathing control, thoracic expansion exercises, airway clearance techniques, and respiratory muscle strength training. Recommendations toward active mobilization include bed mobility activities, active range-of-motion exercises, active (assisted) limb exercises, activities-of-daily-living training, transfer training, cycle ergometer, pre-gait exercises, and ambulation.



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As of publication date, the number of patients with respiratory syndrome caused by coronavirus 2 (SARS-CoV-2), the virus that causes coronavirus disease 2019 (COVID-19), is still increasing rapidly worldwide. Spreading of COVID-19 occurs mainly through respiratory droplets and aerosols produced when an infected person coughs or sneezes.¹ To our knowledge, there is currently no consensus on the period the virus is transmissible to other humans; however, the duration and transmissibility seem to differ between patients with differing severity of illness.² Even after resolution of symptoms, individuals might keep shedding the virus.³ Diagnosis of COVID-19 requires detection of SARS-CoV-2 RNA using a combination of nasopharynx and throat sample;^{4,5} SARS-CoV-2 RNA can also be detected in stool and blood.⁴ Chest computed tomography images from patients with COVID-19 typically demonstrate bilateral, peripheral ground glass opacities. Unfortunately, this pattern is non-specific and overlaps with other infections; therefore, the diagnostic value of chest computed tomography imaging for COVID-19 may be low.^{4,5}

Recent data from China and Italy indicate that in 80% of cases COVID-19 infection causes “mild and moderate illness,” approximately 15% of cases develop “severe illness” leading to hospitalization, and 5% develop “critical illness” requiring ICU treatment.^{2,4–6} Hospitalized patients with COVID-19 experience a variety of symptoms, including fever, muscle pain, tiredness, cough, and difficulty breathing.⁷ Elderly people and those with underlying health conditions are considered to be more at risk of developing severe symptoms⁴ and have a higher risk of physical deconditioning during their hospital stay.^{8,9} Physical therapists have an important role in supporting hospitalized patients through respiratory support and active mobilization. Physical therapist management should be tailored to the individual patient’s needs concerning frequency, intensity, type, and timing of the interventions, in particular for those with severe/critical illness, older than 70 years of age, obesity, comorbidity, and other complications.^{10,11} Yet physical therapists need to be aware of potential challenges when treating patients with COVID-19. In a recent study, an international group of authors described the physical therapist management for COVID-19 in an acute hospital setting, including workforce planning, screening, delivery of physical therapist interventions, and personal protective equipment (PPE).¹²

In line with this international study¹² and the consensus statement of Italian respiratory therapists,¹³ we aim to provide guidance and detailed recommendations for hospital-based physical therapists managing patients hospitalized with COVID-19 through a national approach in the Netherlands.

Scope

This study focuses on adult patients admitted to an (acute) hospital setting due to COVID-19. In general, patients with COVID-19 experience the following signs and symptoms: fever (83%–99%), cough (59%–82%), fatigue (44%–70%), weight loss (40%–84%), shortness of breath (31%–40%), secretion production (28%–33%), and myalgias (11%–35%).^{4,6} Recent studies showed that illness severity can range from mild to critical.^{2,4–6}

- Mild to moderate (mild symptoms up to mild pneumonia): 80%
- Severe (dyspnea, hypoxia, or >50% lung involvement on imaging): 15%
- Critical (respiratory failure, shock, or multiorgan system dysfunction): 5%

Critical cases, needing ICU treatment, may show symptoms of Acute Respiratory Distress Syndrome (ARDS) such as lung disease, with widespread inflammation in the lungs.⁵ Consolidation lesions also remain at long term and can leave fibrotic changes in the lungs.⁵ Furthermore, patients who are critically ill needing ICU treatment are at risk of developing post-intensive care syndrome (PICS), including ICU-acquired weakness (ICU-AW).^{13–15} Mortality among patients admitted to the ICU ranges from 39% to 72%.⁴

Health care professionals should be aware that the clinical progression of symptoms might occur 1 week after illness onset.^{5,13,14} Important subgroups are elderly people (≥ 70 years of age) and those with underlying health conditions (eg, hypertension, diabetes, cardiovascular disease, chronic respiratory disease, and cancer), who are considered to be more at risk of developing severe symptoms⁴ but also at risk of physical deconditioning during hospital stay.^{8,9}

Figure 1 is based on recent literature and shows the flow of patients with COVID-19 with their signs and symptoms before^{4,6,7} and during hospital admission,^{4,5,7–9,13,15,16} the severity classification,^{2,4–6} and the physical therapy goals during hospital stay.^{10–13,17}

These recommendations focus on the physical therapist management for adult patients with COVID-19 admitted to the (acute) hospital setting. Recommendations contain specific physical therapy goals concerning respiratory problems and deconditioning, including ICU-AW and PICS. The recommendations are outlined in 2 sections:

- Section 1: Patients who are critically ill with COVID-19 admitted to the ICU.
- Section 2: Patients who are severely ill with COVID-19 admitted to the COVID ward.

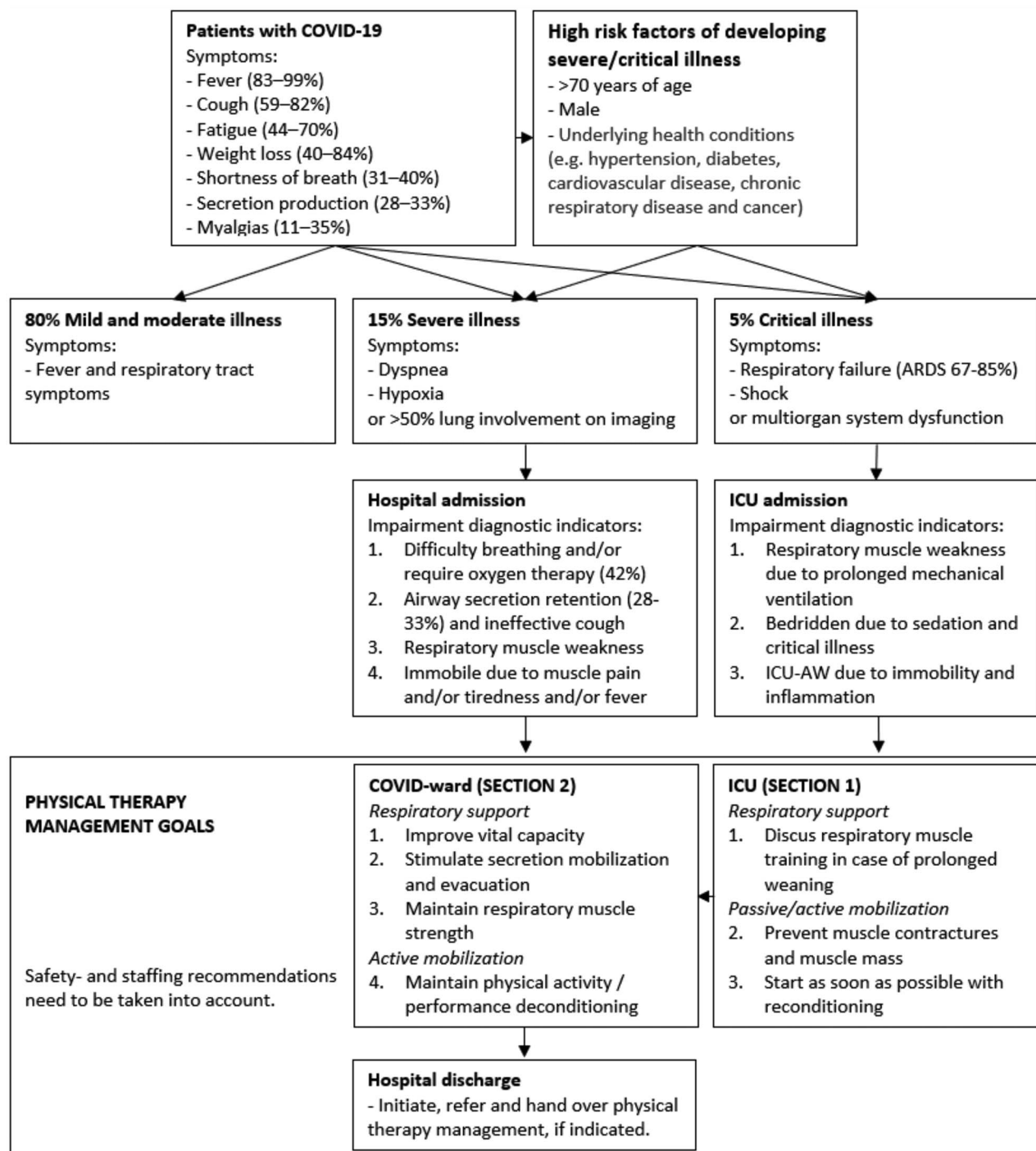


Figure 1.

The flow of patients with COVID-19 with their signs and symptoms before^{4,6,7} and during hospital admission^{4,5,7,8,13,16}; the severity classification,^{2,4–6} and the physical therapy goals during hospital stay.^{10–13,17}

We used existing international recommendations^{12,13} as the basis for further specification and contextualization. When our recommendations diverge from the international recommendations, we clarified this in the main text and through a separate paragraph with reflections. The recommendations are structured in the following order: safety recommendations, treatment recommendations (specified for different phases of hospitalization), discharge recommendations, and staffing recommendations.

Pragmatic Methodology

Due to the acute and sudden spreading of COVID-19, the evidence base for optimal treatment for this group of patients is evolving rapidly and new insights are emerging at a similar pace. Nevertheless, clear recommendations for hospital-based physical therapist management, either based on evidence or best practices, are crucial to support the recovery of patients and safety of health care professionals. These recommendations will be updated periodically based on new evidence and experience and will be made available through the website of the Royal Dutch Society for Physical Therapy and the World Confederation for Physical Therapy.

To cope with this rapidly evolving evidence base, we utilized a pragmatic approach, rather than a formal approach (such as Grading of Recommendations Assessment, Development and Evaluation [GRADE]),¹⁸ to formulate our recommendations. First a working group was installed comprising experts on content (K.F., R.O., E.K., N.K., M.S., E.H.) and experts on guideline methodology (F.D., T.H., P.W.). The working group members conducted a purposive scan of the literature and drafted the initial recommendations based on the knowledge of symptoms in patients with COVID-19 and current practice for physical therapist management in patients hospitalized with lung diseases and in patients admitted to the ICU. Simultaneously, an expert group of hospital-based physical therapists in the Netherlands (see Acknowledgments) was formed based on the formal and informal networks of the working group. This expert group served as a sounding board group. Recommendations drafted by the working group based on available evidence and best practices were discussed with the expert group. Considerations by the expert group were discussed in the working group. Recommendations were finalized when consensus, in terms of no opposing votes, was reached among the members of the working group.

The final recommendations are summarized in [Figure 2](#). We sought and received endorsements for our recommendations from 40 hospital-based physical therapists from over 20 Dutch hospitals, the Royal Dutch Society for Physical Therapy, the Dutch Association for Hospital-Based Physical Therapists,

Association for Cardiovascular and Respiratory Physical Therapists, and the Dutch Society for Intensive Care Medicine. The authors and consulted experts were all based in the Netherlands; therefore, generalizability to hospital-based physical therapy settings in other countries, with different health care organizations, different task profiles, and different scope of practice, could be limited.

Recommendations: Safety

Respiratory droplets and aerosols may be released from patients during physical therapist interventions and may cause further spread of the virus. Direct contact between physical therapists and patients with COVID-19, therefore, should be minimized to avoid risk of virus transmission and reduce usage of scarce PPE. Therefore, we recommend physical therapists make optimal use of telecommunication and written information material. If direct (face-to-face) contact with patients with COVID-19 is required, physical therapists should use PPE. Recommended PPE include a gown, gloves, eye protection, and a facemask.⁴ Procedures for the use of PPE vary between hospitals; therefore, the use of PPE should be checked locally with hospital officers for hygiene and infection prevention. Concerning adequate use of PPE, treating physical therapists should be informed that certain treatment modalities can lead to extra viral exposure. The following procedures can induce the release of droplets and aerosols^{12,13,19}:

- Noninvasive assisted ventilation or high-flow nasal oxygen therapy;
- Manual techniques for respiratory support, including compression, which may lead to coughing and secretion mobilization;
- Secretion mobilization devices, such as positive expiratory pressure, Flutter Mucus Clearance Device (Allergan Pharmaceutical Company, Dublin, Ireland); Acapella DM & DH Vibratory PEP Therapy System (Smiths Medical Inc, Carlsbad, CA); and high-frequency chest wall oscillation devices;
- Endotracheal suctioning;
- Active mobilization, which may lead to coughing and secretion mobilization or disconnection of the mechanical ventilation.

If one of the above procedures is performed, physical therapists are recommended to wear a facemask that filters at least 95% of airborne particles (ie, FFP2 mask, N95 facemasks). Physical therapists should ensure that they are fully competent in the use of PPE.⁴ Safety recommendations need to be taken into account during all steps in physical therapist management. Benefits of hands-on physical therapist management should always be weighed against the potential risks of virus transmission.

Safety Recommendations
Minimize contact with patients with COVID-19; always consider the benefits of hands-on physical therapist treatment versus the risks of virus transmission and the use of scarce personal protective equipment (PPE).
Make optimal use of digital and/or written information for the instruction of patients.
Treatment Recommendations
Section 1: Patient is critically ill and admitted to the intensive care unit (ICU)
Phase A: Patient is unconscious
Physical therapist management for respiratory support and active mobilization is not required due to a lack of therapeutic goals in this phase, the risk of transmission of the virus, and the limited availability of PPE.
If contractures are suspected, nurses can consult physical therapists for advice on passive movements, limb positioning or splinting.
Phase B: Patient is conscious and able to cooperate
Discuss with the multidisciplinary team whether to pragmatically initiate respiratory muscle strengthening in patients with prolonged weaning.
Stimulate active mobilization including bed mobility activities; in case safety recommendations for physical therapist management cannot be met, instruct nurses to combine active mobilization with their daily care activities.
Monitor patients' respiratory and hemodynamic functions continuously when performing active mobilization.
Section 2: Patient is severely ill and admitted to the COVID ward
Respiratory support
Use breathing control and thoracic expansion exercises to improve vital capacity.
Use active cycle of breathing techniques in patients who need airway clearance to stimulate secretion mobilization and evacuation.
Use inspiratory and expiratory respiratory muscle training in patients recovering from critical illness with suspected respiratory muscle weakness.
Active mobilization
Use bed mobility activities to improve physical functioning and respiratory functioning.
Stimulate active mobilization as much as possible based on patients' needs, preferences, and physical functioning.
Discharge Recommendations
Initiate, refer, and transition patients to physical therapists in primary care practices, rehabilitation clinics, nursing homes, or recovery centers in order to continue physical therapist management, if required.
Staffing Recommendations
Deploy physical therapists with sufficient skills, knowledge, and self-confidence in care for patients who are severely ill in a COVID 19 ward or in the ICU.
Provide psychosocial support for hospital-based physical therapists.

Figure 2.

Summary of recommendations for hospital-based physical therapists managing patients with COVID-19.

- Recommendation: Minimize contact with patients with COVID-19; always consider the benefits of hands-on physical therapist treatment vs the risks of virus transmission and the use of scarce PPE.
- Recommendation: Make optimal use of digital and/or written information for the instruction of patients.

Recommendations: Treatment

Physical therapist management for patients hospitalized with COVID-19 comprises elements of respiratory support and active mobilization.^{20,21} Recommendations toward respiratory support, defined as the “proactive approach to minimize respiratory symptoms during the acute phase of a pulmonary disease,”²² are presented in detail. In the

treatment of patients with COVID-19, respiratory support can consist of breathing control, thoracic expansion exercises, airway clearance techniques, and respiratory muscle strength training. Recommendations toward active mobilization concern the “proactive approach to support any physical activity where patients assist with the activity using their own strength and control: patients may need assistance from staff or equipment, but they are actively participating in the exercise.”²¹ Examples of active mobilization are bed mobility activities (eg, bridging, rolling, lying to sitting), active range-of-motion exercises, active (assisted) limb exercises, activities of daily living (ADL) training, transfer training, cycle ergometer, pre-gait exercises, and ambulation.²³

Section 1: Patient Is Critically Ill and Admitted to ICU

Recommendations for physical therapy during mechanical ventilation in the ICU depend on the level of consciousness and cooperation of the patient.¹⁷ Therefore, the recommendations for physical therapist management differ between Phase A, where the “patient is unconscious” (Richmond Agitation and Sedation Score [RASS] < -2 and Standardized 5 Questions [S5Q] < 3); and Phase B, where the “patient is conscious and able to cooperate” (RASS score \geq -2 and S5Q \geq 3).¹⁷

Phase A: Patient is unconscious: respiratory support.

Patients with critical illness due to COVID-19 may develop ARDS-like symptoms, requiring admission to the ICU.²⁴ Initially, the majority of patients are deeply sedated (RASS \leq -4) and mechanically ventilated in prone position.²⁵ These patients often receive neuromuscular blocking agents to support mechanical ventilation, as this drug application can improve chest wall compliance, eliminate ventilator dyssynchrony, and reduce intraabdominal pressures.²⁶ Given the lack of therapeutic goals in this phase, physical therapist management concerning respiratory support is not recommended. This might be different for physical therapists outside the Netherlands with other scope of practice concerning respiratory support.

Phase A: Patient is unconscious: active mobilization.

Patients who are deeply sedated cannot actively participate in mobilization. Physical therapist management in this phase focuses on maintaining joint mobility and preventing (soft tissue) contractures. The administering of neuromuscular blocking agents, however, reduces the risk of contractures.²⁷ Additionally, the evidence base for preventive stretching is limited.²⁸ Based on these considerations, we think that the risk of transmission of the virus and the limited availability of PPE do not outweigh the benefits of regular joint mobility screening by physical therapists. When neuromuscular blocking agents are discontinued, the risk for developing contractures increases. If contractures are suspected,

nurses can consult physical therapists for advice on passive movements, limb positioning, or splinting.¹⁷

- Recommendation: Physical therapist management for respiratory support and active mobilization is not required due to a lack of therapeutic goals in this phase, due to the risk of transmission of the virus, and due to the limited availability of PPE.
- Recommendation: If contractures are suspected, nurses can consult physical therapists for advice on passive movements, limb positioning, or splinting.

Phase B: Patient is conscious and able to cooperate: respiratory support.

The moment sedation is reduced (RASS \geq -2) and the patient is conscious and able to cooperate (S5Q \geq 3), a new phase starts.²⁵ Normally, this is the phase to start active mobilization and respiratory support; however, in patients with COVID-19, detachment of the closed mechanical ventilation system circuit should always be avoided due to the risk of virus transmission. Even in the case of weaning from mechanical ventilation, where physical therapists typically aim to ensure sufficient inspiratory muscle strength,^{29,30} the risk of virus transmission via droplets or aerosols in using medical assistive testing devices is too high. Therefore, we recommend not detaching the ventilation system for the purpose of respiratory function testing, respiratory muscle training, or breathing exercises.¹⁹ To our knowledge, it remains unclear if both droplets and aerosols are filtered by disposable bacterial filters.³¹

In case of prolonged weaning, patients who fail more than 3 weaning attempts or require more than 7 days of weaning after the first spontaneous breathing trial,³² respiratory muscle training should be discussed in the multidisciplinary team.³⁰ The team may decide that benefits of respiratory muscle training outweigh the safety risks.

In the phase after prolonged (assisted) mechanical ventilation, inspiratory (IMT) and expiratory muscle training can be used to counterbalance the weakness of the respiratory muscles.^{29,33} Moreover, additional benefits of strengthening are increased exercise tolerance and cough strength. Usually, noninvasive handheld manometers to assess maximal static inspiratory pressure can help quantify respiratory muscle strength and initiate training.^{34,35} Usually, scores lower than 30 cmH₂O may indicate a degree of inspiratory muscle weakness that could impact on weaning and recovery.³⁶ However, the use of these devices is not recommended in patients with COVID-19 due to the increased risk of virus transmission. In this situation, training can be started pragmatically (ie, without respiratory testing results) using a threshold training device with low resistance (<10 cmH₂O) and can be increased based on clinical presence, experienced dyspnea, and Borg score for perceived exhaustion.³⁷ For

respiratory muscle strengthening, a combination of both IMT and expiratory muscle training is recommended, as this combination is superior to IMT alone in improving respiratory muscle strength.³⁵ As respiratory muscle training devices could carry the virus (prolonged), the use of these devices should be discussed with hospital officers for hygiene and infection prevention.

- Recommendation: Discuss with the multidisciplinary team whether to pragmatically initiate respiratory muscle strengthening in patients with prolonged weaning.

Phase B: Patient is conscious and able to cooperate: active mobilization. When patients become conscious and cooperative, active mobilization can be considered. Active mobilization should aim to prevent ICU-AW and deconditioning from immobilization and illness. The Medical Research Council Sum-Score is widely used to diagnose ICU-AW, which is defined as an Medical Research Council Sum-Score < 48.³⁸ It is assumed that patients diagnosed with ICU-AW may benefit from active mobilization also following their ICU admission.³⁹ These physical activities for patients who are critically ill should be planned and targeted following the evidence-based statement for physical therapist management in the ICU as much as possible.¹⁷ Patient safety criteria according to Sommers et al¹⁷ for active mobilization that always need to be considered at the ICU are presented in Figure 3. Close monitoring of respiratory and hemodynamic functions of patients is crucial to ensure patients' safety.^{17,21} As a first step, bed mobility activities can be performed by assisting bridging, rolling, and transferring from supine to sitting.²³ Medical assistive devices (eg, a bed cycle) might be used to support active mobilization. However, use of these devices should be discussed with hospital officers for hygiene and infection prevention. To evaluate and increase training intensity, frequency, and/or activities, criteria of American College of Sports Medicine guidelines for exercise testing and prescription,⁴⁰ Modified Borg Dyspnea Scale,³⁷ and/or the evidence-based statement of Sommers et al¹⁷ can be used. Figure 4 shows our expert opinion suggestions for active mobilization sessions in patients with COVID-19 at the ICU.

Ideally, the physical therapist is the leading health care professional to guide active mobilization. However, safety recommendations can also be decisive in initiating physical therapist management. If safety recommendations for health care providers do not warrant direct physical therapy contact, we recommend instructing nurses to combine active mobilization with daily care activities. In this case, the physical therapist has a coaching role.

- Recommendation: Stimulate active mobilization including bed mobility activities; in case safety recommendations for physical therapist management cannot be met, instruct nurses to

combine active mobilization with their daily care activities.

- Recommendation: Monitor patients' respiratory and hemodynamic functions continuously when performing active mobilization.

Section 2: Patient Is Severely Ill and Admitted to the COVID Ward

Patients who are severely ill with COVID-19 who require hospitalization can present with complications such as pneumonia, hypoxemic respiratory failure/ARDS, sepsis and septic shock, cardiomyopathy and arrhythmia, acute kidney injury, and complications from prolonged hospitalization, including secondary bacterial infections.⁴ Because the consequences of the infection impact the respiratory system, one of the goals of physical therapist management is to optimize respiratory function. Therefore, respiratory support aims to improve breathing control, thoracic expansion, and mobilization/evacuation of secretion. Active mobilization aims to increase (or maintain) physical functioning and independence in ADL. These recommendations also apply for patients recovering from critical illness due to COVID-19. Additionally, in patients recovering from critical illness, respiratory muscle strength/endurance training can be continued.

Respiratory support. Respiratory support serves several purposes: to improve vital capacity, to evacuate secretion, and to strengthen respiratory muscle. Techniques and goals are briefly introduced as follows:

- Improvement of vital capacity: To relax the airways and relieve the symptoms of wheezing and tightness that normally occur after coughing or breathlessness (respiratory frequency >25 breath/min, Modified Borg Dyspnea Scale >4), breathing control is used. Breathing control can help if patients with COVID-19 are experiencing shortness of breath, fear, or anxiety or are in a panic.⁴¹ It stimulates tidal volume breathing, with neck and shoulders relaxed and the diaphragm contracting for inspiration. Patients should be encouraged to breathe in through their nose to humidify, warm, and filter the air and to decrease the turbulence of inspired flow.⁴² The length of time spent performing breathing control may vary depending on how breathless patients feel.⁴¹ Difficulty of breathing can be evaluated using the Modified Borg Dyspnea Scale.³⁷ Thoracic expansion exercises are recommended to improve ventilation also in the lower lung fields. This increases the vital capacity and improves lung function, especially if atelectasis is present.⁴³ Patients should be stimulated to inhale deeply and slowly, combined with chest expansion and shoulder expansion.⁸ Extra stimuli can be provided through visual feedback using incentive spirometry.⁴³ Thoracic hyperinflation

It is recommended that every patient be screened for the presence of red flags (contraindications) and relative contraindications to consider (possible) risks and benefits before and during every physical therapist treatment session. The criteria mentioned below are (relative) contraindications for mobilizations out of bed and physical activities of patients in the ICU and must be taken into consideration during the clinical reasoning process. An intensivist needs to be consulted in case of a patient showing 1 of the following conditions before mobilization/physical activities.

Red Flags (Evidence Level 1)

Heart rate

- Recent myocardial ischemia
- Heart rate < 40 and > 130 beats/min

Blood pressure

- Mean arterial pressure (MAP) < 60 mmHg and > 110 mmHg

Oxygen desaturation

- $\leq 90\%$

Parameters of ventilation

- Fractional concentration of inspired oxygen (FiO_2) ≥ 0.6
- Positive end expiratory pressure (PEEP) ≥ 10 cm H₂O

Respiratory frequency

- Respiratory frequency > 40 breath/min

Level of consciousness of patient

- Richmond Agitation Sedation Scale (RASS) score = -4, -5, 3, 4

Doses inotropic

- High inotrope doses
Dopamine ≥ 10 mcg/kg/min
Noradrenaline/adrenaline ≥ 0.1 mcg/kg/min

Temperature

- $\geq 38.5^\circ\text{C}$
- $\leq 36^\circ\text{C}$

Relative Contraindications (Evidence Levels 3 and 4)

- Clinical View
 - Decreased level of awareness/consciousness
 - Sweating
 - Abnormal face color
 - Pain
 - Fatigue
- Unstable fractures
- Presence of lines that make mobilization unsafe.
- Neurological instability: Intra Cranial Pressure (ICP) ≥ 20 cmH₂O

Figure 3.

Criteria for safety of treatment according to Sommers et al.¹⁷ Level of evidence of the literature and clinical expertise: level 1 = recommendation based on evidence of research of level A1 (systematic review) or at least 2 independent studies of level A2 (randomized controlled trial of good quality and size); level 2 = recommendation based on 1 study of level A2 or at least 2 independent studies of level B (randomized controlled trial of moderate or weak quality or insufficient size, or other comparative studies, eg, patient controlled and longitudinal cohort studies); level 3 = recommendation based on 1 study of level B or level C (non-comparative studies); level 4 = recommendation based on expert opinion.

Step 1

Condition: Patient safety criteria should be met throughout the entire session.

- **Bed mobility activities**—eg, (assisted) bridging and rolling.
- **(Assisted) exercises while lying supine**, eg, cervical rotation, shoulder elevation, biceps flexion, finger flexion and extension, and ankle pumps. Starting with 5 repetitions in 1 set, with progression to 10-15 repetitions in 3 sets.

Step 2

Conditions: Active mobilization in supine should be well tolerated and patient safety criteria should be met throughout the entire session.

Termination criteria should be considered with the following *relative* contraindications: heart rate < 40 and > 130 beats/min, blood pressure (mean arterial pressure) < 65 and > 110 mmHg, respiratory frequency > 40 breaths/min, oxygen saturation < 85%, cardiac arrhythmia, and clinical symptoms (decreased level of awareness/consciousness, sweating, abnormal face color, pain, fatigue, discomfort).

- **Bed mobility activities** might be increased to (assisted) transferring from supine to sitting.
- **(Assisted) exercised while sitting**, eg, cervical flexion and extension, thoracic rotation, weight bearing with arms (to increase postural control), and knee extension. Starting with 5 repetitions in 1 set, with progression to 10-15 repetitions in 3 sets.
- **Passive or active bed cycling for 20 minutes** might also be considered; however, the use of medical assisted devices should also be discussed with hospital officers for hygiene and infection prevention.

Figure 4.

Expert opinion suggestions for active mobilization sessions in patients who are critically ill with COVID-19 in the intensive care unit (ICU), Phase B.

should be prevented using adequate monitoring of performance.

- **Evacuation of secretion:** Early reports indicate that patients with COVID-19 do not show airway mucus hypersecretion;^{24,44} however, patients with specific comorbidities (eg, chronic obstructive pulmonary disease, cystic fibrosis, neuromuscular disease) might actually need respiratory support due to airway secretion retention or ineffective cough.¹³ In case of clinical signs for presence of airway secretion (by hearing, feeling, or chest x-ray), different techniques and devices can be applied to mobilization or evacuation. When using these techniques, please keep the safety recommendations in mind. The active cycle of breathing techniques (ACBT) are the preferred procedure. This also includes the breathing control and thoracic expansion exercises, and combines these with huffing and coughing.^{41,42,45} Huffing and coughing contribute to the formation of respiratory droplets and aerosols and should be avoided in direct contact with health care professionals. Therefore, these maneuvers are only recommended in case of airway obstruction due to excess secretions. The multidisciplinary team should carefully evaluate whether airway obstruction is present through

medical history taking (eg, the presence of productive cough), physical examination (eg, the presence of pulmonary rhonchus), and observations. Telecommunication and/or written instruction material can be used to support the use of ACBT. If patients fail to effectively use ACBT, teaching these techniques under direct supervision of a physical therapist can be considered.

- **Strengthening of respiratory muscle:** Patients with COVID-19 might have suspected respiratory muscle weakness caused by prolonged mechanical ventilation during ICU stay. After transfer to the COVID ward, respiratory muscle strengthening can be continued for patients recovering from critical illness according to the recommendations in Section 1, Phase B. Training protocols typically use resistive loads ranging between 30% and 80% of maximal static inspiratory pressure.⁴⁶ However, the use of noninvasive handheld manometers is not recommended in patients hospitalized with COVID-19 due to the increased risk of virus transmission. According to Section 1, Phase B, training can be started pragmatically (ie, without respiratory testing results) using a threshold training device with low resistance (<10 cmH₂O) and can be increased based on clinical presence,

experienced dyspnea, and Borg score for perceived exhaustion.³⁷ One of the unique advantages of respiratory muscle training is that it can be implemented in shorter intervals (30 breaths, 2 times/d). Training effects from respiratory muscle training have been observed for multiple protocols lasting only 4 weeks.⁴⁶ A telehealth or mobile app-based model would allow for the opportunity for real-time remote monitoring of compliance and assessment. Telehealth and home-based models for respiratory muscle training have been studied with similar effects.⁴⁷

- Recommendation: Use breathing control and thoracic expansion exercises to improve vital capacity.
- Recommendation: Use active cycle of breathing techniques in patients who need airway clearance to stimulate secretion mobilization and evacuation.
- Recommendation: Use inspiratory and expiratory respiratory muscle training in patients recovering from critical illness with suspected respiratory muscle weakness.

Active mobilization. If patients are bedridden and suffering from COVID-19, pulmonary ventilation can be stimulated by bed mobility activities through bridging, rolling, and sitting.¹¹ If possible, patients might assist with their own strength and control. If needed, staff and equipment can be used to support the activity. A vertical position can be obtained with less support of patients by tilting the bed or using a tilt table.

To prevent further deconditioning, patients should be stimulated to be physically active through active mobilization as much as possible through the hospitalization period. Physical therapists can provide specific exercises and training that meet the needs and preferences of patients with COVID-19. Maintaining or improving physical functioning should be executed following common safety recommendations, monitoring, and guidance.^{17,21} Based on our expert opinion, at least patient's saturation and heart rate should be monitored before and during active mobilization due to the low and fluctuating vital capacity of patients with COVID-19. Active mobilization interventions that need to be considered are bed mobility activities, active range of motion exercises, active (assisted) limb exercises, ADL training, transfer training, cycle ergometer, pre-gait exercises, and ambulation.²³ Sitting and standing are the preferred postures for patients, if possible. To evaluate and increase training intensity, frequency, and/or activities, criteria of American College of Sports Medicine guidelines for exercise testing and prescription,⁴⁰ Borg score,³⁷ and/or the evidence-based statement of Sommers et al¹⁷ can be used. Figure 5 shows our expert opinion

suggestions for active mobilization sessions in patients with COVID-19 in the COVID ward.

Instructions can be provided through telecommunication, flyers, and/or videos when patients are physically and cognitively capable to exercise independently. If patients with COVID-19 are unable to exercise independently, for example as the result of ICU-AW, and safety recommendations by physical therapists cannot be met, it is recommended to instruct nurses how to support active mobilization. It is a decision of the interprofessional team of health care professionals to assess benefits of support by a physical therapist vs the risks of viral transmission and limited use of PPE.

- Recommendation: Use bed mobility activities to improve physical functioning and respiratory functioning.
- Recommendation: Stimulate active mobilization as much as possible based on patients' needs, preferences, and physical functioning.

Discharge Recommendations

The hospital-based physical therapist should screen patients with severe illness due to COVID-19 on whether physical therapist management should be continued after hospital discharge.⁴⁸ Patients may experience loss of function and independence due to hospitalization and in severe cases develop a PICS, including physical, cognitive, and mental impairments, as a result of their prolonged stay in the ICU.^{14,49–51} Based on earlier experiences and knowledge from the SARS epidemic (SARS-CoV),⁵² substantial increases can be expected in long-term health care need for patients with COVID-19. Continuing care based on patients' needs after hospital discharge is important. The hospital-based physical therapist has an important role in warranting continuity of physical therapist management. When hospital discharge is forthcoming, sufficient hand-over of patient information to physical therapists working in primary care practices, rehabilitation clinics, nursing homes, or recovery centers is needed. Based on clinical expertise with post-ICU rehabilitation, it is recommended that discharge information should at least contain anamnestic information (medical, psychosocial), patient's clinical question, goals and provided physical therapy and recovery process, current limitations in functioning and daily life activities, and other involved health care professionals.^{49–51}

- Recommendation: Initiate, refer, and transition patients to physical therapists in primary care practices, rehabilitation clinics, nursing homes, or recovery centers to continue physical therapist management, if required.

Step 1

Condition: Patient safety criteria should be met throughout the entire session.

- **(Assisted) exercises while lying supine** such as: cervical rotation, shoulder elevation, biceps flexion, finger flexion and extension, and ankle pumps. Start with 5 repetitions in 1 set, with progression to 8-10 repetitions in 3 sets. Use criteria of American College of Sports Medicine (ACSM) or moderate intensity:
 - Patients should be able to talk but not sing.
 - Perceived exertion 3-4 out of 10, metabolic equivalent tasks level 3-6.

Step 2

Conditions: Active mobilization in supine should be well tolerated, and patient safety criteria should be met throughout the entire session.

Termination criteria should be considered with the following *relative* contraindications: heart rate < 40 and > 130 beats/min, blood pressure (mean arterial pressure [MAP]) < 65 and > 110 mmHg, respiratory frequency > 40 breaths/min, oxygen saturation < 85%, cardiac arrhythmia, and clinical symptoms (decreased level of awareness/consciousness, sweating, abnormal face color, pain, fatigue, discomfort).

- **(Assisted) exercises while sitting**, such as: hip flexion, knee extension, shoulder anteflexion and abduction, and going from sit to stand. Start with 5 repetitions in 1 set, with progression to 8-10 repetitions in 3 sets. Use criteria of American College of Sports Medicine (ACSM) or moderate intensity:
 - Patients should be able to talk but not sing
 - Perceived exertion 3-4 out of 10, metabolic equivalent tasks level 3-6.

Step 3

Conditions: Active mobilization while sitting should be well tolerated patient safety criteria should be met throughout the entire session.

Termination criteria should be considered with the following *relative* contraindications: heart rate < 40 and > 130 beats/min, blood pressure (MAP) < 65 and > 110 mmHg, respiratory frequency > 40 breaths per minute, oxygen saturation < 85%, cardiac arrhythmia, and clinical symptoms (decreased level of awareness/consciousness, sweating, abnormal face color, pain, fatigue, discomfort).

- **Exercises while standing**, eg, hip flexion, knee flexion, shoulder anteflexion, shoulder abduction, stepping in place. Start with 5 repetitions in 1 set, with progression to 8-10 repetitions in 3 sets. Use criteria of American College of Sports Medicine (ACSM) or moderate intensity:
 - Patients should be able to talk but not sing
 - Perceived exertion 3-4 out of 10, metabolic equivalent tasks level 3-6.
- Additional active mobilization interventions that need to be considered: ADL training (ie, eating and washing), ambulation, cycle ergometer.

Figure 5.

Expert opinion suggestions for active mobilization sessions in patients who are severely ill with COVID-19 in the COVID ward.

Staffing Recommendations

Professional Expertise

Careful planning is required when physical therapists are deployed in departments where they are not used to work, such as the ICU. Hospital-based physical therapists should have adequate knowledge, skills, and attitude in terms of self-confidence to treat patients in isolation, with complex respiratory problems, low physical functioning and with complex acute care needs. The deployment of physical therapists in a COVID-19 ward or ICU with sufficient skills, knowledge and attitude (self-confidence) and experience in critical care should be optimized.¹⁹ Hospital-based physical therapists with these skills and knowledge should be tasked with training of less experienced colleagues to provide them with the necessary skills, knowledge and self-confidence for physical therapist management of patients with COVID-19.

- Recommendation: Deploy physical therapists with sufficient skills, knowledge and self-confidence in care for patients who are severely ill at a COVID-19 ward or in the ICU.

Psychosocial Support

The COVID-19 outbreak presents new challenges for health care professionals. Physical therapists will work intensively with patients who are severely ill, which can lead to mental health distress. It is recommended for managers to plan sufficient recovery time between work shifts of physical therapists and to let less experienced colleagues carefully be supervised by experienced peers. In these turbulent times, provision of psychosocial support should be considered.

- Recommendation: Provide psychosocial support for hospital-based physical therapists.

Reflections

In this manuscript, we provide detailed recommendations and intervention descriptions for hospital-based physical therapists managing patients hospitalized with COVID-19 in the Netherlands. Our recommendations are generally in line with the recent international clinical practice recommendations of Thomas et al¹² and the consensus statement of Italian respiratory therapists.¹³ However, there are a number of differences in physical therapist interventions:

- We do not recommend neuromuscular electrical stimulation in bedridden patients with COVID-19 because of the lack of robust evidence of effectiveness, the hygienic aspect, the absence of the equipment in most Dutch hospitals, and our concerns about the feasibility during the hectic care of patients who are severely or critically ill.

- We do not recommend providing certain aspects of respiratory therapy care such as endotracheal suctioning or adjusting oxygen therapy, because these procedures are outside the scope of practice of Dutch physical therapists.

In our recommendations, we focused on physical therapists managing hospitalized patients with COVID-19. However, it is important that recommendations will be provided for the multidisciplinary care after hospital discharge given the physical, cognitive, and mental impairments of patients with COVID-19. In addition, COVID-19 is a novel disease and our understanding of the symptomatology, clinical course, recovery, and transmissibility is emerging. Thus, treatment paradigms need to be evaluated and updated as new information becomes available.

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