



COVID-19 and pulmonary rehabilitation: preparing for phase three

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Considering the expected high burden of respiratory, physical and psychological impairment following the acute phase of COVID-19, a huge number of patients should be referred early to a rehabilitation programme <https://bit.ly/3d0s0hu>

Cite this article as: Polastri M, Nava S, Clini E, *et al.* COVID-19 and pulmonary rehabilitation: preparing for phase three. *Eur Respir J* 2020; 55: 2001822 [<https://doi.org/10.1183/13993003.01822-2020>].

As of 15 May 2020, 4405680 coronavirus 2019 (COVID-19) cases have been reported worldwide [1]. Although figures are increasing, it seems the virus aggression is lowering, significantly reducing the pressure on the intensive care unit (ICU) beds. At the time of writing, the lockdown is going through a new phase of remodelling, and the National Authorities are testing the possibility of resuming economic activities. From the general population point of view, this is an encouraging aspect but, all those professionals involved in the pathway of care are aware of the importance this phase has on preventing the spread of the infection.

Patients who have successfully recovered from the acute COVID-19 pneumonia will require health support to define and quantify the consequences of the disease. The follow-up is currently the new challenge as it was in the beginning for ICUs. Indeed, it is not clear if COVID-19 will leave permanent lung and/or physical damage and, if so, to what extent. Alterations of lung tissue such as ground-glass opacities, consolidation, vascular thickening, bronchiectasis, pleural effusion, crazy paving pattern and irregular solid nodules [2], may progress in over 80% of patients [3]. Persisting limitations in respiratory function and gas exchange will likely be more pronounced in the subgroup of ICU survivors. In addition, as in non-COVID-19 related acute respiratory distress syndrome (ARDS) [4], we can anticipate a high incidence of ICU acquired weakness that is associated with poor short- as well as long-term outcomes [5]. It has been found that cognitive impairment in ARDS survivors ranges from 70% to 100% at hospital discharge and 20% at 5 years, while mood deterioration including depression and post-traumatic stress disorder were also present [6]. Patients with COVID-19 seem to be prone to movement-related fatigue, similar to ARDS patients [7], even in those subjects not developing a critical illness. Therefore, the rehabilitation community is calling for action preparing for post-intensive care syndrome (PICS) in COVID-19 patients

Received: 16 May 2020 | Accepted: 19 May 2020

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[8–10]. Notwithstanding, it is as yet unclear to what extent these subjects, similar to non-COVID-19 patients, are at risk for prolonged respiratory, physical, functional and cognitive limitations [11], and thus in need for appropriate rehabilitation.

Below we will address two critical questions and provide potential answers. The first question to arise is how can we identify patients with an impaired health condition after COVID-19 and how can the follow-up be organised? This is a critical point because answering such a question would include the availability of more detailed figures. Some patients with a poor health condition, specifically those with an extended long stay in the ICU, will be discharged immediately for inpatient rehabilitation. Others will be desperate to go home after the critical period in the hospital.

Post-discharge pulmonary out-patient consultations must be prepared and allow adequate early assessment of symptoms (fatigue, anxiety, depression and dysphagia), pulmonary function and exercise performance. Based on these findings, follow-up and treatment in out-patient rehabilitation or primary care with general practitioners, physiotherapists, occupational therapists and nurses can be organised. Experiences with post-ICU follow-up clinics are reported [12], but insufficient evidence is available to determine whether ICU follow-up services are effective in identifying and addressing the unmet health needs of ICU survivors [13]. Since these patients do consult their general physician more frequently [14], it is essential to raise the awareness for PICS so that patients' ICU experiences are not merely a black box for their primary care physicians [15].

The second question is what kind of rehabilitation can be conducted? Rehabilitative activities provided in an out-patient setting should consider physical, cognitive and psychosocial outcomes. Although PICS is a well-established finding in non-COVID-19 ARDS patients, its treatment is still under development [16, 17]. Randomised controlled trials to date have not shown significant effects of post-ICU rehabilitation and exercise interventions [18–20]. Although patient's characteristics were considered to impact on the outcome of functional exercise performance in a secondary analysis of studies by DENEHY and co-workers [21, 22], the programme content might be a more critical determinant of the lack of effectiveness. Most studies in patients after ICU discharge to enhance recovery included (home-based, mostly unsupervised) exercise training interventions [20]. These interventions were primarily self-delivered exercise supported by diaries and regular phone calls [20]. It is well known from studies in patients with COPD that home-based unsupervised exercise training is not improving exercise performance in comparison to a comprehensive supervised programme [23]. In addition, patients suffering from PICS are facing not only physical but also cognitive and psychosocial impairments. Therefore, these conditions should be targeted in a multidisciplinary programme [16], such as pulmonary rehabilitation according to its definition [24], by covering the specific needs of patients suffering from PICS. Preliminary data from China support this assumption [25].

As occurred in phase one of COVID-19, when international scientific societies and professionals released practical recommendations to be followed [26–30], in phase three their contributions will also be of substantial support to get further insights into the most profitable and shared therapeutic trajectories. To define a rehabilitation programme for post-COVID-19 patients, mirroring the algorithm of pulmonary rehabilitation for patients with chronic respiratory conditions is an evidence-based, well recognised, widely accepted available option. Considering that the phenotypes trajectories are extremely different and not always related to the ICU experiences, an accurate triage and baseline core set of assessments is necessary to prioritise and offer special programmes/settings of rehabilitation (in-hospital, out-patient, telerehabilitation, tele-coaching, home-rehabilitation, mixed form). The high number of patients involved will invite technology and new health organisational approaches to be developed. The combination of either COVID *versus* non-COVID chronicity needs calls for an urgent answer and a sharp point of equilibrium.

Conflict of interest: None declared.

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