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**Title:**

**Systematic rapid living review on rehabilitation needs due to Covid-19: update to April 30<sup>th</sup> 2020**

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## Abstract

**Background.** This paper adds to the series of systematic rapid living reviews, started in April 2020, to provide the rehabilitation community with updates on the latest scientific literature on rehabilitation needs due to Covid-19 pandemic.

**Objectives.** To present the results of a systematic scientific literature search performed on papers published from April 1st to April 30th, 2020.

**Methods.** A systematic search was performed on PubMed, Embase, Scopus, CINAHL, PEDro, Web of Science and the main international guideline databases for articles published (including Epub), in English, from April 1<sup>st</sup> to April 30<sup>th</sup>, 2020. Papers were included if they reported on one of the following: 1) prevalence and features of the emerging disability after Covid-19; 2) rehabilitation strategies applied for Covid-19 patients, regardless of setting or stage; 3) information about rehabilitation services after Covid-19; 4) impact on diseases of rehabilitative interest; 5) complications of rehabilitative interest.

**Results.** Out of 445 articles retrieved for the time frame, 50 were finally included for qualitative analysis. They consist of 7 guidelines, 1 scoping review, 1 randomized controlled trial, 4 descriptive studies (qualitative), 1 case series, 1 case report, and 35 expert opinions.

**Conclusions.** This systematic rapid living review showed an increasing evidence on rehabilitation needs due to COVID-19 outbreak during April 2020. The main novelties include: 1) the first appearance of epidemiological data on the likely high incidence of neurological complications/disabling sequelae in patients hospitalized for COVID-19; 2) rapid guidelines on the management of chronically disabled patients in the COVID-19 era; 3) advices to provide COVID-19 patients with early respiratory rehabilitation in the acute phase, and with telemonitoring and telerehabilitation in the post-acute phase. Although the overall quality of studies has increased, prospective cohort studies on disability course in COVID-19 pandemic and experimental studies on the effects of rehabilitation are still warranted.

**Keywords:** Covid-19; Severe Acute Respiratory Syndrome Coronavirus 2; Coronavirus; Rehabilitation; Physical and Rehabilitation Medicine; Exercise

## Introduction

The present paper adds to the series of systematic rapid living reviews on rehabilitation answers to the Covid-19 emergency, started in April 2020, as an editorial strategy to provide a timely knowledge synthesis about the needs of rehabilitation due to Covid-19 pandemic. The first rapid living review<sup>1</sup> showed the results of the 9 articles included, out of the 2578 articles retrieved from December 21<sup>st</sup>, 2019 up to March 31<sup>st</sup>, 2020. These articles conveyed the following messages: 1) early rehabilitation should be granted to inpatients with Covid-19; 2) people with restricted mobility due to quarantine or lockdown should receive exercise programs to reduce the risk of disability/functional decline; 3) tele-rehabilitation should be regarded as an effective option for people at home.

As of May 1<sup>st</sup>, 2020, the total number of diagnosed SARS-CoV-2 infections is more than 3 million worldwide, causing more than 230,000 deaths<sup>2</sup>. Over the last month, a decrease in the daily number of new cases has been reported by most European countries, showing that the quarantine is effective<sup>3</sup>.

Main public health objectives include the reduction of morbidity, severe disease, and mortality in the population through proportionate non-medical countermeasures, with emphasis on protecting frail people, until effective vaccines, treatments and medicines become available.

In this scenario, the Pan American Health Organization (PAHO), an international public health agency serving the World Health Organization (WHO), considering the role of rehabilitation during the COVID-19 pandemic, affirmed that<sup>4</sup>: severe COVID-19 patients will have the main rehabilitation needs due to prolonged immobilization and ventilatory support, requiring a particular skill-set acquired through specialist training; rehabilitation needs might be intensified by other comorbidities in elderly; the rehabilitation professionals should facilitate an early discharge of COVID-19 patients.

Therefore, taking into account the rehabilitation needs due to COVID-19 pandemic, the present systematic rapid living review will present the results of a systematic scientific literature search performed on papers published from April 1<sup>st</sup> to April 30<sup>th</sup>, 2020.

## Methods

On May 4<sup>th</sup>, 2020 an extensive search was performed on PubMed, Embase, Scopus, CINAHL, PEDro and Web of Science databases. We undertook a systematic review to explore the evidence reporting COVID-19 outbreak in relation to rehabilitation needs and published (including Epub) from April 1<sup>st</sup> to April 30<sup>th</sup>, 2020. A systematic search was also performed in the following guideline databases: Guidelines International Network (GIN), National Institute for Clinical Excellence (NICE), Australian National Health and Medical Research Council

(NHMRC) Guidelines, National Library for Health (NLH) Guidelines database, The Scottish Intercollegiate Guidelines Network (SIGN), and the Canadian Clinical Practice Guidelines (CPG) Infobase. The search strategy is described in Appendix 1. This study has been submitted to PROSPERO and was designed in line with Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P).

Three authors (AdS, EA, FN) independently completed all searches and systematically identified and removed duplicate records, through Zotero software. In this review, the only restriction was for English language. This study selection had two phases: the first based on titles and abstracts evaluation and the second one based on a thorough assessment of the full-text papers. In both phases, there was a double check based on the criteria defined by the first rapid review performed by our group<sup>1</sup>, i.e.: Does the paper report on: 1) *prevalence and features of the emerging disability after Covid-19?* 2) *rehabilitation strategies applied for Covid-19 patients, regardless of setting or stage?* 3) *information about rehabilitation services after Covid-19?* 4) *impact on diseases of rehabilitative interest* 5) *complications of rehabilitative interest?*

Three authors (AdS, EA, FN) independently extracted data from eligible full-text papers using a piloted data extraction form in Excel. Accuracy was assessed by concordance of the extracted data. Key data were extracted from each study relevant to the specific research questions. Disagreements were discussed and reconciled or referred to two more reviewers for adjudication (MGC, SN) at each phase.

A narrative synthesis of the selected articles was performed.

## Results

Four hundred forty-five articles were retrieved for the time frame. After screening, 73 articles were selected for full-text assessment, 50 being finally included for qualitative analysis (Figure 1). Among the publications, we reported 7 guidelines, 1 scoping review, 1 randomized controlled trial (RCT), 4 descriptive studies (qualitative), 1 case series, 1 case report, and 35 expert opinions. Twenty-five studies were conducted in Europe: 8 in Italy, 7 in the United Kingdom, 3 in France, 2 in Spain, 1 Portugal, 1 Finland, 1 Netherlands, 1 Switzerland, and 1 international collaboration (Netherlands and Switzerland). Ten studies were conducted in Asia: 4 in China, 2 in Iran, 2 in Japan, 1 in Singapore, and 1 in Israel. Seven studies in North America: 6 in the United States, 1 in Canada. Finally, 3 studies in Australia and 5 designed from intercontinental collaborations. We classified the articles into 5 categories based on the research questions as reported above.

### ***Studies reporting on the prevalence and /or characteristics of emerging disability after COVID-19***

One scoping review of 32 retrospective studies reported incidence of new neurological events in 6% to 67% patients hospitalized for COVID-19<sup>5</sup>, with corticospinal signs, confusion and neuromuscular injuries affecting more than half patients.

**Studies reporting on rehabilitation approaches to COVID-19 patients**

In this category, we found one RCT reporting the greater efficacy of 6-week respiratory rehabilitation, compared to no treatment, at improving pulmonary function, endurance, quality of life and anxiety in elderly patients with COVID-19<sup>6</sup>.

Two practice guidelines provided recommendations for the management of adult patients with confirmed or suspected COVID-19 in the acute care setting<sup>7</sup> and for the management of swallowing disorders and the assessment of acute dysphonia in the context of the COVID-19<sup>8</sup>.

One qualitative descriptive study<sup>9</sup> shared the early experiences from the clinical field in Northern Italy on the respiratory management of COVID-19 patients in the acute and immediate post-acute phases.

Nine expert opinions provided suggestions about acute and/or post-acute management of people with COVID-19. Some of them provide general advices<sup>10,11</sup>, others provide specific description of rehabilitation approaches to people with mild or severe respiratory symptoms<sup>12-14</sup>, whereas, others focus on the rehabilitation needs of specific patients subgroups like people with obesity<sup>15</sup>, pre-existent reduced respiratory muscle performance<sup>16</sup>, people awaiting surgery<sup>17</sup>, and subjects suffering from post-intensive care syndrome secondary to COVID-19<sup>18</sup>.

The key messages were:

- In the acute phase, early respiratory rehabilitation was recommended for mild patients<sup>10,12</sup>, while different views existed for the patients with severe complications<sup>9,12</sup>.
- In the post-acute phase, telerehabilitation and telemonitoring (using wearable devices, mobile phone APPs, virtual reality) was proposed as the first option, while inpatient or outpatient rehabilitation was suggested for cases with most severe disability<sup>10,12,16</sup>. Prehabilitation has also been advised to prevent complications in people undergoing surgery<sup>13,17</sup>.

**Studies reporting on the organization of rehabilitation services after COVID-19**

One NICE guideline provided an algorithm for the admission of COVID-19 patients to critical care, linking this decision to the patient's functional recovery potential<sup>19</sup>.

Two qualitative descriptive studies were reports of the webinars on COVID-19 ("Covinars"), organized by the Italian Society of Physical Medicine and Rehabilitation (SIMFER), that provided notes for the preparation of PRM services and on the use of telerehabilitation<sup>20,21</sup>. A preliminary attempt to use a telerehabilitation system is described in one case series<sup>22</sup>; the authors presented a telemedicine approach, exploiting a tablet to deliver exercises to isolated individuals, under remote supervision of the physical therapist and monitored with a pulse oximeter.

Out of 16 expert opinions included in this category, 4 conveyed the local experience about service organization<sup>23-26</sup>, 4 addressed the issue of cardiac rehabilitation<sup>27-30</sup>, 1 suggested a model for a post-ICU

rehabilitation unit<sup>31</sup>, while another proposed criteria for admission of COVID-19 patients to the rehabilitation units<sup>32</sup>. Two provided advises on the procedures to reduce the risk of infection during clinical practice<sup>33,34</sup> and 2 papers discussed the role of physical therapists<sup>35</sup> or digital-physical therapists<sup>36</sup> in the COVID-19 era. Finally, two papers launched a call for action to provide a coordinated response to rehabilitation needs of COVID-19 patients<sup>37,38</sup>.

The key messages were:

- To encourage home-based interventions through telehealth (for patient's monitoring and exercise delivering), especially for chronically disabled patients
- To ensure patients and staff safety in the COVID-19 era
- To establish specific criteria for patients' admission to rehabilitation unit

### ***Studies reporting on the impact of COVID-19 on diseases of rehabilitative interest***

Four guidelines (3 from NICE and one from the French Rare Health Care for Neuromuscular Diseases Network-FILNEMUS) addressed the specific needs of people with chronic obstructive pulmonary disease<sup>39</sup>, cystic fibrosis<sup>40</sup>, or rheumatological autoimmune, inflammatory, and metabolic bone disorders<sup>41</sup>, and neuromuscular disorders<sup>42</sup>, respectively.

One qualitative descriptive study, based on a worldwide survey among rehabilitation professionals caring for people living with spinal cord injury (SCI), highlighted substantial variability of screening practices and availability of screening kits, also revealing that most patients with SCI are worried for their vulnerability to infection and fragility of caretaker supply<sup>43</sup>.

The case of a 56-year-old tetraplegic male developing COVID-19 was first reported in Italy<sup>44</sup>.

Nine expert opinions described the impact of COVID-19 on diseases of rehabilitative interest, as neuromuscular disorders<sup>45</sup>, vulnerable populations or frail people<sup>46,47</sup>, SCI<sup>48</sup>, Parkinson's Disease<sup>49</sup>, dysphagia following surgery for Head and Neck Cancer<sup>50</sup>, osteoarthritis<sup>51</sup>, cardiology patients<sup>52</sup>, and, broadly, patients with rehabilitation needs<sup>53</sup>.

### ***Studies reporting on late complications due to COVID-19 that may be of rehabilitative interest***

Only one paper heralds the crucial role rehabilitation may have in preventing secondary impairments, due to immobilization syndrome and critical illness neuropathy and myopathy<sup>54</sup>.

Main descriptions of all papers included in the present systematic living review are depicted in Table 1.

## Discussion

This second systematic rapid living review reports papers published in April 2020 and addressing rehabilitation needs due to COVID-19 pandemic. Compared to the previous one, that searched papers published from 21<sup>st</sup> December 2019 up to 31<sup>st</sup> March 2020, this review provides the following important updates:

1) there is a growing concern, among the medical community, about the long-term care to be provided both to people surviving a COVID-19 infection and to people with chronic disabling conditions who were restricted home during the lockdown and denied the regular access to rehabilitation services. This is documented by the impressive increase of articles meeting the selection criteria and published in one month (50 papers), compared to those extracted by literature search in the previous 3 months (9 papers). Although the overall quality of evidence is still low, with the largest part of papers being represented by expert opinions, some novelties can be highlighted: in fact, one parallel group experimental trial and a few qualitative descriptive studies are presented. Moreover, accredited scientific groups like NICE and FILNEMUS, provided rapid guidelines, whose recommendations were developed in direct response to the rapidly evolving situation and so could not follow the standard process for guidance development. The recommendations are based on evidence and expert opinion.

2) the first epidemiological data, about the disabling sequelae of COVID-19 infection, point to a central and peripheral nervous system involvement either as a likely consequence of virus migration to the brain (hypogeusia and hyposmia) or as an adverse effect of severe respiratory syndrome and ICU stay (Post-Intensive Care Syndrome, hypoxic encephalopathy with dysexecutive syndrome persisting in the medium term); a single scoping review of 32 retrospective studies reports incidence and risk of secondary neurologic events ranging from 6%, to 67%<sup>5</sup>.

3) the efficacy of rehabilitation interventions delivered to COVID-19 patients in the acute phase is diffusely claimed, though it is mostly not supported by evidence: in fact, 11 out of 13 papers disclose experts' opinions and one paper is a descriptive study; of note that one Chinese RCT states the efficacy of 6-week rehabilitation on respiratory and psychological function, quality of life, and mobility, in 72 elderly patients with COVID-19<sup>6</sup>.

4) the role of rehabilitation in the management of COVID-19 sequelae (like immobilization syndrome, and critical illness neuropathy-myopathy) is still addressed by one paper only<sup>54</sup>.

5) the largest number of papers, including one rapid NICE guideline<sup>19</sup>, address organization barriers to rehabilitation intervention delivery; they recommend safety procedures, alert patients, caregivers and staff against the risks of aerosol-generating procedures, like NIV and mechanical cough assist; finally, they endorse the use of tele-monitoring and tele-rehabilitation to avoid face-to-face interaction between the patient and the healthcare provider. A couple of papers also recommend pre-habilitation in patients undergoing surgery to prevent possible complications of COVID-19. Among this group of papers, it is worth to mention the point of-



view by the Spanish Society of Physical Medicine and Rehabilitation (SERMEF), on the impact of COVID-19 outbreak on rehabilitation services and PRM in Spain<sup>23</sup> and the report of the webinars on COVID-19 (“Covinars”), organized by the Italian Society of Physical Medicine and Rehabilitation (SIMFER)<sup>20,21</sup>. Both Scientific Societies stressed the importance of reinforcing academic and training contents of PRM physicians in the area of Internal Medicine, strengthen the rehabilitation services, and establish specific criteria for admission of COVID-19 patients to the rehabilitation units. Carda et al.<sup>32</sup> recommend the following: a)  $\geq 7$  days from diagnosis of COVID-19; b) at least 72 hours with no fever and no fever-reducing medication; c) stable respiratory rate and oxygen saturation; d) clinical and/or radiological evidence of stability.

6) Up to fifteen papers, including 3 rapid NICE guidelines, contend that COVID-19 is expected to realize and important impact on patients with chronically disabling diseases, as spinal cord injury<sup>34,43,48</sup>, cardiovascular diseases<sup>29,30,52</sup>, neuromuscular diseases<sup>42,45</sup> or respiratory diseases<sup>39,40</sup>.

Taken all together, the findings of this rapid review provide the following key points:

- New neurological events affect 6% to 67% patients hospitalized for COVID-19 and may cause persistent disability
- Early respiratory rehabilitation is recommended, in the acute phase, for COVID-19 patients, including non-invasive ventilation, changes of posture and passive mobilization
- Telemonitoring and telerehabilitation are the recommended option for the management of COVID-19 patients in the post-acute phase
- Chronically disabled patients should be given access to teleconsultations and any possible support system (e.g., illustrated sheets with links to online videos) for self-rehabilitation and exercises, to cope with the cessation of regular in-house or office care by the rehabilitation team, while reserving hospitalization for emergencies or assessments for which the delay may result in a loss of survival chance
- Specific criteria are needed for admission of COVID-19 patients to rehabilitation units

### **Study limitations**

The present systematic rapid living review has some limitations: first, the 1-month window considered for the literature search; thus, the short time elapsed from the start of COVID-19 pandemic might lead to have a few findings concerning prevalence of the emerging disability in COVID-19 patients and their late complications of rehabilitative interest; another limitation might be the lack of risk of bias evaluation; however, up to date, prospective cohort studies and experimental studies addressing rehabilitation needs related to COVID-19 are still lacking.

## Conclusions

This systematic rapid living review, on papers published from April 1<sup>st</sup> to April 30<sup>th</sup>, 2020, showed an increasing evidence on rehabilitation needs due to COVID-19 outbreak. With respect to the first published rapid review, the main novelties, at present, include:

- the availability of first epidemiological data about the likely high incidence of neurological complications/disabling sequelae in patients hospitalized for COVID-19;
- the publication of rapid guidelines on the management of chronically disabled patients, by disease subgroups, in the COVID-19 era;
- the advice, from qualitative descriptive studies, to provide COVID-19 patients with early respiratory rehabilitation in the acute phase, opting for telemonitoring and telerehabilitation in the post-acute phase.

Prospective cohort studies on disability course in COVID-19 pandemic and experimental studies on rehabilitation efficacy are still warranted.

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## Figures and Tables

**Figure 1.** PRISMA flow diagram.

**Table I.** Description of the articles on rehabilitation needs due to COVID-19 included in the rapid review updated to 30th April 2020.



**Table I.** Description of the articles on rehabilitation needs due to COVID-19 included in the rapid review updated to 30<sup>th</sup> April 2020.

N.	Authors, Journal, Year	Aim of the study	Study population or target population	Study design	Study setting or target setting	Nation or geographical Area involved	Main results and conclusions
<b><i>Prevalence and /or the characteristics emerging disability after COVID-19</i></b>							
1	Herman C, et al. Neurology 2020 <sup>5</sup>	To assess the potential impact of pre-existing neurological comorbidities and new neurological events in patients hospitalized with COVID-19.	COVID-19 patients	Scoping review	ICU, acute wards	China	<ul style="list-style-type: none"> <li>• 32 retrospective studies selected out of 643 retrieved</li> <li>• Prevalence of pre-existing neurological illness: 8.0 % (322 cases out of a total 4014 patients hospitalized for Covid-19)</li> <li>• Incidence and risk of secondary neurologic events ranges from 6%, to 67%. Most frequent complications in people admitted to the ICU are: corticospinal signs, followed by confusion, neuromuscular injury, hypoxic encephalopathy and stroke. In people discharged home, 33% showed a dysexecutive syndrome.</li> </ul>
<b><i>Rehabilitation approaches dedicated to COVID-19 patients</i></b>							
1	Brugliera L, et al. J Rehabil Med. 2020 <sup>10</sup>	To provide information on the rehabilitation needs of COVID-19 patients in different settings	COVID-19 patients	Expert opinion	Acute care, inpatient rehabilitation, outpatient rehabilitation, and home-based settings	Italy	<ul style="list-style-type: none"> <li>• Acute phase: early respiratory rehabilitation highly recommended (non-invasive ventilation, changes of posture, and passive mobilization)</li> <li>• Post-acute phase: neuromotor rehabilitation for immobilization syndrome (passive/active mobilization, muscle strength exercises, and articular recovery)</li> <li>• Need of speech therapists and neuropsychologists to treat dysphagia and cognitive impairment</li> <li>• Few and minor sequelae might benefit from outpatient or home-based rehabilitation (aerobic exercises, strength training, static and dynamic balance training, bronchial clearance techniques, exercises for activities of daily living, and neuropsychological support)</li> </ul>
2	Kiekens C, et al. Eur J Phys Rehabil Med. 2020 <sup>9</sup>	To share the early experiences from the clinical field in Northern Italy about respiratory management in the acute and immediate post-acute phases.	COVID-19 patients	Descriptive : qualitative	ICU, acute wards, rehabilitation wards	Italy	<p>Rehabilitation services reorganization:</p> <ul style="list-style-type: none"> <li>• no visitors</li> <li>• reduction or suspension of activities and admissions of “classical” patients</li> <li>• support of therapists to nurses in other tasks</li> <li>• restriction of contacts between personnel and Covid-19 patients</li> <li>• use of web based electronic patient records</li> </ul> <p>Advice:</p> <ul style="list-style-type: none"> <li>• accurate monitoring in the weaning phase from ventilatory support</li> <li>• early rehabilitation in ICU patients with several complications seems not well tolerated (rapid desaturation)</li> <li>• in case of lung fibrosis as a sequel of pneumonia use respiratory rehabilitation or NIV</li> <li>• in case of tough secretions, provide specific physiotherapy techniques or technical removal</li> </ul>
3	Li J. Eur J Phys Rehabil Med. 2020 <sup>12</sup>	To describe rehabilitation management of patients with COVID-19.	COVID-19 patients	Expert opinion	Home, ICU, rehabilitation hospitals	China	<p>Acute phase management:</p> <ul style="list-style-type: none"> <li>• Mild patients: <ul style="list-style-type: none"> <li>○ Respiratory training and mild aerobic training and Chinese traditional exercises (Tai-ji, Ba-duan-jin), as well as square dance, in mobile cabin hospitals.</li> </ul> </li> <li>• Severe and critical patients: <ul style="list-style-type: none"> <li>○ Breath training at prone and/or semi recumbent bed position, moderate head elevation, limb mobilization, bed and bedside sitting and standing, as well as bedside walking.</li> <li>○ Respiratory training (timing and program remain should be clarified).</li> <li>○ Patients with chronic diseases or complications require appropriate rehabilitation plans.</li> </ul> </li> </ul>



							<ul style="list-style-type: none"> <li>• Telerehabilitation (wearable devices, mobile phone APPs, virtual reality)</li> <li>• Inpatient rehabilitation for some severe cases</li> </ul>
4	Liu K et al., Complementary Therapies in Clinical Practice. 2020 <sup>6</sup>	To investigate the effects of 6-week respiratory rehabilitation training on respiratory function, QoL, mobility and psychological function in elderly patients with COVID-19.	Elderly patients with COVID-19 at ≥6 months of onset.	RCT	Hospital	China	<ul style="list-style-type: none"> <li>• RCT of respiratory rehabilitation (36 cases) vs no treatment (36 cases)</li> <li>• Intervention: (1) respiratory muscle training; (2) cough exercise; (3) diaphragmatic training; (4) stretching exercise; and (5) home exercise. Respiratory training included 2 sessions/week for 6 weeks, each session lasting 10 min.</li> <li>• Significant increase in pulmonary function tests, 6 MWT, SF36 score and anxiety score, in the intervention group compared to controls</li> </ul>
5	Mattei A et al., Eur Ann Otorhinolaryngo I Head Neck Dis. 2020 <sup>8</sup>	To provide recommendations for the management of swallowing disorders and the assessment of acute dysphonia in the context of the COVID-19	Patients with swallowing disorders or recent dysphonia following ORL surgery.	Practice guideline	Hospital	France	<ul style="list-style-type: none"> <li>• Assess patients suffering from swallowing disorders only in cases of emergencies and in a hospital environment.</li> <li>• Postpone voice rehabilitation and provide tele-rehabilitation whenever it is technically possible and allowed by the current regulations</li> <li>• Apply same precautions to all patients (even asymptomatic)</li> <li>• Advice for caregivers: <ul style="list-style-type: none"> <li>○ be aware of the high risk of contamination from droplets emitted by the patient</li> <li>○ Procedures at very high risk of contamination: clinical and flexible endoscopic swallowing assessments, flexible endoscopies, insertions of nasogastric tubes and video fluoroscopic swallowing exams.</li> <li>○ PPE recommended: protective glasses, FFP2 (N95) mask, cap, gloves and gown.</li> <li>○ Learn the appropriate dressing and undressing technique.</li> </ul> </li> </ul>
6	Rahmati-Ahmadabad S et al, Obes Med. 2020 <sup>15</sup>	To review literature about the effect of exercise intensity on inflammation in obesity patients in the COVID-19 era	Patients suffering from obesity	Expert opinion	Outpatient, home-based settings	Iran	<ul style="list-style-type: none"> <li>• Light and moderate intensity exercise can reduce inflammation in obese patients, thus having an indirect protective effect against the virus.</li> <li>• On the other hand, high intensity exercise, especially in obese people, can cause the production of oxidants and transient suppression of immune system that could exacerbate COVID-19 symptoms.</li> </ul>
7	Severin R et al, Am J Med. 2020 <sup>16</sup>	To investigate the potential role of respiratory muscle performance.	COVID-19 patients	Expert opinion	ICU, acute care, inpatient rehabilitation, outpatient rehabilitation, and home-based settings	U.S.A.	<ul style="list-style-type: none"> <li>• Respiratory muscle performance can be reduced because of several factors, such as aging, obesity, physical inactivity, smoking and chronic disease.</li> <li>• People with pre-existent reduced respiratory muscle performance have major difficulties in weaning from mechanical ventilation and is reported an elevated number of complications during the process, especially in obese patients.</li> <li>• The authors propose to screen respiratory muscle performance, annually, in patients at risk. If reduced performance is detected a home-based training approach would be prescribed, remotely monitored using telemedicine.</li> </ul>
8	Silver JK et al, Am J Phys Med Rehabil. 2020 <sup>17</sup>	To propose prehabilitation for patients awaiting surgery.	Patients awaiting surgery	Expert opinion	Inpatient rehabilitation, outpatient rehabilitation, and home-based settings	U.S.A.	<ul style="list-style-type: none"> <li>• Prehabilitation should be considered to reduce surgical risk in post-pandemic elective surgery.</li> <li>• Clinical prehabilitation programmes should: <ul style="list-style-type: none"> <li>○ Focus on modalities that could prevent or reduce incidence of known surgical complications,</li> <li>○ Measure the outcome by both surgical and rehabilitation metrics,</li> <li>○ Be practically feasible in order to increase adherence,</li> <li>○ Be discernible from general lifestyle recommendations.</li> </ul> </li> </ul>
9	Simpson R et al, Am J Phys Med Rehabil. 2020 <sup>13</sup>	To describe impairment patterns in critically ill patients with acute respiratory distress and related service organization in the ICU.	COVID-19 patients	Expert opinion	ICU, acute care, inpatient rehabilitation, outpatient rehabilitation, and home-based settings	Canada	<ul style="list-style-type: none"> <li>• Physical and cognitive functions and psychosocial wellbeing can be severely impacted in COVID-19 patients admitted to the ICU.</li> <li>• Multimodal interventions for acute care and inpatient rehabilitation are warranted optimize outcome.</li> <li>• Innovative approaches are used, like tele-rehabilitation to avoid face-to-face interaction between the patient and the healthcare provider, and prehabilitation to prevent possible complications of COVID-19.</li> </ul>

Phys Ther.

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prevalence of PICCS, discuss the opinion rehabilitation physical cognitive or mental health status arising after critical illness and

	2020 <sup>18</sup>	possibilities for optimizing outcomes for PICS patients and suggest future directions for research and practice.			outpatient rehabilitation, and home-based settings		persisting beyond acute care hospitalization”. <ul style="list-style-type: none"> <li>• The syndrome impacts on functional capabilities and psychological and neuropsychological aspects of patients.</li> <li>• Given the increasing number of survivors to critical illness, a routine screening of people referred to physical therapists is advised, with ICU stay being considered a yellow flag.</li> <li>• A comprehensive evaluation for PICS patients and interventions applicable in ICU, inpatients, outpatients and home-based settings are reported.</li> </ul>
11	Thomas P, et al J Physiother. 2020 <sup>7</sup>	To provide recommendations for use by physiotherapists and other relevant stakeholders in the acute care setting caring for adult patients with confirmed or suspected COVID-19.	COVID-19 patients.	Practice guideline	Acute care inpatients	Australia	<ul style="list-style-type: none"> <li>• 17 recommendations for physiotherapy workforce planning and preparation, including criteria for assigning staff to acute care of COVID19 patients</li> <li>• 7 criteria to determine the indication for physiotherapy intervention in the acute hospital setting and a screening tool to match patient’s clinical features with the need for physiotherapy referral</li> <li>• 27 recommendations concerning the delivery of respiratory, mobilization, exercise and other rehabilitation interventions by physiotherapists</li> <li>• 15 recommendations about the use of personal protective equipment during physiotherapy care</li> </ul>
12	Wainwright TW,et al J Rehabil Med. 2020 <sup>11</sup>	To assert the necessity for the development, co-ordination, and delivery of inter-disciplinary rehabilitation to patients with COVID-19 and propose that collaborative self-management strategies be considered as a key component within the interdisciplinary rehabilitation pathways dedicated to these patients	COVID-19 patients	Expert opinion	Outpatient rehabilitation, and home-based settings in a long-term care perspective	UK	<ul style="list-style-type: none"> <li>• Challenges are expected to threaten the healthcare system over the longer term due to the current epidemics, like: handling the rehabilitation burden of COVID-19 patients post-acute care; managing emergency non-COVID conditions within restricted resources and managing the interrupted care of patients with long-term chronic conditions.</li> <li>• Rehabilitation services are not currently resourced to assist with the operational management of the cited challenges.</li> <li>• The new models of post-acute care for COVID-19 must include collaborative self-management to encourage and coach patients to actively manage medical, lifestyle, or emotional elements of their condition. This can be done through online-guidance, live streaming and video-consultations.</li> </ul>
13	Zhu C, et al. Heart Lung. 2020 <sup>14</sup>	To support the need for early pulmonary rehabilitation program in severe SARS-CoV-2 pneumonia.	COVID-19 patients	Expert opinion	ICU	China	<ul style="list-style-type: none"> <li>• This is a case report of a 41-year-old man with severe SARS-CoV-2 pneumonia admitted to the ICU and treated with an individualized rehabilitation program for 9 days, during weaning from mechanical ventilation in the ICU.</li> <li>• Treatment included: a) Postural change and prone position, b) Respiratory training to restore respiratory muscle strength and lung volume, c) Early mobilization and physical exercises and d) Psychological intervention and sleep promotion.</li> </ul>

**Organization of rehabilitation services after COVID-19**

1	Alpalhão V & Alpalhão M. Phys Ther. 2020 <sup>33</sup>	To provide information on clinical practices to reduce the risk of infection for both physical therapists and patients in COVID-19 era	COVID-19 patients, patients in need of rehabilitation and physical therapists	Expert opinion	Acute care, inpatient rehabilitation, outpatient rehabilitation, and home-based settings	Portugal	<p>Recommendations for physical therapists to ensure that they can be delivered also in the COVID-19 era, adopting precautions to reduce the risk of infection spread:</p> <ul style="list-style-type: none"> <li>• Wear disposable PPE, changing it between patients</li> <li>• Reduce the number of patients and therapists in the same physical space</li> <li>• Propose digital physical therapist practice, making use of technology for communicating with and guiding patients</li> </ul>
2	Babu AS, et al. Can J Cardiol. 2020 <sup>27</sup>	To present alternative CR delivery models, implementing the HBCR options	Patients needing CR	Expert opinion	Home-based setting	India and USA	<ul style="list-style-type: none"> <li>• HBCR prescription should be modified due to stay at home orders.</li> <li>• Other types of physical activity should be explored, as: calisthenics, chair-based exercises, resistance and balance exercises, and the use of yoga.</li> <li>• TDCR, a non-supervised delivery of CR with the assistance of technology might be useful in COVID-19 era</li> </ul>
3	Boldrini P, et al. Rehabil Med.	To provide notes for the preparation of PRM services worldwide starting of rehabilitation.	COVID-19 patients	Descriptive qualitative	Acute care, inpatient and rehabilitation	Italy	<ul style="list-style-type: none"> <li>• The first “Covinar”, organized by SIMFER (March 18<sup>th</sup>, 2020) involved the webinar had 230 live viewers (4.5%) out of 5 000 PRM specialists, and more than 1000 recordings.</li> <li>• The participants report an overall difficulty in acting proactively and in defining a</li> </ul>

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	2020 <sup>20</sup>				home-based settings		stable framework for organization and delivery of rehabilitation interventions
4	Carda S, et al. Ann Phys Rehabil Med. 2020 <sup>32</sup>	To report the main clinical manifestations due to COVID-19 and to propose criteria for admission of COVID-19 patients to Rehabilitation Units	COVID-19 patients	Expert opinion	Inpatient rehabilitation, outpatient rehabilitation, and home-based settings	World	<ul style="list-style-type: none"> <li>Main repercussions due to COVID-19 are: respiratory, central nervous system and cognitive, deconditioning, critical-illness-related myopathy and neuropathy, dysphagia, joint stiffness and pain, and psychiatric problems.</li> <li>Admission to a Rehabilitation Unit should be performed based on 4 criteria:               <ol style="list-style-type: none"> <li>≥7 days from diagnosis of COVID-19</li> <li>at least 72 hr with no fever and no fever-reducing medication</li> <li>stable respiratory rate and oxygen saturation</li> <li>clinical and/or radiological evidence of stability</li> </ol> </li> </ul>
5	Chaler J, et al. Eur J Phys Rehabil Med. 2020 <sup>23</sup>	To provide the point of-view by the SERMEF on the impact of COVID-19 outbreak on Rehabilitation Services and PRM specialists activity	COVID-19 patients, patients in need of rehabilitation	Expert opinion	Acute care, inpatient rehabilitation, outpatient rehabilitation, and home-based settings	Spain	<p>The SERMEF proposes to:</p> <ol style="list-style-type: none"> <li>reinforce the academic and training contents of PRM physicians in the area of Internal Medicine</li> <li>to provide resources to launch research projects on the COVID-19 impact on rehabilitation</li> <li>to strengthen the Rehabilitation Services during COVID-19 outbreak</li> </ol>
6	Dalal H, et al. Eur J Prev Cardiol. 2020 <sup>28</sup>	To clarify that there is need of caution in introducing innovative CR techniques	Patients needing CR and respiratory rehabilitation	Expert opinion	Outpatient rehabilitation, and home-based settings	UK	<ul style="list-style-type: none"> <li>Self-managed, home-based interventions are being encouraged</li> <li>Research on the implementation of novel CR approaches is urgently needed</li> </ul>
7	Escalon MX, et al. Am J Phys Med Rehabil. 2020 <sup>24</sup>	To share the experience on COVID-19 pandemic from the PRM Department of Mount Sinai Hospital, New York. U.S.A.	COVID-19 patients, patients in need of rehabilitation	Expert opinion	Acute care, inpatient rehabilitation, outpatient rehabilitation, and home-based settings	U.S.A.	<ul style="list-style-type: none"> <li>COVID-19 patients should be treated like people with ARDS</li> <li>A home monitoring program started for persons with true or suspected COVID-19</li> <li>Their PRM Department provided only essential consultations, as for people in need of intrathecal baclofen pump refill</li> </ul>
8	Falvey JR, et al. Phys Ther. 2020 <sup>35</sup>	To outline how physical therapists can help offload emergency department volume and of meet post-discharge rehabilitation demand for COVID-19 survivors	COVID-19 patients, patients in need of rehabilitation	Expert opinion	Acute care, inpatient rehabilitation, outpatient rehabilitation, and home-based settings	U.S.A.	<ul style="list-style-type: none"> <li>Home- or community-based rehabilitation should be guaranteed to the subset of patients at highest risk for avoidable hospitalization</li> <li>Physical therapists might bring added value to Emergency Department practice for musculoskeletal injuries</li> <li>Physical therapists might have a key role in rehabilitation of post-acute patients</li> </ul>
9	Khan F & Amatya B. J Rehabil Med. 2020 <sup>37</sup>	To underline the role of medical rehabilitation as an integral component of the comprehensive management of the COVID-19 emergency and provide recommendations for rehabilitation approach of the COVID-19 patient.	COVID-19 patients	Expert opinion	Acute care, inpatient rehabilitation	Australia	<ul style="list-style-type: none"> <li>The rehabilitation needs for COVID-19 survivors vary in various settings and over time, yet rehabilitation is essential in all phases of pandemic management.</li> <li>Early rehabilitation is fundamental to promote respiratory function recovery, reduce complications, improve function and, eventually, mitigate cognitive impairment and increase quality of life.</li> <li>Residual disability is expected to affect up to one-third of COVID-19 patients, due to neurologic manifestations occurring in the acute phase, including stroke, impaired consciousness and skeletal muscle injury.</li> <li>Recommendations are provided about organizational (n. 10) and operational issues (n.13) to be considered when planning rehabilitation services in the COVID-19 era.</li> </ul>
10	Lee A. Phys Ther. 2020 <sup>36</sup>	To identify recommendations on digital physical therapist practice and offer future directions in advancing digital practice and		Expert opinion	Home	World	<ul style="list-style-type: none"> <li>COVID-19 presents digital practice opportunities for improved access, high quality, and safety in physical therapy services for both service user and provider.</li> <li>Possible limitations concern: specific federal and state payer guidelines, regulatory hurdles, patient privacy barriers, inadequate technology training, limited</li> </ul>

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							beneficial services. <ul style="list-style-type: none"> <li>The guiding principles require strong provider-patient relationship, valid and reliable evidence, and the conduct of research to show whether telerehabilitation gives more benefits than risks for digital physical therapist practice</li> </ul>
11	Levy J et al., Ann Phys Rehabil Med. 2020 <sup>21</sup>	To describe a model for a ventilator-weaning early rehabilitation unit to deal with post-ICU impairments	COVID-19 ventilator-dependent patients with stable disease and no other organ failure but respiratory or neurological features	Expert opinion	Tertiary care university hospital, post-ICU rehabilitation unit	France	The main features of an organization model representing a possible intermediary stage between ICU and either home discharge or inward rehabilitation are described: <ul style="list-style-type: none"> <li>Beds and rooms dedicated to post-ICU ventilator-dependent COVID-19 patients: each bed equipped with a ventilator and non-invasive continuous monitoring; each room equipped with a lift and harness for transfers.</li> <li>Staff: senior and junior physicians with ICU or ventilator training and expertise. Paramedic staff including rotations of nurses and caregivers per 24 hr. Paramedic staff undergoing a full-day teaching program with the medical staff and a ventilation-specialized nurse before the opening of the unit. Physiotherapists dedicated to motor and cardiorespiratory rehabilitation of patients, and part-time occupational, speech therapists and psychologists.</li> <li>Criteria for admission: Ventilator-dependent patients tracheotomized at least 24 hr before admittance, weaned from vasopressors for 48 hr and without any other organ failure needing invasive support. Before ICU discharge, patients are switched from an ICU ventilator to the weaning unit ventilator with clinical assessment and arterial blood gas analysis after 2 hr.</li> </ul>
12	Mukaino M, Am J Phys Med Rehabil, 2020 <sup>22</sup>	To present a preliminary attempt to use a telerehabilitation system to deliver exercise to isolated individuals.	Patients in need of rehabilitation	Case series	Inpatients acute setting	Japan	<ul style="list-style-type: none"> <li>4 patients underwent telerehabilitation using a tablet while in communication with the physical therapy and being monitored with a pulse oximeter.</li> <li>Patients were overall satisfied with the exercise program (NRS ranged from 8 to 10 with a median of 10), felt meaningful for their health to participate in the program (range 7 to 10, median 10), and they would recommend this exercise to others (range 8 to 10, median 10).</li> </ul>
13	Negrini S, Eur J Phys Rehabil Med., 2020 <sup>21</sup>	To report the contents of the third SIMFER Covinar about the application of telemedicine in rehabilitation.	COVID-19 and rehabilitative outpatients.	Descriptive : qualitative	Outpatient setting	Italy	<ul style="list-style-type: none"> <li>The experience with telemedicine applied on rehabilitative outpatients of 6 clinicians is presented.</li> <li>All the clinicians interviewed underlined that it was feasible and cost-effective.</li> <li>They also clarified that it is not a substitute of the human interaction between patients and doctor. Furthermore, the clinicians presented the many problems related to organization, such as privacy and payment issues.</li> <li>Overall, the consensus was that telemedicine could and must be an integrative solution to common practice.</li> </ul>
14	NICE guideline www.nice.org.uk/guidance/ng159 <sup>19</sup>	To provide recommendations about critical care in adults in the COVID-19 era	Adults needing critical care in the COVID-19 era	Practice guideline	ICU	UK	<ul style="list-style-type: none"> <li>An algorithm supporting decision making for the admission of COVID-19 patients to critical care is described, it links admission of individual adults to critical care on the likelihood of their recovery to an acceptable outcome</li> <li>The following recommendations about how to provide functional prognosis are given: <ul style="list-style-type: none"> <li>assess all adults for frailty, irrespective of COVID-19 status, using an individualized assessment of frailty for any patient aged under 65, or patient of any age with stable long-term disabilities (for example, cerebral palsy), learning disabilities or autism.</li> <li>adopt a standard assessment (the CFS score), as part of a holistic assessment, for people &gt;65 without stable long-term disabilities.</li> <li>involve relevant specialists if needed.</li> <li>record the frailty assessment in the patient's medical record.</li> </ul> </li> </ul>
15	Pedersini P et al, Phys Ther. 2020 <sup>25</sup>	To share insights useful to optimize physical therapy reaction and organization in response to COVID-	Physical therapists	Expert opinion	Acute care, inpatient, outpatient and	Italy	<ul style="list-style-type: none"> <li>The Italian physical therapists response to the emergency is reported.</li> <li>Due to the measures of social distancing undertaken by the government, activity had to be re-organized. Every non-urgent physical therapy treatment had to be</li> </ul>

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					setting.		impossibility to maintain a safe distance. <ul style="list-style-type: none"> <li>• Many therapists provided care in acute care setting in response of the increasing demand due to COVID-19.</li> </ul>
16	Stam HJ et al J Rehabil Med. 2020 <sup>38</sup>	To launch a call for action to acknowledge the need for a coordinated response to the cohort of post-ICU patients	COVID-19 patients	Expert opinion	Acute care and inpatient rehabilitation setting.	Netherlands and Switzerland	<ul style="list-style-type: none"> <li>• Several disabling consequences of severe respiratory illness and intensive care treatments are expected to affect COVID-19 survivors, in the frame of a PICS.</li> <li>• Major risk factors for PICS are cognitive impairments, acute brain dysfunction, hypoxia, hypotension, and glucose dysregulation.</li> <li>• Cognitive impairments may occur in 30% to 80% of post-ICU patients, depending on pre-existing cognitive deficits and age.</li> <li>• Early rehabilitation combining mobilization with physiotherapy is reported to be an important strategy to facilitate and improve long-term recovery and functional independence of patients with PICS, also shortening the duration of ventilation and hospitalization.</li> <li>• Resources should be allocated to facilitate in- and outpatients' rehabilitation interventions for ICU survivors, by promoting an early transfer of patients from ICU to rehabilitation facilities.</li> </ul>
17	Thomas E et al. Eur J Prev Cardiol. 2020 <sup>30</sup>	To provide evidence summary and advice on telehealth as an efficacious and safe solution for patients, family and staff in the domain of cardiac rehabilitation (CR)	People in need of cardiac rehabilitation in countries hit by the COVID-19 outbreak	Expert opinion	Home-based setting.	Australia	<ul style="list-style-type: none"> <li>• Telehealth is both efficacious and safe. Considering more than 30 unique telehealth trials conducted internationally within CR settings, a metanalysis confirms that tele-CR is significantly associated with reduced Hospitalizations and cardiac events.</li> <li>• Practical advices concern the content of messages to be conveyed by tele-CR, the media to be used (email, text messages, Mobile health). Videoconferencing is especially valued as a means to develop a therapeutic rapport, supervise exercise remotely, provide feedback and support, share screens and files for educational and counseling purposes, enhancing efficiency and providing the opportunity for participants to share experience if groups are allowed. Web-based resources, like Cardiac College, can also help.</li> </ul>
18	Torres-Castro R et al. Spinal Cord. 2020 <sup>34</sup>	To alert rehabilitation professionals against the risks of performing aerosol-generating procedures in SCI subjects in the COVID-19 era.	People with cervical SCI in need of rehabilitation in countries hit by the COVID-19 outbreak	Expert opinion	Spine unit or rehabilitation setting for SCI patients	Spain and Chile	<ul style="list-style-type: none"> <li>• People with cervical SCI frequently need aerosol-generating procedures, like NIV and mechanical cough assist.</li> <li>• To ensure staff safety in the COVID-19 era, physiotherapists should wear a waterproof long-sleeved gown, double non-sterile gloves, eye protection (with lateral protection), and a respirator that ensures a level of protection equal to or greater than N95/FFP2.</li> <li>• Physiotherapists should also be aware that exhaled air-jet spreads through the mask's holes up to 91.6 cm, in the case of NIV via a full-face mask in a bi-level setting with a single limb circuit.</li> </ul>
19	Treger I et al. Eur J Phys Rehabil Med. 2020 <sup>26</sup>	To describe changes in the organization of rehabilitation services in a Israeli rehabilitation department	People in need of post-acute rehabilitation in countries hit by the COVID-19 outbreak	Expert opinion	Acute and rehabilitation settings	Israel	Changes to the organization of rehabilitation services have challenged the transfer of acute patients to the appropriate rehabilitation setting. In fact, day rehabilitation services are closed, people prefer to be discharged home than prolong hospitalization in inpatient rehab facilities, home rehabilitation is severely compromised by staff loss and lockdown policies.
20	Yeo TJ et al. Eur J Prev Cardiol. 2020 <sup>29</sup>	To provide a range of options for Cardiac rehabilitation delivery during the COVID-19 crisis and beyond.	People in need of cardiac rehabilitation in countries hit by the COVID-19 outbreak	Expert opinion	Home-based setting.	Singapore	<ul style="list-style-type: none"> <li>• CR is currently underutilised in most countries in spite of its proven efficacy.</li> <li>• The ongoing outbreak has amplified traditional barriers to CR</li> <li>• In this scenario, the authors list a range of CR methods and related barriers to their successful delivery, concluding with a call for enhancing the role of technology to boost CR programs.</li> </ul>

**Impact of COVID-19 on diseases of rehabilitative interest**

Bloem BR. J	COVID-19 pandemic on Parkinson's disease	Parkinson's disease	Expert opinion	as	reduced physical exercise, with a worsening of their motor and non-motor		
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	Parkinsons Dis. 2020 <sup>49</sup>						symptoms. The following is recommended: <ul style="list-style-type: none"> <li>• Apply self-management strategies to reduce stress (e.g., mindfulness), increase coping (e.g., cognitive behavioural therapy) or enhance physical activity (e.g., home-based training programs, online singing, exercise or dancing classes).</li> </ul>
2	Jalali M, et al. Disability & Society. 2020 <sup>46</sup>	To describe the different challenges people with disabilities are facing during the COVID emergency in Iran, and provide advice for the management	People with disabilities	Expert opinion	Community	Iran	<p>Advices for the management of people with disabilities in the COVID-19 era</p> <ul style="list-style-type: none"> <li>• Use tele-rehabilitation for therapy, assessment and follow-up</li> <li>• Provide valid and usable informative materials for people with hearing and visual disability (sign language translator, Braille, audio, and electronic formats) regarding the disease and infection control</li> <li>• Provide educational materials for specific types of disabilities and their families/caregivers</li> <li>• In case of caregivers' illness or quarantine: a substitute caregiver needs to be put in place. A written history of the person with medical and rehabilitation needs should be provided in case of emergency.</li> <li>• In addition to political attempts, humanitarian and charity donations may be necessary to face the poverty of disabled people and the weakness of the health care system to respond to normal daily demands let alone those arising through the COVID-19 emergencies.</li> </ul>
3	Ku PK et al., Head Neck. 2020 <sup>50</sup>	To provide a strategic plan to facilitate safe practice in dysphagia management for health care personnel and patients with dysphagia, without jeopardizing the standard of care.	Patients with dysphagia following surgery for Head and Neck Cancer	Expert opinion	Home setting, hospital	Hong Kong	<ul style="list-style-type: none"> <li>• Defer any non-urgent instrumental swallowing</li> <li>• Screening of TOCC in last 14 days and/or fever, acute respiratory symptoms and/or smell and/or taste disturbances (anosmia, hyposmia, taste loss)</li> <li>• Use telehealth to: <ul style="list-style-type: none"> <li>○ screen and assess swallowing function,</li> <li>○ implement swallowing training,</li> <li>○ monitor and review progress,</li> <li>○ engage home caregivers and plan future services.</li> </ul> </li> <li>• Advice for clinical evaluation through telehealth: <ul style="list-style-type: none"> <li>○ advanced preparation is necessary to ensure the patient has appropriate food and liquid boluses available,</li> <li>○ use clear feeding instruments to allow the clinician to best gauge the size of bolus presented,</li> <li>○ food coloring in boluses to increase visibility, and application of colored tape at the level of the thyroid cartilage to aid in visualization of laryngeal elevation during swallow</li> <li>○ use also quantitative swallowing measures.</li> </ul> </li> <li>• If instrumental assessment is necessary, adopt conservative, high level PPE. VFSS is preferable to FEES.</li> </ul>
4	López-Dolado E & Gil-Agudo A. Spinal Cord. 2020 <sup>48</sup>	To describe the experience of a monographic center for SCI	People with SCI	Expert opinion	National SCI monographic hospital	Spain	<ul style="list-style-type: none"> <li>• Isolate and treat adequately SCI patients with COVID-19</li> <li>• Design and apply the infrastructure to perform face-to-face and remote ongoing rehabilitation treatment using telemedicine support</li> <li>• Continue admission of new patients with acute SCI using enhanced hygiene protection conditions: quarantine them for 7 days in single-use rooms in a dedicated ward. RT-PCR in suspect of COVID-19 infection and, if confirmed, send the patient to the SCI COVID-19 inpatient area.</li> </ul>
5	Mesa Vieira C, et al. Maturitas, 2020 <sup>47</sup>	To analyse the impact of COVID-19 and its prevention measures on the wellbeing of vulnerable populations.	People experiencing disability. Homeless, indigenous, migrant and populations.	Expert opinion	Outpatient and homebased settings.	Switzerland	<ul style="list-style-type: none"> <li>• The authors focused on the most vulnerable populations, including people experiencing disability. During a pandemic, the barriers that impair their access to health care could worsen, and this could put them to an increased sanitary risk.</li> <li>• The author formulated a call for action for policymakers to promote strategies to protect the well-being of the whole population, especially the most vulnerable communities.</li> </ul>

6	Mobasheri A. Case Rep Womens Health. 2020 <sup>51</sup>	To stress the need for exercise for women suffering from osteoarthritis.	Women suffering from osteoarthritis	Expert opinion	Homebased setting.	Finland.	<ul style="list-style-type: none"> <li>• Women with osteoarthritis should be advised about the risks of immobility during social distancing due to COVID-19 and the importance of exercising even during the current crisis,</li> <li>• They should evaluate which kind of exercise are feasible in their house and perform regular physical activity.</li> </ul>
7	NICE guideline <a href="http://www.nice.org.uk/guidance/ng168">www.nice.org.uk/guidance/ng168</a> <sup>39</sup>	To provide recommendations about the community-based care of patients with COPD in the COVID-19 era	People with COPD	Practice guideline	Home-based setting	UK	<p>The guideline provides 43 different recommendations for the management of people with COPD. A few of them may be relevant for the rehabilitation care, as indicated here:</p> <ul style="list-style-type: none"> <li>• Use online pulmonary rehabilitation resources. This covers self-management, home exercise and educational materials</li> <li>• Advise patients currently using airway clearance techniques to continue to do so, adopting precautions to reduce the risk of nebulization when inducing sputum.or using non-invasive ventilation at home</li> </ul>
8	NICE guideline <a href="http://www.nice.org.uk/guidance/ng170">www.nice.org.uk/guidance/ng170</a> <sup>40</sup>	To provide recommendations about the management of people with cystic fibrosis in the COVID-19 era	People with cystic fibrosis	Practice guideline	Hospital and home care setting	UK	<p>The guideline provides 36 different recommendations for the management of people with cystic fibrosis Many of them are relevant for rehabilitation care, as indicated here:</p> <p>Patients without COVID-19 infection</p> <ul style="list-style-type: none"> <li>• Communicate with patients, their families and carers, and support their mental health and wellbeing to help alleviate any anxiety and fear they may have about COVID-19.</li> <li>• Minimise face-to-face contact to reduce the risk of infection by video-consultation or any other remote communication aid</li> <li>• Tell patients, their families and carers to continue with all their usual self-care arrangements including.</li> <li>• Monitor patients with cystic fibrosis closely, because they may be at greater risk of rapid deterioration if they contract COVID-19.</li> <li>• Specialist cystic fibrosis centres should maintain sufficient inpatient beds and facilities for those patients for whom a hospital admission is essential</li> </ul> <p>Patients with suspect COVID-19</p> <ul style="list-style-type: none"> <li>• Ensure that relevant members of the cystic fibrosis team are involved in decisions about the care of patients with suspected COVID-19, including escalation of treatment</li> <li>• Alert patients and family members against the risks of infectious aerosol generating procedures</li> </ul>
9	NICE guideline <a href="http://www.nice.org.uk/guidance/ng167">www.nice.org.uk/guidance/ng167</a> <sup>41</sup>	To provide recommendations for the management of people with rheumatological autoimmune, inflammatory and metabolic bone disorders in the COVID-19 era	People with rheumatologica l autoimmune, inflammatory and metabolic bone disorders	Practice guideline	Hospital and home care setting	UK	<p>The guideline provides 42 different recommendations for the management of people with rheumatological autoimmune, inflammatory and metabolic bone disorders. A few of them are relevant for rehabilitation care, as indicated here:</p> <p>Patients without COVID-19 infection</p> <ul style="list-style-type: none"> <li>• Communicate with patients and support their mental wellbeing, to help alleviate any anxiety and fear they may have about COVID-19.</li> <li>• Minimise face-to-face contact</li> <li>• In musculoskeletal services, prioritise rehabilitation for patients who have had recent elective surgery or a fracture, and for those with acute or complex needs (including carers).</li> </ul> <p>Patients with known or suspect COVID-19</p> <ul style="list-style-type: none"> <li>• Continue hydroxychloroquine and sulfasalazine</li> <li>• Do not suddenly stop prednisolone</li> <li>• Only give corticosteroid injections if the patient has significant disease activity and there are no alternatives</li> <li>• Temporarily stop other disease-modifying antirheumatic drugs, IAK inhibitors and</li> </ul>

10	Righi G, et al. Spinal Cord Ser Cases. 2020 <sup>44</sup>	To report the first case of COVID-19 in a tetraplegic person in Italy.	Tetraplegic COVID-19 patient	Case report	Outpatient, inpatient settings	Italy	<ul style="list-style-type: none"> <li>• Case report of a 56-year-old tetraplegic male developing COVID-19.</li> <li>• The patient never exhibited coughing, and did not develop severe symptomatology, in spite of its disability</li> </ul>
11	Singh R, et al. Eur J Phys Rehabil Med. 2020 <sup>53</sup>	To share early experience with COVID-19 in the UK.	Patients in need of rehabilitation	Expert opinion	Inpatient rehabilitation, outpatient rehabilitation, and home-based settings	UK	<ul style="list-style-type: none"> <li>• The following measures taken in UK to limit the spread of COVID-19 infection are expected to impact on patients in need of rehabilitation:</li> <li>• Many inpatients wards, especially rehabilitative wards, have been cleared.</li> <li>• Most face-to-face appointments have been switched to telephone appointments with mixed review.</li> <li>• The pandemic has interfered even with medical learning, as it is impossible for students to get access to the patients.</li> <li>• Eventually, the number of disabled people is expected to increase as most COVID-19 survivors will exhibit functional impairment.</li> </ul>
12	Solé G, et al. Revue Neurologique. 2020 <sup>42</sup>	To provide a practice guideline to homogenize the management of NMD patients within the French territory, in the COVID-19 era	People with NMD in countries hit by the COVID-19 outbreak	Practice guideline	Hospital and home care setting	France	<p>The FILNEMUS advises the following strategies for the management of NMD:</p> <ol style="list-style-type: none"> <li>1) reserve hospitalization for emergencies, urgent diagnostic approaches (as in case of Guillain-Barre´ syndrome, or myasthenia gravis)</li> <li>2) offer hospital care for treatments, check-ups and cardiorespiratory assessments for which the delay may result in a loss of survival chance;</li> <li>3) ensure teleconsultations be conducted by a doctor, a resident, or a coordinator nurse, to verify that the cancellation of the hospitalization will not harm the patient.</li> <li>4) make support systems available (e.g., illustrated sheets with links to online videos) for self-rehabilitation and exercises, to cope with the cessation of regular in-house or office care by the rehabilitation team;</li> <li>5) continue nusinersen intrathecal injections in patients with type 1 SMA and among young children with type 2 SMA.</li> <li>6) do not stop immunosuppressants in patients with a dysimmune pathology in the absence of any manifestations suggestive of COVID-19;</li> <li>7) clearly identify patients with a good prognosis, who may be eligible for resuscitation admission in ICU;</li> <li>8) adopt measures to adapt the circuit and the use of NIV to limit nebulization and continue using NIV in ventilator-dependent patients.</li> </ol>
13	Stillman MD, et al. Spinal Cord Ser Cases. 2020 <sup>43</sup>	To investigate COVID-19 screening practices and availability of screening kits among rehabilitation professionals caring for people living with SCI.	People with SCI in countries hit by the COVID-19 outbreak	Descriptive qualitative	Spine units	World	<ul style="list-style-type: none"> <li>• This worldwide survey collected 783 responses, highlighting substantial variability in the rehabilitation medicine community in COVID-19 screening practices and availability of screening kits.</li> <li>• Only 5.8% respondents had tested their outpatients with SCI for COVID-19, and 4.4% reported having a patient with SCI with the virus. Screening of inpatients was performed only for symptomatic individuals in 53.3% cases or never in 29.9% cases.</li> <li>• Patients with SCI are worried for their vulnerability to infection (76.9%) and fragility of caretaker supply (42%).</li> </ul>
14	Veerapandiyar A, et al. Muscle Nerve. 2020 <sup>45</sup>	To provide recommendations pertaining to care of patients with DBMD in the COVID-19 era.	People with DBMD in countries hit by the COVID-19 outbreak	Expert opinion	Hospital and home care setting	USA	<p>The following main recommendations are provided, concerning the care of patients with DBMD:</p> <ul style="list-style-type: none"> <li>• Continue treatment with corticosteroids, Exon skipping medications, and Angiotensin converting enzyme inhibitors and/or angiotensin receptor blockers (for prophylaxis or treatment of cardiomyopathy).</li> <li>• Do not prescribe Hydroxychloroquine.</li> <li>• Treat patients with chronic respiratory insufficiency in collaboration with pulmonary and/or anaesthesiology specialists, avoiding the use of supplemental oxygen without ventilatory support.</li> <li>• Continue multidisciplinary care for these patients using telehealth.</li> </ul>



Chest Dis. 2020 <sup>52</sup>	strategies to overcome them in the COVID-19 era and beyond	rehabilitation in countries hit by the COVID-19 outbreak	is drastically reduced due to postponement of all elective activities. Conversely, the proportion of STEMI vs NSTEMI has increased, as only patients with worse symptoms are hospitalized, while those with mild symptoms or chronic conditions (see heart failure) prefer to stay at home. The CR section of EAPC recommends setting priorities for referral to CR, increase patients turnover, adopt precautions during training, shorten the programs, keep track of discharged patients and follow them with remote assessment. In the near future, CR units should be prepared to face the needs of patients with acute coronary syndrome or with worsening heart failure whose features could be similar to that of pre-PTCA era, with more frequent STEMI, left ventricular systolic dysfunction, poorer physical function for longer inactivity and poorer prognosis.			
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**Late complications due to COVID-19 that may be of rehabilitative interest**

1	Coraci D, et al. J Med Virol. 2020 <sup>54</sup>	To provide information on the support that rehabilitation might provide for COVID-19 patients, taking into account the possible relationship between respiratory failure and neuroinvasion of SARS-CoV-2.	COVID-19 patients, patients in need of rehabilitation	Expert opinion	Acute care, inpatient rehabilitation, outpatient rehabilitation, and home-based settings	Italy	<ul style="list-style-type: none"> <li>Rehabilitation could play a relevant role for the management of post-acute COVID-19 patients preventing secondary impairments, due to immobilization syndrome, and critical illness of neuropathy and myopathy</li> </ul>
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Abbreviations: ARDS: acute respiratory distress syndrome; COPD = chronic obstructive pulmonary disease; COVID-19= COroNaVIrus Disease 19; Covinar= COVID-19 webinar; CFS= Clinical Frailty Scale; CR= cardiac rehabilitation; DBMD=Duchenne Becker Muscular Dystrophies; EAPC= European Association of Preventive Cardiology; FEES= Fiberoptic Endoscopic Evaluation of Swallowing; FILNEMUS = French Rare Health Care for Neuromuscular Diseases Network; HBCR= home-based cardiac rehabilitation; ICU= intensive care unit; NIV = non-invasive ventilation; NMD= Neuromuscular Disorders; ORL= Otorhinolaryngology; PICS= Post-Intensive Care Syndrome; PPE= personal protective equipment; PRM= Physical and Rehabilitation Medicine; PTCA= percutaneous transluminal coronary angioplasty; QoL= quality of life; SARS-CoV-2= Severe Acute Respiratory Syndrome - Coronavirus - 2; SCI= Spinal Cord Injury; SF36=Short Form (36) Health Survey; SIMFER= Italian Society of Physical Medicine and Rehabilitation; SERMEF= Spanish Society of Physical Medicine and Rehabilitation; SMA= Spinal muscular atrophy; STEMI= ST elevation myocardial infarction; TDCR= technology driven cardiac rehabilitation; TOCC= Travel, Occupation, Contact and Clustering; UK= United Kingdom; U.S.A. = United States of America; VFSS= Videofluoroscopic Swallowing Study; 6MWT= 6-meter walking test.

Figure 1. PRISMA flow diagram.

