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CHAPTER 9

Physiotherapeutic management for patients with Covid-19

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9.1 Introduction

Physiotherapy, as a part of the recovery services, is an essential component, with significant impact in health care, that may be given to individuals throughout their life to optimize physical and cognitive functionality and to decrease the level of disability. Physiotherapy helps individuals to reach their entire functional potential and to improve daily living activities ([World Confederation for Physical Therapy WCPT, 2020](#))

Physiotherapeutic management for patients with COVID-19 emphasizes the importance of improving respiratory function by reducing respiratory effort and optimizing oxygenation. Even if it is estimated that at the current time approximately 80% of patients who contact the virus do not develop symptoms and recover without having any special treatment, the given repercussions due to prolonged hospitalization or quarantine at home will represent the beginning regarding the establishment of a respiratory recovery program, which will have as objectives the improvement of the quality of life, combating a sedentary lifestyle, and bringing some benefits in the psychosocial sphere of the individual, etc. Early mobilization and return to an active life must be encouraged for patients with COVID-19. The prevention of complications due to prolonged immobilization, the transfers (changing position from sitting in standing and vice versa), obtaining the static and dynamic balance, and the realization of ADL are very important ([Thomas et al., 2020](#); [Managementul fizioterapeutic pentru COVID-19 în Spitalele de urgență, 2020](#)).

The need for an approach specific to patients who exhibit symptoms associated with infection with SARS-CoV-2, is given by the main fact that patients who develop medium and severe forms of this disease have oftentimes one or more than one diagnosis in the cardio-respiratory, oncology, renal, metabolic, etc. fields. Such treatment must be individualized, taking into the account the conditions associated with the health state of the patient. The treatment is drafted by the efforts of a multidisciplinary team: physician, assistants, and physiotherapist, all of them having the same goal: ensuring, at discharge from the hospital, a patient with improved signs and symptoms, able to continue their daily activities on their own. Early rehabilitation therapy for

patients with COVID-19 with critical stages and average stages aims to decrease breathing difficulties, provide relief of symptoms, relieve anxiety and depression, and decrease the incidence of complications. The intervention process of early rehabilitation is applied after a general clinical assessment. The functional respiratory assessment (the evaluation of the activity of the thoracic cage, the amplitude of diaphragm activity, the pattern and breathing frequency), the heart status, the capacity to mobilize and the ability to realize ADL must be highlighted ([Managementul fizioterapeutic pentru COVID-19 în Spitalele de urgență, 2020](#); [Physiotherapy Management for COVID-19 in the Acute Hospital Setting, 2020](#)).

It is vital both to reduce the impact of the acute period and to reintegrate people after COVID-19 through a joint multidisciplinary effort. Post-acute rehabilitation of the disease beginning with functional clinic evaluation and setting treatment goals ([World Health Organization, 2020](#)).

9.2 Physiotherapeutic management for patients with COVID-19

The physiotherapist performs the functional evaluation and elaborates the rehabilitation plan based on physical intervention and movement in order to satisfy the needs of the people after COVID-19. The physiotherapy has an important role in all phases of the disease ([Carda et al., 2020](#)).

Inclusion criteria on physiotherapy:

- An increase in oxygen therapy to $SpO_2 > 60\%$
- Evidence of retained pulmonary secretions with difficulty expectorating
- Ineffective cough/airway clearance

Exclusion criteria on physiotherapy:

- Viral pneumonia
- ARDS
- Cardiovascular instability
- Uncooperative patient
- Unstable intracranial pressure
- Uncontrolled bronchospasm
- Pulmonary embolism ([Khan & Amaty, 2020](#))

9.2.1 The functional evaluation

The functional evaluation of the patient with COVID-19 is performed in the context of a specialized clinical examination. It is recommended to use accessible and easily applied tests, without overburdening the patient and adding time costs. The multidisciplinary team must use the same means of evaluation for efficient communication and for monitoring the functional evolution. For the evaluation of the cardiorespiratory

functional capacities and of the general tolerance to effort, the following functional tests can be applied:

- Patient specific functional scale—evaluation of the perception of limits in carrying on daily activities;
- Short physical performance battery (SPPB)—assessment of the physical capacity;
- Monitoring of oxygen saturation (SpO₂) and vital indices (heart rate, blood pressure, respiratory rate) before, during, and at the end of the rehabilitation session.
- Borg scale and Borg CR 10—assessment of the degree of dyspnea and fatigue (Khan & Amaty, 2020).
- Berg scale—balance assessment;
- Walking test—functional capacity;
- Barthel score—assessment of daily functional abilities (ADL);
- Joint assessment—assessment of range of motion)
- Muscles assessment—assessment of muscle strength (Chartered Society of Physiotherapy, 2020; World Confederation for Physical Therapy WCPT).

9.2.2 The objective and interventions specific to the physiotherapy program

- decreased dyspnea
- respiratory reeducation
- facilitating expectoration
- maintaining and increasing joint mobility
- increase muscle strength
- cardiovascular adaptation to physical effort
- speech and swallowing reeducation
- ADL training
- behavioral reeducation (Thomas et al., 2020; Managementul fizioterapeutic pentru COVID-19 în Spitalele de urgență, 2020).

9.2.3 Methods and means used in the physiotherapy process

- early mobilization
- oxygen therapy
- reeducation and transfers
- training the respiratory muscles
- reeducation of diaphragmatic breathing
- facilitating expectoration
- breathing and sputum facilitation position
- cough reeducation
- positive expiratory pressure (PEP) therapy
- accelerating the expiratory flow

- spirometry exercises on inhale and exhale
- electrical stimulation of the hypertrophic muscles
- static and dynamic breathing exercises
- passive joint mobilization, free active and objects
- muscle toning exercises
- retraining through aerobic exercises
- phonation and swallowing training techniques ([Handbook of COVID-19; World Confederation for Physical Therapy WCPT](#)).

The physiotherapy process can be divided into acute phases (the patient is in critical condition), subacute (stabilization of the patients vital function after the critical condition), and long-term post discharge from the hospital sequelar phase.

- *Acute phase (intensive care, critical care units)*

Physiotherapy aim to support the airways and improve physical/cognitive function by facilitating early rehabilitation. Interventions that facilitate tissue saturation with oxygen must be indicated; elimination of airways secretions/clearance bronchopulmonary early removal of mechanical ventilation. Rehabilitation also aims to promote adequate nutrition and prevention of aspiration pneumonia, especially in the postintubation period and/or patients with a tracheotomy ([Thomas et al., 2020](#)).

In the acute respiratory manifestation there are not recommended the following techniques for reeducation: diaphragmatic breathing, forced breathing through mouth, bronchial drainage, positive expiratory pressure, stimulatory spirometry, manual mobilization of the scapular humeral joints, training the respiration muscles, aerobic exercises ([https://physio-pedia.com/COVID 19: PostAcute_Rehabilitation](https://physio-pedia.com/COVID_19: PostAcute_Rehabilitation)).

- *Subacute phase (special care departments, center for patients with COVID-19)*

Physiotherapy addresses the mobility deficit, respiratory function, cognition, swallowing disorders (dysphagia), nutrition deficiencies, and communication. During this period, independence in the activities of daily living are followed, that providing psychosocial support that can prevent mental health issues.

- *Chronic phase—long lasting (outpatient services, at home, mobile teams, telemedicine services)*

Physiotherapy aims at gradually increasing physical effort. There is also an education on energy conservation, behavior change, adaptation of home and workplace, and use of assistive devices. During long-term recovery post COVID-19, the patients can benefit from pulmonary rehabilitation intervention aimed at the improvement of respiratory and physical deficits by indicating the involvement of physical activity programs in daily activities and psychoemotional support. During this period it is opportune to implement telemedicine means which contain distance exercise sessions, providing informational support to patients discharged from hospital ([Kiekens, Boldrini, & Andreoli, 2020; World Health Organisation, 2020](#)).

All physiotherapeutic interventions are selected and performed in relation to the observed dysfunctions after assessment; training the patient in simple programs, no

overloads, with a gradual increase of the effort is necessary in creating the rehabilitation program. Consultation with a pulmonologist is required, especially in patient with persistent respiratory disorders

The rehabilitation therapy of the patients with COVID-19 includes mainly the posture management and respiratory physiotherapy. Change of posture can change the ratio of ventilation/perfusion and may lead to an improvement in the exchange of gases, but it may also lead to an unexpected worsening. It is recommended to use pillows and auxiliary devices which permit a comfortable, stable position, without the need of any effort from the patient. The postural drainage can reduce the influence of sputum on the respiratory tract, which is particularly important for improving the V/Q (ventilation/perfusion) ratio. The patients need to be educated to get themselves in a position that will allow gravity to assist in draining excretions of the pulmonary lobes or the lung segments. Standing is the best position of the body for breathing in a state of rest. In respiratory physiotherapy the physical exercises can completely expand the lungs and help in removing secretions in the lung alveoli and respiratory airways. Also the vital capacity increases, improving the respiratory function. The breathing exercises are based on deep and slow breathing (in inspiration the patient must move the diaphragm actively) and on thoracic expansion combined with the mobilization of the scapular girdle (the inspiration must be deep and slow, during the inspiration the thoracic cage is moving forward and with the raising of the upper limbs; in the expiration the thoracic cage is moving backward, and the upper limbs return to the initial position). The active cycle of the respiratory techniques is composed of three phases (control of breathing, thoracic expansion, and expiration). The modality of a breathing cycle must be developed with regard to the patient's health status (Voicu, Tudorache, Lovin, & Friesen, 2009).

9.2.4 Methodical indication for physiotherapeutic treatment

Pulmonary rehabilitation after COVID-19 addresses the symptoms, lung functional capacity, and quality of life. The exercises will be applied individually, depending on the evolution of each patient; there is no standardized program, but some specific recovery principles post COVID-19 can be issued.

- Rehabilitation programs for patients with COVID-19 must be developed with regard to respiratory complications and other conditions, sequelae that impose restrictions on general function.
- The initial evaluation is recommended in a timely manner and safe conditions, depending on the degree of respiratory failure, as well as physical and mental condition.
- Low intensity exercises (≤ 3 METs or equivalent) must be taken into account, in particular for patients who require oxygen therapy with simultaneous monitoring of vital parameters (heart rate, respiratory rate, blood pressure, pulse oximetry). The

intensity of the exercises should be increased gradually in relation to the evolution of the symptoms and the general condition.

- When patients after discharge have symptoms such as dyspnea, respiratory disorders, and productive coughs, respiratory rehabilitation is recommended. This includes postures, breathing, rhythm adjustment, breathing exercises to train the respiratory muscles and training on coughing and correct expectoration.
- Patients with balance and coordination disorders require enrollment in activities aimed at restoring balance, including the use of assistive devices (crutches, sticks, walking devices).
- Progressive resistance training is recommended. The training task for each muscle group is 8–12 repetitions, 1–3 muscle groups per unit of time. The training interval of each group is 2 minutes, 2–3 times a week, with the increase of the training load by 5%–10% per week.
- Aerobic exercises are also recommended such as walking, brick walking, jogging, and swimming, initially at a low intensity then gradually increasing the intensity and duration of the effort. Repeat 3–5 times a week, 20–30 minutes for each session, for at least 6 weeks ([Ambrosino, 2020](#); [Royal Dutch Society for Physiotherapy, 2020](#)).

Recommendations for the reeducation of functional capacities

- In patients with mild or no disabilities (with SPPB score greater than 10, Barther index greater than 70) aerobic exercises with a progressive increase in intensity based on symptoms is recommended (BORG fatigue and/or dyspnea below 3) to restore normal physical function.
- In patients with moderate to severe disabilities (SPPB less than 10, Barthel index less than 70) an exercise program is recommended to improve autonomy, muscle strength in the limbs and in the respiratory muscles, balance, gait, and quality of life.
- The patients with COVID-19 who have experienced the following symptoms: severe pain throat, precordial pain, dyspnea, general fatigue, chest pain, cough or fever, should avoid exercise for 2–3 weeks after the disappearance of these symptoms.
- Rest periods are increased, if the patient's condition during physiotherapy session worsens.
- Prolonged and high intensity rehabilitation sessions are to be avoided ([NHS England, 2020](#)).

SpO₂ measurement is mandatory during exercises, subsequent oxygen supplementation may be prescribed if SpO₂ is less than 93%.

Active segmental mobilization must be followed by progressive muscle strengthening within individual rehabilitation programs. Electrical neuromuscular stimulation can be applied on an outpatient's basis.

Aerobic retraining can be done by walking or cycling. Progressive aerobic exercise can be increased to 20–30 minutes daily.

It is necessary to reorganize the daily functional activity; taking into account the recommendations of physical distance, monitoring physical activities can be done at long distance (Lazzeri et al., 2020).

The appearance of the following alarm signs determines the cessation and revision of the physiotherapy programs:

- shallow breathing
- SpO₂ less than 95%
- blood pressure less than 90/60 or greater than 140/90
- heart rate greater than 100 beats/minute
- temperature higher than 37.2°C
- overfatigue
- chest pains
- severe cough
- blurry vision
- vertigo
- palpitations
- sweating
- loss of balance
- headache (Pan American Health Organization, 2020).

9.2.5 Early mobilization of the patient with respiratory diseases

Methods for early mobilization include (Falvey, Krafft, & Kornetti, 2020):

- posture changes to facilitate breathing;
- simple exercises in bed lying down with the mobilization of the upper and lower limbs;
- simple sitting exercises with mobilization of the upper and lower limbs;
- stability exercises for the lower limbs and torso;
- simple standing exercises with mobilization of the upper and lower limbs;
- ADL training exercises; and
- progressive aerobic exercises up to 20–30 minutes.

It is important to monitor the patient's respiratory and hemodynamic status during rehabilitation. There is information on energy conservation and behavioral modification (World Health Organization, 2020).

Ways to approach breathing:

- Light positions to help control breathing, such as:
 - lying sideways with shoulders and head raised;
 - lying on stomach to facilitate expiration;
 - sitting with the trunk slightly bended;
 - standing with anterior and posterior support;
 - standing with posterior support (against the wall).

- Respiratory control techniques
 - deep breathing techniques;
 - breathing stacking techniques;
 - secretion management;
 - postural drainage.
- Warnings!
 - the patient is active depending on the energy level;
 - hydration is very important;
 - the patient must know the methods of energy conservation (<https://www.cdc.gov/coronavirus/2019-ncov/clinical-guidance-management-patients.htm>).

Things for patients to be reminded:

- energy needs can fluctuate;
- exercise is good but be wise about it;
- perform comfortable activities, learn to stop and change tasks when they are difficult;
- set small goals;
- try to do a little more each day without overdoing it; and
- take breaks between tasks.

Bed exercises (<https://www.cdc.gov/coronavirus/2019-ncov/clinical-guidance-management-patients.htm>):

- head and neck movements;
- neck circumduction;
- shoulder rotations;
- abduction of the arms;
- forearm flexion on the arm without weight;
- flexion, extensions of the fingers;
- quadriceps contractions;
- dorsiflexion of the foot;
- ankle and foot circumduction.

Exercises from sitting positions (<https://www.cdc.gov/coronavirus/2019-ncov/clinical-guidance-management-patients.htm>):

- Shoulder exercises;
- shoulder flexion with weights;
- shoulder abductions;
- forearm flexion on the arm with low weight;
- contractions of the quadriceps and sural triceps;
- plantar flexion and dorsiflexion;
- foot circumduction.

Exercises in standing (NHS England, 2020; NHS):

- abduction and adduction of the hip (with the leg on side);
- hip extension (with the leg back);

- squats;
- quadriceps contractions;
- standing on the tips of the toes.

Exercises for stability and balance (<https://www.cdc.gov/coronavirus/2019-ncov/clinical-guidance-management-patients.htm>, NHS):

- tilt of the trunk;
- pelvis inclination;
- pelvic tilts;
- hip rotations.

9.2.6 Physiotherapy in the first 6 weeks after hospital discharge

After hospital discharge, the patient is contacted by phone to evaluate the situation and to see if the patient meets difficulties or limitations in the daily physical functions, and if there are indications for further rehabilitation.

The majority of patients hospitalized have comorbidities, and we must take these issues into account, when designing a physiotherapy program.

The patients who are in intensive care units may have very low physical tolerance and limits to exercise.

ADL will be resumed gradually ensuring the monitoring of the patient's physical function.

ADL and physical exercises are recommended to be performed at low to moderate intensity and for a short duration of time.

The following evaluations are recommended to observe the evolution and patient tolerance to physical effort:

- Specific functional scale of the patient.
- oxygen saturation before, during and after exercises. Oxygen saturation: SpO₂ of 95% is the lower limit at rest, and 90% SpO₂ is the lower limit during exercise. When saturation occurs (SpO₂ less than 90% during exercise) physical activities or physical exercise is suspended.
- Heart rate before, during, and after exercise;
- Borg scale CR10 for respiratory difficulties and fatigue, before, during, and after exercise. Maximal score of 4/10 is recommended as a threshold for intensity of the exercise and for respiration and fatigue. Clinical information is not always available, because no maximum exercise tests are performed and it is impossible to estimate the risk of training exercise at moderate to high intensity.
- Patients can perform exercises at home only if they are able to do understand and apply proper exercise task management (frequency, intensity, time, and type).
- ADL are the main points of evaluation ([Royal Dutch Society for Physiotherapy, 2020](#); [Smith et al., 2020](#)).

9.2.7 Physiotherapy after 6 weeks post hospital discharge

The patient needs are reevaluated to determine the modality in which the rehabilitation should be adapted and improved. It will reevaluate the level of physical function of the patient, comparing it with the previous tests. The objectives for treatment are tied to physical activities and effort capacity, based on the effort tests and on the measurements of physical activities. The goal of these objectives of treatment should be the improvement of ADL and increase of the effort capacity.

Methods of evaluation that may be used in this stage

- The functional specific scale of the patient (intensity of 60%–80% from maximum performance of the effort).
- SPPB: balance test, walking speed test of 4 m distance.
- Standing test, from five times from the chair, manual catch dynamometry, walking test of 6 minutes.
- Pedometer to evaluate the daily physical function.
- Oxygen saturation SpO₂ (in effort lower limit is of 93%).
- Heart rate, respiratory rate and blood pressure.
- Borg scale CR10 for respiratory difficulties and fatigue, before, during, and after physical exercise (6/10 on the Borg scale CR10).

When physical tests and effort tests are not showing restriction or some risk, the training will be increased gradually (frequency, intensity, and type). The needs of the patient and the physical abilities are those which will lead to the establishment of the treatment objectives. The objectives of rehabilitation need to be reviewed and actualized based on the functional evaluation ([Royal Dutch Society for Physiotherapy, 2020](#); [Smith et al., 2020](#)).

The patient with rehabilitation needs must be reevaluated at 3 months post hospital discharge. The reevaluation should include the following:

- physical problems;
- sensory problems;
- communication problems;
- necessities of social care or equipment;
- psychological problems (anxiety, depression, symptoms, PTSD—posttraumatic stress disorders);
- behavioral and cognitive problems;
- psychosocial problems.

After hospital discharge post-COVID-19, the patient can face dyspnea that appears rapidly and obstructs the daily living activities. That may cause fear and may aggravate the patient's health status. A calm attitude diminishes dyspnea, permitting gradually loading of daily living activities ([Ancuța, 2010](#); [Silver, 2020](#)).

Respiratory techniques

1. *Controlled diaphragmatic breathing.* That technique will help to relax and control the respiration:
 - a. patient in dorsal decubitus with a pillow under his neck, knees bent, a palm on the abdomen, and the other one on the thorax;
 - b. slowly inhale through nose and then exhale through mouth. As you breathe, the hand on the abdomen is moving, and the hand on the chest remains unmoved. Repeat 5 to 10 times.
2. *Rhythmic respiration*

This technique is used when activities with a large amount of effort occurs, climbing stairs, walking on rising terrain. It is important to not rush. The activities will be divided into small parts to ease the movement performance without fatigue or without respiratory difficulties at the end. Inhale before the effort in that activity, for example, before making a step or climbing a stair, and exhale during the movement, such as the climbing of stair or performing a step. The inhalation is done through the nose and exhalation through the mouth ([World Health Organisation, 2020](#)).

9.2.8 Example of exercise program after hospital discharge

The program has a beneficial effect on health and contributes to a more rapid recovery.

The objectives in this program are:

- improvement of physical condition;
- reeducation of dyspnea;
- increase of muscles strength;
- balance improvement;
- improvement of focusing capacity;
- decrease of stress;
- increase confidence and self- esteem;
- increase energy level.

The main condition in this program of physical exercises is *safety!*

In the case in which the patient was immobilized for a long period, had balance difficulties, received oxygen, or has vision difficulties in performing the exercise program, these factors should be taken into account with specialist advice, and the physiotherapy treatment will be done under strict supervision ([Prvu Bettger et al., 2020](#)).

Precautions in performing the program.

- drink lots of liquids;
- the rhythm must not fatigue the patient;

- the exercise program will stop if dizziness, nausea, difficulty breathing, and/or severe pain in the chest appear.

Warming up prepares the body for effort and contains simple exercises from sitting and standing with support, with a duration of 5 minutes.

Each movement will be repeated two to four times.

1. from sitting, raise and lower the shoulders;
2. circumduction of the shoulders anterior and posterior from sitting;
3. from sitting, raise and alternately lower a knee;
4. circumduction of the feet from sitting (move one foot at a time);
5. flexion, extension of the arms, swinging them anteriorly and posteriorly, from standing with support;
6. side bending of the trunk from standing;
7. dorsal flexion with traction of the tips of the toes up, and plantar flexion stretching the tips of the toes from standing with support (Falvey et al., 2020).

The specific program of exercises:

1. Walking on the spot; if necessary, the patient will look for a chair support or a stable surface; will raise the knees one at a time.
2. The step on single stair; will raise one leg, then the other one on a stair or stepper.
 - a. If necessary, a point of support will be fixed, or a chair to be close to be able to rest;
 - b. exchange with the other leg with which it starts at every 10 steps;
 - c. the height of the step or the speed will be increased;
 - d. if the balance is satisfied some light weights may be used.
3. The walking on a plane surface.
 - a. Use a walking device (frame), crutches or sticks, if necessary;
 - b. gradually increase the speed and the traveled distance;
 - c. if possible, go further walking on a sloping route.

Strengthening exercises

Exercises for the upper limbs:

1. Flexion and extension of the elbows with a light weight in hands;
 - a. gradually increase in intensity, number, and the weight;
 - b. perform simultaneously, alternating, from 5 to 10 repetitions, 2 to 3 series.
2. Push-ups against the wall:
 - a. hands on the wall, at shoulder level, with the fingers up and feet at a 20–30 cm distance apart;
 - b. body is maintained straight and bend the elbows as approaching the wall, then slowly stretch them until full extension occurs;
 - c. perform up to 5 repetitions in 2 to 3 series.
3. Abduction of the arms:
 - a. with a weight in each hand, with arms next to the body, and with palms face down the floor;

- b. the arms will be raised laterally to shoulder level and then slowly lowered;
 - c. the exercise may be performed from sitting or standing;
 - d. repeat 5 to 10 times, in 2 to 3 series;
4. Sitting and standing:
 - a. from standing, flex the knees, lower the trunk down, like the movement when sitting on the chair;
 - b. repeat 3 times, 3 to 5 series.
5. Knee extension:
 - a. from sitting on a chair with flexed knees, leg will be extended one at a time, maintain for 3 seconds, then slowly flex;
 - b. repeat with the other leg;
 - c. 10 to 15 repetitions on each leg.
6. Sittings:
 - a. stand with the back against the wall, heels at a 20–30 cm distance from the wall;
 - b. the back slides slowly on the wall, flexing the knees;
 - c. the hips must be higher than the knees;
 - d. make 5 repetitions, in 3 series.

Return of the body after exercises

After the performance of the exercises, named previously, it is necessary to perform some exercises in return for 5–10 minutes:

- walking on the spot in a slow rhythm;
- warming up exercises;
- stretching exercises for upper and lower limbs (Falvey et al., 2020; World Health Organisation, 2020).

Medical recovery of the patients with COVID-19 is a complex process with regard to the evaluation, management, and recovery treatment, with continued monitoring through which the patient is helped to have a physical, cognitive, and psychological functionality at the optimum level, to improve the daily living activities, and to reintegrate back to society. The physical exercises are necessary to all patients with COVID-19 in order to prevent and treat the neuromuscular complications.

References

- Ambrosino, N. (2020). An Italian consensus on pulmonary rehabilitation in COVID-19 patients recovering from acute respiratory failure: Results of a Delphi process. *Monaldi Archives for Chest Disease*, 90(1444), 1444.
- Ancuța, C. (2010). *Esențialul în medicină fizică și recuperare medicală*, Editura Gr. T. Popa.
- Carda, S., Invernizzi, M., Bavikatte, G., Bensmail, D., Bianchi, F., Deltombe, T., . . . Molteni, F. (2020). The role of physical and rehabilitation medicine in the COVID-19 pandemic: The clinician's view. *Annals of Physical and Rehabilitation Medicine*, 63(Issue 6), 554–556, November.
- Chartered Society of Physiotherapy (2020, June 23). *COVID-19: The road to recovery*.
- Falvey, J. R., Krafft, C., & Kornetti, D. (2020). The essential role of home-and community-based physical therapists during the COVID-19 pandemic. *Physical Therapy*, Apr 17.

- <https://physio-pedia.com/COVID_19:_PostAcute_Rehabilitation>.
- <<https://www.cdc.gov/coronavirus/2019-ncov/clinical-guidance-management-patients.htm>>.
- Handbook of COVID-19 Prevention and treatment—Terapia de reabilitare pentru pacienții cu COVID-19.
- Khan, F., & Amaty, B. (2020). Medical rehabilitation in pandemics: Towards a new perspective. *Journal of Rehabilitation Medicine: Official Journal of the UEMS European Board of Physical and Rehabilitation Medicine*, 52(4), jrm00043.
- Kiekens, C., Boldrini, P., Andreoli, A., Avesani, R., Gamma, F., Grandi, M., ... Negrini, S. (2020). Rehabilitation and respiratory management in the acute and early post-acute phase. “Instant paper from the field” on rehabilitation answers to the Covid-19 emergency. *European Journal of Physical and Rehabilitation Medicine*.
- Lazzeri, M., Lanza, A., Bellini, R., Bellofiore, A., Cecchetto, S., Colombo, A., ... Frigerio, P. (2020). Respiratory physiotherapy in patients with COVID-19 infection in acute setting: A Position Paper of the Italian Association of Respiratory Physiotherapists (ARIR). *Monaldi Archives for Chest Disease*, 90, 1285.
- Managementul fizioterapeutic pentru COVID-19 în Spitalele de urgență: Recomandări – Ghid de practică clinică Versiunea 1.0 23 Martie 2020.
- NHS. *COVID-19: Supporting your recovery*. Lancashire Teaching Hospitals.
- NHS England (2020, June 5). *After-care needs of inpatients recovering from COVID-19. Version 1*.
- Pan American Health Organization. (2020). *Rehabilitation considerations during the COVID-19 outbreak*. Washington DC, USA: PAHO.
- Physiotherapy Management for COVID-19 in the Acute Hospital Setting: Recommendations to guide clinical practice Version 1.0 23 March 2020. <<https://www.journals.elsevier.com/journal-of-physiotherapy>> .
- Prvu Bettger, J., Thoumi, A., Marquevich, V., De Groote, W., Battistella, L. R., Imamura, M., ... Stein, J. (2020). COVID-19: Maintaining essential rehabilitation services across the care continuum. *BMJ Global Health*, 5.
- Royal Dutch Society for Physiotherapy. (2020). *KNGF position statement: Physiotherapy recommendations in patients with COVID-19*. Amersfoort, Netherlands: KNGF. <<https://www.kngf.nl/kennisplatform/guidelines>> .
- Silver, J. K. (2020). Prehabilitation could save lives in a pandemic. *BMJ (Clinical Research ed.)*, 369, Apr 6.
- Smith, J. M., Lee, A. C., Zeleznik, H., Coffey Scott, J. P., Fatima, A., Needham, D. M., & Ohtake, P. J. (2020). Home and community-based physical therapist management of adults with post-intensive care syndrome. *Physical Therapy*, Apr 13.
- Thomas, P., Baldwin, C., Bissett, B., Boden, I., Gosselink, R., Granger, C. L., ... van der Lee, L. (2020). Physiotherapy management for COVID-19 in the acute hospital setting: Clinical practice recommendations. *Journal of Physiotherapy*, 66(2), 73–82.
- Voicu, M., Tudorache, S., Lovin, & Friesen, M., *Tratat de reabilitare pulmonară*, Editura Mirton, Timișoara 2009.
- World Confederation for Physical Therapy (WCPT) Respiratory Management of COVID 19.
- World Confederation for Physical Therapy (WCPT) (2020, May). *WCPT response to COVID-19: Briefing paper rehabilitation and the vital role of physiotherapy*.
- World Health Organisation, Europe (2020). *Support for rehabilitation: Self-management after COVID-19 related illness*.
- World Health Organization (2020, May 27). *Clinical management of COVID-19 – Interim guidance*.