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SOFMER Société Française de Médecine Physique et de Réadaptation

**TOOLKIT GUIDE**

# HAS • Rapid responses in the context of COVID-19 - Management of COVID+ patients in Physical Medicine and Rehabilitation (MPR), and on return home

**Validated by the HAS Board on 16 April 2020**

## Key points

- **Rapid response No. 1:** Respiratory, cardiovascular, renal, neurocognitive, psychiatric, musculoskeletal, metabolic and nutritional deficiencies of variable severity, restricting activity, are common and particularly significant in these patients, requiring long-term treatment.
- **Rapid response No. 2:** The risk of contamination requires strict application of protective measures during physiotherapy/rehabilitation sessions throughout the contagious phase, which can last beyond the acute phase.
- **Rapid response No. 3:** The objectives of hospitalisation in a Physical Medicine and Rehabilitation unit are diagnostic evaluation and assessment of specific deficiencies and restrictions in activity, definition of physiotherapy/rehabilitation programmes and follow-up of medical complications.
- **Rapid response No. 4:** Some patients require a multidisciplinary physiotherapy/rehabilitation programme coordinated by a Physical Medicine and Rehabilitation physician. The use of oxygen therapy is often necessary.
- **Rapid response No. 5:** For as long as the patient's condition is not stabilised, physiotherapy/rehabilitation must take into account the risk of cardiorespiratory decompensation and specific thromboembolic complications, with monitoring of vital signs.
- **Rapid response No. 6:** Each physiotherapy/rehabilitation intervention should take into account the fatigability of these patients, who are often undernourished and asthenic and present comorbidities.
- **Rapid response No. 7:** Physiotherapy/rehabilitation at home may be carried out remotely via telecare, or via self exercise programmes using exercises learned in advanced and

supervised remotely, or by a physiotherapist in the patient's own home if the absence of a therapist would constitute a loss of opportunity for the patient.

- **Rapid response No. 8:** Physiotherapy/rehabilitation at home may be implemented after the acute phase, for a progressive and controlled resumption of low-intensity physical activity (1-3 METs or shortness of breath ≤3 on the Borg scale), continuation of respiratory rehabilitation, resumption of mobilisation and usual functional activities, refeeding, psychological follow-up, in accordance with the patient's dyspnoea, fatigability and tolerance.
- **Rapid response No. 9:** COVID-19 patients, whether in hospital or at home, should be informed that a distance retraining programme focusing on endurance may be necessary, with the aim of achieving a return to work or to physical and social activities.

# Context

COVID-19 causes respiratory problems, but also other disturbances (neurocognitive, cardiovascular, gastrointestinal, hepatic and renal, metabolic, psychiatric, etc.). The possible sequelae are secondary to the specific damage caused by the viral infection and the excessive immune response, as well as "non-specific" complications of acute respiratory distress system (ARDS), immobility and prolonged stays in the intensive care unit.

Post COVID-19 ARDS can progress to restrictive respiratory failure due to respiratory muscle weakness, as is the case in SARS (Chan, 2003), and secondary pulmonary fibrosis with impaired diffusion (Chan, 2003 ; Ye, 2020; Bissett, 2012; Pan, 2020) associated with physical deconditioning. The respiratory consequences after the acute phase are still little described in the literature (Huang, 2020; ATS/IDSA, 2019; Wang, 2020; Zhou, 2020; Zhang, 2020). Some patients present cardiovascular effects, such as myocarditis and thromboembolism, which may also cause cardiovascular deconditioning (Madjid, 2020; Inciardi, 2020). Patients with underlying cardiovascular disease have a poorer prognosis (Madjid, 2020; Zheng, 2020; Wu, 2017; Badawi, 2016).

COVID-19 may cause meningo-encephalic, bone marrow and peripheral neurological effects, directly or indirectly (Wu, 2020; Mao, 2020). Some COVID+ patients admitted to the intensive care unit develop ICU-acquired weakness (ICUAW), this being particularly frequent in the event of previous comorbidities (McNeary, 2020; Huang, 2020; Xiang, 2014). Other non-specific complications can be expected in fragile patients, such as decubitus complications (sarcopenia, pressure ulcers, muscle deconditioning (Connolly, 2016), muscle and tendon contractures (Clavet, 2015), joint limitations (Clavet, 2015), psychomotor disadaptation syndrome (Manckoundia, 2014), cognitive and psychiatric disorders, such as post-traumatic stress), along with severe multifactorial denutrition (van Zanten, 2019). During the subacute period, the denutrition may be maintained by anorexia (loss of appetite), itself exacerbated by dyspnoea, anosmia (loss of sense of smell) and ageusia (loss of sense of taste), depressive syndrome and motor disorders impeding feeding.

Studies have revealed that survivors of severe forms of SARS 2003 had persistent pulmonary sequelae up to 15 years later, musculoskeletal sequelae and post-traumatic stress disorder, along with depression and chronic fatigue up to 4 years later (Xiang, 2014; Zhang, 2020; Ngai, 2010). By analogy, it may be assumed that there will be severe pulmonary, neurological (ICUAW), cardiac and musculoskeletal sequelae in some COVID-19 survivors, leading to limitation of activity and social restrictions (Herridge, 2011; Heyland, 2005; Bienvenu, 2018; Fan, 2014).

**Reminder**

These rapid responses drafted on the basis of available knowledge on the date of publication are liable to evolve on the basis of new data.

# Rehabilitation of post-COVID-19 patients hospitalised in a Physical Medicine and Rehabilitation unit (excluding Post-ICU Rehabilitation units)

## Problem context

The proportion of patients requiring rehabilitation in a healthcare facility is probably high for severe forms (Fuke, 2018; Kress, 2014). In France, initially severe forms and patients discharged from the ICU or intermediate care unit are mostly sent to specialised physical medicine and rehabilitation units or follow-on care and rehabilitation units specialising in respiratory conditions. Dependent elderly people with multiple diseases are generally cared for in the geriatric sector, or other sectors, on a full hospitalisation or day hospital basis.

Rehabilitation is similar to that for ARDS for patients having been treated in the ICU, and to that for deconditioned patients for less severe cases, with two specificities:

- the highly contagious nature of the viral infection, which requires the maintenance of protective measures until a multidisciplinary decision, involving infectiologists, has been taken to lift isolation measures;
- the fragility of these patients, liable to present sudden medical decompensation, such as respiratory failure, or thromboembolic or cardiovascular complications.

Physiotherapy/rehabilitation professionals must work on the basis of each patient's individual needs. The intervention of psychologists is essential; the intervention of adapted physical activity trainers may be discussed for reconditioning in the chronic phase.

Monitoring of vital signs - particularly respiratory signs - at rest and during exercise should be reinforced throughout the duration of rehabilitation: respiratory rate and oxygen saturation, heart rate. The performance of an exercise ECG during the first physiotherapy sessions may be useful for some patients, depending on their comorbidities.

## Assessments, scales and scores

### Medical data to be collected before a prescription for physiotherapy is made

Knowing the date of onset of symptoms, the severity criteria of the infectious lung disease course during the acute phase, classificaiton of the patient's phenotype, investigation for potential cardiovascular and thromboembolic involvement, monitoring the kinetics of the infectious and inflammatory syndrome, cardiac troponin levels, anaemia, lymphocytopenia, hepatic and renal damage, etc. The duration of mechanical ventilation and sedation are important data with respect to the potential development of PICS (Post Intensive Care Syndrome).

There are four patient phenotypes (CARM/CSPMR, 2020);

- Phenotype with mild infectious disease or few symptoms: the clinical symptoms are mild and no signs of pneumonia are observed on imaging.
- Phenotype with standard infectious disease, sometimes with a two-phase progression: fever, respiratory symptoms, etc. Imaging reveals pneumonia.
- Phenotype with severe infectious disease: meets one of the following three criteria: i) respiratory distress with respiratory rate ≥ 30 bpm; ii) at rest, there was an oxygen saturation level of ≤93%;

iii) the partial pressure of oxygen in arterial blood (PaO2) / oxygen concentration (FiO2) was ≤ 300 mmHg (1 mmHg = 0.133 kPa).

- Phenotype with critical infectious disease: meets one of the following criteria: i) respiratory failure occurred and required mechanical ventilation; ii) shock occurred; iii) combined multi-organ failure required monitoring and treatment in an intensive care unit.

### Respiratory failure

- History of respiratory disease.
- Respiratory rate, dyspnoea, transcutaneous oxygen saturation at rest and after exercise, measured during expiration (measure without a new breath being taken in), blood gases.
- Tolerance to exercise: Borg scale.
- During the non-contagious period and depending on the indication: Peak flow, peak inspiratory and expiratory pressures, pulmonary function tests.

### Cardiovascular deficiency

- History of cardiovascular diseases.
- Blood pressure, heart rate, systematic ECG at rest in stable condition, exercise ECG depending on the patient's comorbidities.

### Cognitive and psychological deficiencies

Confusional states or delirium during the acute phase, attention and temporospatial orientation disorders (MMS or MOCA), anxiety and depression (Hospital and Anxiety Depression Scale), post-traumatic stress disorder, fatigue (VAS or Modified Fatigue Impact Scale).

### Motor, swallowing and voice deficiencies

- Joint ranges of motion in degrees.
- Qualitative or quantitative motor testing (MRC-SS and grip strength measured using a Jamar dynamometer with the elbow flexed). During the non-contagious period: ultrasound measurement of quadriceps thickness and 1RM strength (standard or isokinetic dynamometer) for the least severe patients.
- Even in the event of suspected ICUAW, electromyographic examination does not modify rehabilitative management (Kress, 2014).
- Swallowing: volume-viscosity swallow test (Rofes, 2014).
- Voice: Phonetic Test of Intelligibility from the Clinical Evaluation Battery of Dysarthria (Auzou, 2006).

### Metabolic deficiencies

Body mass index, weight loss/healthy weight, method of nutrition during acute care, standard laboratory workup, albumin, prealbumin, magnesium, phosphates.

Norton or Braden scale

### Functional capacity and performance measurements

- Capacity for activities of daily living: Barthel, Functional Independence Measure.
- Balance: sitting/standing postural balance, Berg Balance Scale.
- Overall motor function: number of chair stands in 1 min, time for 5/10 chair stands under SpO2 monitoring, respiratory/heart rate, dyspnoea (VAS, Borg).
- Timed Up and Go test (TUG).

After the contagious period and if indicated:

- 10 metres and 6 minutes walk tests, stair ascent/descent test.
- Exercise tolerance: maximum/sub-maximum exercise tests (ergometers adapted to the patients' capacities, stepper test with control of O2 saturation during exercise), exercise ECG, VO2-max with analysis of blood gases.
- Canadian Occupational Performance Measure (COPM)

### Rehabilitation programme

- Precautions before/after exercises, and criteria for stopping exercises:
  - Polypnoea at rest > 22 bpm is a contraindication to active exercises, and if SpO2 < 90% the possibility of oxygen therapy during active exercises should be discussed.
  - If any of the following conditions occur during physiotherapy, the therapist must immediately stop the exercise and consult a physician: chest tightness and/or pain, shortness of breath, malaise, headaches, blurred vision, palpitations, sweats, cyanosis, obnubilation, confusion, inability to speak, signs of diaphragmatic dysfunction (dyspnoea on anteflexion, thoracoabdominal asynchrony, paradoxical breathing), etc.
  - A decrease in SpO2 of > 4 points compared to SpO2 at rest requires adaptation of exercise intensity and administration of O2 (if prescribed by a physician).
- Locomotor rehabilitation:
  - Disadaptation for orthostatism and exercise: verticalization of severe patients begun using a verticalization bed. Verticalization on a tilted surface and standing device, movement to a chair as soon as possible, monitoring BP and pulse and with appropriate venous compression.
  - Recovery or preservation of joint range of motion by passive mobilization, active exercises and postures (Roeseler, 2013): lower limbs (ankle equinus), shoulder girdle and cervical spine (prolonged intubation, prone position and surgical approaches).
  - Muscle strengthening (Roeseler, 2013): Favour overall muscle strengthening to begin with. If the patient is too weak to get out of bed, bedside cycle ergometers can be used (Burtin, 2009). Transcutaneous electrical stimulation may be proposed in addition to muscle strengthening and motor reprogramming. Progressive-intensity analytical and dynamic muscle strengthening can be combined with sit/stand transfers, assisted walking (body weight support), and, possibly, cycle ergometer, stepper and treadmill. Dynamic muscle strengthening against resistance depending on respiratory tolerance. Resume as early as possible: sit/stand transfers and walking, with specific rehabilitation for psychomotor disadaptation syndrome. Respiratory coordination with muscle strengthening exercises is particularly important in this population.
- Respiratory rehabilitation:
  - Breathing exercises may potentially be proposed in a stable patient without polypnoea at rest (RR ≤ 22) in preparation for reconditioning for exercise (muscle strengthening and adapted overall endurance work), which has been shown to be effective on functional capacities following idiopathic pulmonary fibrosis (Dowman, 2014).
  - The breathing exercises proposed are implemented depending on respiratory muscle and pulmonary gas exchange deficiencies and expiratory capacities and cough.
  - Exercises aimed at improving breathing control are performed without direct supervision (Lee, 2017) with the objectives of increasing tidal volume (Bahenský, 2019) and reducing psychological consequences (stress, anxiety and depression) (Kim, 2013 ; Chien, 2015 ; van

Diest, 2014 ; Holland, 2012), with a longer expiratory time than inspiratory time in order to prevent diaphragm fatigability (Bellemare, 1983). A sitting, forward-leaning position with arm support promotes diaphragmatic function and closed-chain accessory respiratory muscle recruitment (Gosselink, 2003). Following mechanical ventilation, patients with an MIP ≥ 28 cmH2O appear to benefit most from inspiratory muscle training, which improves maximum inspiratory pressure (IPMax) (Bissett, 2019). Maintain the same precautions for therapists as for pursed-lip exercises during the contagious phase: favour self-rehabilitation with verbal encouragement, air the room before caregivers enter.

  - Respiratory physiotherapy methods for lung secretion clearance should implemented with precautions during the contagious phase and following a risk/benefit assessment. During this phase, education and self-rehabilitation are favoured. If ventilatory capacities are impaired, propose instrumental drainage (breath stacking, with exsufflator with filters and equipment precautions to prevent infection of caregivers).
  - Pursed-lip breathing used during exercise has demonstrated an effect on respiratory rate and minute ventilation in patients with COPD, but we do not know the degree of obstructive involvement in COVID-19 (Fleig Mayer, 2018). Pursed-lip breathing at rest may have an impact on arterial blood gas parameters due to its positive expiratory pressure effect, but these data are old (Mueller, 1970). Nonetheless, because COVID-19 patients probably have expiratory muscle weakness, breathing exercises with expiration braking still have indications in this population. They may increase the risk of spread of the virus during the contagious phase (due to significant mobilisation of expiratory reserve) and they may be poorly tolerated in terms of respiratory fatigue and circulatory tolerance.
  - Monitoring of exercise tolerance should be performed using the modified Borg scale or a numerical scale, measurement of pulse and SpO2 (Bausewein, 2007).
- Neuropsychological rehabilitation: Following sedation, encephalopathy that persists for a relatively long period of time (Hopkins, 2010; Herridge, 2011) and causes cognitive problems (Wu, 2020) is very regularly observed after acute respiratory failure. Propose a cognitive rehabilitation therapy programme based on screening results.
- Rehabilitation therapy for swallowing and voice damaged by: prolonged intubation, respiratory muscle weakness, reduction in pharyngeal sensitivity, thoracoabdominal asynchrony, gastric reflux, fatigue, concentration problems, laryngeal oedema following extubation.
- Other medical follow-up:
  - Undernutrition: Systemic nutritional follow-up of calorie and protein intakes (inflammatory syndrome, hypercatabolism, increased energy expenditure due to respiratory workload, anorexia secondary to infection, respiratory discomfort, anosmia, ageusia, stress, refeeding syndrome (van Zanten, 2019)).
  - Pressure ulcers: Systematic measures given the high risk of pressure ulcers, even in unusual locations (face, chest, knees, wings of ilium, top of foot) due to prolonged decubitus and the prone position for the most hypoxaemic patients (Guérin, 2013).
  - Post-traumatic stress disorder: Remediation by a psychologist offered in the event of post-traumatic stress disorder-type anxiety and depression.
- Encouragement of independence and preparation for return home:
  - Support to resume everyday habits and social participation.
  - Assessment of obstacles in the home, proposal of adaptations with technical aids.
  - Remote monitoring of rehabilitation in the event of autonomy-reducing sequelae.
  - If necessary, education in social distancing and barrier measures.

- Retraining for exercise and reintegration (in the subacute phase): Overall reconditioning, focusing on cardiorespiratory and muscular endurance, in a day hospital or community medicine setting, to prepare for a return to employment (occupational rehabilitation) and physical and social activities. This information should be given from the initial phase.

## Return home

Physiotherapy/rehabilitation at home can be organised in a variety of ways: community practitioners at home, telecare, rehabilitative home hospitalisation, mobile team. General practitioners play a crucial role.

The main objective is a progressive and controlled return to light physical activities, respecting fatigue levels and focusing on the resumption of walking and previous autonomy. If necessary, continue or propose respiratory physiotherapy, nutritional follow-up and psychological care.

Rehabilitation at home can be carried out by a physiotherapist via telecare (see Decree), or via previously learned exercises supervised remotely by a rehabilitation professional (for example, smartphone application). After the contagious period and for the most fragile patients, the intervention of a mobile team or a rehabilitative home hospitalisation may be envisaged.

Rehabilitation at home may be carried out following the remote opinion of an occupational health therapist (telecare possible, see Decree).

A Physical Medicine and Rehabilitation unit referral for a cognitive assessment, reconditioning or socioprofessional reintegration programme may subsequently be proposed in accordance with the general practitioner.

### Indications based on clinical situations

1. Post-COVID-19 patients discharged to home following hospital treatment

Rehabilitation adapted on the basis of deficiencies (pulmonary, neurological, musculoskeletal, etc.): support to return to adapted light physical activities, with dividing up of activities, respecting of fatigue levels, breathing control and assessment of oxygen saturation during exercise before hospital discharge.

Symptoms suggestive of anxiety, depression and post-traumatic stress disorder should be looked for in order to put in place psychological follow-up or cognitive stimulation via telecare if necessary.

Refeeding begun during hospitalisation should be continued and monitored, with regular weighing. The help of a dietician or nutritionist may be sought.

2. COVID-19 patients with no indication for hospitalisation, quarantined and monitored at home

During the acute phase and the symptomatic phase of the disease, the physical activity advice for the general population is contraindicated. During this phase, no systematic respiratory physiotherapy: secretion clearance to be studied in the event of secondary infection, respecting health professional protection rules (see above).

Once the acute phase has passed, the most common clinical signs are asthenia and physical deconditioning: resume adapted light and divided-up physical exercise, respecting fatigue levels and dyspnoea, in the absence of fever.

The help of a dietician or nutritionist may be sought for appropriate refeeding. Psychological support should be proposed depending on clinical signs.

The development of signs of respiratory exacerbation should trigger a telephone alert to the general practitioner and/or a hospital structure.

3. Patients with chronic diseases and without COVID-19

Patients with chronic diseases receiving rehabilitation therapy or for whom regular physical activity needs to be maintained on a home exercise programme (COPD, coronary failure, heart failure, chronic low back pain, neurological disease, age-related weakness, etc.), should receive optimal support. Rehabilitation should be continued at home wherever possible, but with physical and social distancing measures to avoid infection of already vulnerable patients.

### Assessments, scales and scores

An interview seeks to identify situations causing dyspnoea (MMRC and Borg scale during exercise), unusual fatigue (VAS), overall tolerance to light physical activities reported by the patient and expected activity limitations secondary to COVID-19. Monitoring of oxygen saturation is performed if possible.

In the elderly, it is necessary to assess fear of falling and the fall risk (standing balance, TUGT).

### Rehabilitation programme

At home, management should be conducted with verbal guidance primarily, respecting distancing rules and using the required equipment.

- Breathing exercises:
  - Training in controlled breathing movements: abdomino-diaphragmatic breathing in the sitting position, leaning forward with the elbows on the knees.
  - Bronchial secretion clearance guidance if expiratory capacities are sufficient: favour expiratory flow regulation exercises over expiratory braking exercises. Slow, deep exhalation to drain secretions towards the upper airways, then increased expiratory flow with an open glottis to evacuate expectoration.
  - If inspiratory and expiratory capacities are insufficient (peak flow < 180 ml/minute) or if these techniques are ineffective, medical reassessment is essential. Instrumental decongestion methods may become necessary.
- Functional exercises:
  - After the acute and symptomatic phase and during the contagious isolation phase, a return to low-intensity physical activity (muscle strengthening depending on the patient's tolerance) can be performed by the patient at home (potentially supervised remotely).
  - Recommendations for the resumption of low-intensity physical activities:
    - Recommended intensity between rest (1.0 MET) and light physical exercise (< 3.0 MET), dyspnoea intensity ≤ 3/10 on the Borg scale (moderate shortness of breath in which the individual can talk but not sing).
    - Frequency: Twice daily, 1 hour after a meal.
    - Exercise time of 15 to 45 minutes per session depending on the patient's physical condition; for fragile patients, prefer intermittent exercises.
  - Work on sitting/standing balance, transfers, posture and walking difficulties.

## Resources

These rapid responses will evolve as knowledge in the field of COVID-19 increases. They supplement the websites, documents and guidelines developed by learned societies.

See all the French National Authority for Health's rapid responses in the context of COVID-19.

### Link to the websites of learned societies

- SOFMER (French Society of Physical Medicine and Rehabilitation) https://www.sofmer.com/
- CNP-MPR (French National Council for Physical Medicine and Rehabilitation Physicians) https://sites.google.com/site/cnpdempr/
- CMK (French College of Physiotherapists) https://www.college-mk.org/
- CNPE (French National Council for Occupational Therapists) https://cnp-ergotherapie.fr/

### Documents issued by CNPs (National Council for healthcare professionals)/learned societies/ministry/etc.

- HCSP (French National Council for Public Health) https://www.hcsp.fr/Explore.cgi/PointSur?clef=2
- Teleconsultation: https://solidarites-sante.gouv.fr/soins-et-maladies/maladies/maladies-infectieuses/coronavirus/covid-19-informations-aux-professionnels-de-sante/article/covid-19-et-tel-esante-qui-peut-pratiquer-a-distance-et-comment

# Bibliographic references


1. American Thoracic Society, Infectious Diseases Society of America, Metlay JP, Waterer GW, Long AC, Anzueto A, et al. Diagnosis and treatment of adults with community-acquired pneumonia. An official clinical practice guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med 2019;200(7):e45-e67. http://dx.doi.org/10.1164/rccm.201908-1581ST
2. Auzou P, Rolland-Monnoury V. Batterie d'évaluation clinique de la dysarthrie (BECD). Isbergues: Ortho Edition; 2006.
3. Badawi A, Ryoo SG. Prevalence of comorbidities in the Middle East respiratory syndrome coronavirus (MERS-CoV): a systematic review and meta-analysis. Int J Infect Dis 2016;49:129-33. http://dx.doi.org/10.1016/j.ijid.2016.06.015
4. Bahenský P, Malátová R, Bunc V. Changed dynamic ventilation parameters as a result of a breathing exercise intervention program. J Sports Med Phys Fitness 2019;59(8):1369-75. http://dx.doi.org/10.23736/s0022-4707.19.09483-0
5. Bausewein C, Farquhar M, Booth S, Gysels M, Higginson IJ. Measurement of breathlessness in advanced disease: a systematic review. Respir Med 2007;101(3):399-410. http://dx.doi.org/10.1016/j.rmed.2006.07.003
6. Bellemare F, Grassino A. Force reserve of the diaphragm in patients with chronic obstructive pulmonary disease. J Appl Physiol Respir Environ Exerc Physiol 1983;55(1 Pt 1):8-15. http://dx.doi.org/10.1152/jappl.1983.55.1.8
7. Bienvenu OJ, Friedman LA, Colantuoni E, Dinglas VD, Sepulveda KA, Mendez-Tellez P, et al. Psychiatric symptoms after acute respiratory distress syndrome: a 5-year longitudinal study. Intensive Care Med 2018;44(1):38-47. http://dx.doi.org/10.1007/s00134-017-5009-4
8. Bissett B, Leditschke IA, Paratz JD, Boots RJ. Respiratory dysfunction in ventilated patients: can inspiratory muscle training help? Anaesth Intensive Care 2012;40(2):236-46. http://dx.doi.org/10.1177/0310057x1204000205
9. Bissett BM, Wang J, Neeman T, Leditschke A, Boots R, Paratz J. Which ICU patients benefit most from inspiratory muscle training? Retrospective analysis of a randomized trial. Physiother Theory Pract 2019:1-6. http://dx.doi.org/10.1080/09593985.2019.1571144
10. Burtin C, Clerckx B, Robbeets C, Ferdinande P, Langer D, Troosters T, et al. Early exercise in critically ill patients enhances short-term functional recovery. Crit Care Med 2009;37(9):2499-505. http://dx.doi.org/10.1097/CCM.0b013e3181a38937
11. Chan KS, Zheng JP, Mok YW, Li YM, Liu YN, Chu CM, et al. SARS: prognosis, outcome and sequelae. Respirology 2003;8(Suppl):S36-40. http://dx.doi.org/10.1046/j.1440-1843.2003.00522.x
12. Chien HC, Chung YC, Yeh ML, Lee JF. Breathing exercise combined with cognitive behavioural intervention improves sleep quality and heart rate variability in major depression. J Clin Nurs 2015;24(21-22):3206-14. http://dx.doi.org/10.1111/jocn.12972

13. Chinese Association of Rehabilitation Medicine, Chinese Society of Physical Medicine and Rehabilitation. [Recommendations for respiratory rehabilitation of COVID-19 in adult]. Zhonghua Jie He He Hu Xi Za Zhi 2020;43(0):E029. http://dx.doi.org/10.3760/cma.j.cn112147-20200228-00206
14. Clavet H, Doucette S, Trudel G. Joint contractures in the intensive care unit: quality of life and function 3.3 years after hospital discharge. Disabil Rehabil 2015;37(3):207-13. http://dx.doi.org/10.3109/09638288.2014.913707
15. Connolly B, Salisbury L, O'Neill B, Geneen L, Douiri A, Grocott MP, et al. Exercise rehabilitation following intensive care unit discharge for recovery from critical illness: executive summary of a Cochrane Collaboration systematic review. J Cachexia Sarcopenia Muscle 2016;7(5):520-6. http://dx.doi.org/10.1002/jcsm.12146
16. Dowman L, Hill CJ, Holland AE. Pulmonary rehabilitation for interstitial lung disease. Cochrane Database of Systematic Reviews 2014;Issue 10:CD006322. http://dx.doi.org/10.1002/14651858.CD006322.pub3
17. Fan E, Dowdy DW, Colantuoni E, Mendez-Tellez PA, Sevransky JE, Shanholtz C, et al. Physical complications in acute lung injury survivors: a two-year longitudinal prospective study. Crit Care Med 2014;42(4):849-59. http://dx.doi.org/10.1097/ccm.0000000000000040
18. Fleig Mayer A, Karloh M, dos Santos K, Pereira de Araujo CL, Almeida Gulart A. Effects of acute use of pursed-lips breathing during exercise in patients with COPD: a systematic review and meta-analysis. Physiotherapy 2018;104(1):9-17. http://dx.doi.org/10.1016/j.physio.2017.08.007
19. Fuke R, Hifumi T, Kondo Y, Hatakeyama J, Takei T, Yamakawa K, et al. Early rehabilitation to prevent postintensive care syndrome in patients with critical illness: a systematic review and meta-analysis. BMJ Open 2018;8(5):e019998. http://dx.doi.org/10.1136/bmjopen-2017-019998
20. Gosselink R. Controlled breathing and dyspnea in patients with chronic obstructive pulmonary disease (COPD). J Rehabil Res Dev 2003;40(5 Suppl 2):25-33. http://dx.doi.org/10.1682/jrrd.2003.10.0025
21. Guérin C, Reignier J, Richard JC, Beuret P, Gacouin A, Boulain T, et al. Prone positioning in severe acute respiratory distress syndrome. N Engl J Med 2013;368(23):2159-68. http://dx.doi.org/10.1056/NEJMoa1214103
22. Herridge MS, Tansey CM, Matté A, Tomlinson G, Diaz-Granados N, Cooper A, et al. Functional disability 5 years after acute respiratory distress syndrome. N Engl J Med 2011;364(14):1293-304. http://dx.doi.org/10.1056/NEJMoa1011802
23. Heyland DK, Groll D, Caeser M. Survivors of acute respiratory distress syndrome: relationship between pulmonary dysfunction and long-term health-related quality of life. Crit Care Med 2005;33(7):1549-56. http://dx.doi.org/10.1097/01.ccm.0000168609.98847.50
24. Holland AE, Hill CJ, Jones AY, McDonald CF. Breathing exercises for chronic obstructive pulmonary disease. Cochrane Database of Systematic Reviews 2012;Issue 10:CD008250. http://dx.doi.org/10.1002/14651858.CD008250.pub2
25. Hopkins RO, Key CW, Suchyta MR, Weaver LK, Orme JF. Risk factors for depression and anxiety in survivors of acute respiratory distress syndrome. Gen Hosp Psychiatry 2010;32(2):147-55. http://dx.doi.org/10.1016/j.genhosppsych.2009.11.003
26. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020;395(10223):497-506. http://dx.doi.org/10.1016/s0140-6736(20)30183-5
27. Inciardi RM, Lupi L, Zaccone G, Italia L, Raffo M, Tomasoni D, et al. Cardiac involvement in a patient with coronavirus disease 2019 (COVID-19). JAMA Cardiol 2020. http://dx.doi.org/10.1001/jamacardio.2020.1096
28. Kim SH, Schneider SM, Bevans M, Kravitz L, Mermier C, Qualls C, et al. PTSD symptom reduction with mindfulness-based stretching and deep breathing exercise: randomized controlled clinical trial of efficacy. J Clin Endocrinol Metab 2013;98(7):2984-92. http://dx.doi.org/10.1210/jc.2012-3742
29. Kress JP, Hall JB. ICU-acquired weakness and recovery from critical illness. N Engl J Med 2014;370(17):1626-35. http://dx.doi.org/10.1056/NEJMra1209390
30. Lee HY, Cheon SH, Yong MS. Effect of diaphragm breathing exercise applied on the basis of overload principle. J Phys Ther Sci 2017;29(6):1054-6. http://dx.doi.org/10.1589/jpts.29.1054
31. Madjid M, Safavi-Naeini P, Solomon SD, Vardeny O. Potential effects of coronaviruses on the cardiovascular system: a review. JAMA Cardiol 2020. http://dx.doi.org/10.1001/jamacardio.2020.1286
32. Manckoundia P, Soungui EN, Tavernier-Vidal B, Mourey F. Syndrome de désadaptation psychomotrice. Gériatr Psychol Neuropsychiatr Vieil 2014;12(1):94-100. http://dx.doi.org/10.1684/pnv.2014.0450

33. Mao L, Wang M, Chen S, He Q, Chang J, Hong C, et al. Neurological manifestations of hospitalized patients with COVID-19 in Wuhan, China: a retrospective case series study [preprint] 2020. https://www.medrxiv.org/content/10.1101/2020.02.22.20026500v1.full.pdf.

34. McNeary L, Maltser S, Verduzco-Gutierrez M. Navigating coronavirus disease 2019 (covid-19) in physiatry: a CAN report for inpatient rehabilitation facilities. PM R 2020. http://dx.doi.org/10.1002/pmrj.12369

35. Mueller RE, Petty TL, Filley GF. Ventilation and arterial blood gas changes induced by pursed lips breathing. J Appl Physiol 1970;28(6):784-9. http://dx.doi.org/10.1152/jappl.1970.28.6.784

36. Ngai JC, Ko FW, Ng SS, To KW, Tong M, Hui DS. The long-term impact of severe acute respiratory syndrome on pulmonary function, exercise capacity and health status. Respirology 2010;15(3):543-50. http://dx.doi.org/10.1111/j.1440-1843.2010.01720.x

37. Pan Y, Guan H, Zhou S, Wang Y, Li Q, Zhu T, et al. Initial CT findings and temporal changes in patients with the novel coronavirus pneumonia (2019-nCoV): a study of 63 patients in Wuhan, China. Eur Radiol 2020. http://dx.doi.org/10.1007/s00330-020-06731-x

38. Roeseler J, Sottiaux T, Titomanlio L. Prise en charge de la mobilisation précoce en réanimation, chez l'adulte et l'enfant (électrostimulation incluse). Réanimation 2013;22(2):207-8.

39. Rofes L, Arreola V, Mukherjee R, Clave P. Sensitivity and specificity of the Eating Assessment Tool and the Volume-Viscosity Swallow Test for clinical evaluation of oropharyngeal dysphagia. Neurogastroenterol Motil 2014;26(9):1256-65. http://dx.doi.org/10.1111/nmo.12382

40. van Diest I, Verstappen K, Aubert AE, Widjaja D, Vansteenwegen D, Vlemincx E. Inhalation/exhalation ratio modulates the effect of slow breathing on heart rate variability and relaxation. Appl Psychophysiol Biofeedback 2014;39(3-4):171-80. http://dx.doi.org/10.1007/s10484-014-9253-x

41. van Zanten AR, de Waele E, Wischmeyer PE. Nutrition therapy and critical illness: practical guidance for the ICU, post-ICU, and long-term convalescence phases. Crit Care 2019;23:368. http://dx.doi.org/10.1186/s13054-019-2657-5

42. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA 2020. http://dx.doi.org/10.1001/jama.2020.1585

43. Wu Q, Zhou L, Sun X, Yan Z, Hu C, Wu J, et al. Altered lipid metabolism in recovered SARS patients twelve years after infection. Sci Rep 2017;7:9110. http://dx.doi.org/10.1038/s41598-017-09536-z

44. Wu Y, Xu X, Chen Z, Duan J, Hashimoto K, Yang L, et al. Nervous system involvement after infection with COVID-19 and other coronaviruses. Brain Behav Immun 2020. http://dx.doi.org/10.1016/j.bbi.2020.03.031

45. Xiang YT, Yu X, Ungvari GS, Correll CU, Chiu HF. Outcomes of SARS survivors in China: not only physical and psychiatric co-morbidities. East Asian Arch Psychiatry 2014;24(1):37-8.

46. Ye Z, Zhang Y, Wang Y, Huang Z, Song B. Chest CT manifestations of new coronavirus disease 2019 (COVID-19): a pictorial review. Eur Radiol 2020. http://dx.doi.org/10.1007/s00330-020-06801-0

47. Zhang P, Li J, Liu H, Han N, Ju J, Kou Y, et al. Long-term bone and lung consequences associated with hospital-acquired severe acute respiratory syndrome: a 15-year follow-up from a prospective cohort study. Bone Res 2020;8:8. http://dx.doi.org/10.1038/s41413-020-0084-5

48. Zheng YY, Ma YT, Zhang JY, Xie X. COVID-19 and the cardiovascular system [commentary]. Nat Rev Cardiol 2020. http://dx.doi.org/10.1038/s41569-020-0360-5

49. Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nature 2020;579(7798):270-3. http://dx.doi.org/10.1038/s41586-020-2012-7

# Drafting method and warning

The method used for this rapid response is based on a summary of the most relevant available conclusive data, national and international guidelines and the consultation of stakeholders (by email).

This document was jointly drafted by the HAS, and contact persons within CNPs (National Councils for healthcare professionals) and learned societies: SOFMER, CNP-MPR.

Validation by the HAS Board on 16 April 2020.

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**These rapid responses are drafted on the basis of available knowledge on the date of publication and are liable to evolve on the basis of new data.**

**These rapid responses are based on what appears to be preferable or necessary at the time of their formulation. They do not take into account personal protective equipment procurement capacities.**