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PHYSIOTHERAPEUTIC TREATMENTS RELEVANT IN SEQUELAE AFTER COVID-19

TRATAMENTOS FISIOTERAPÊUTICOS RELEVANTES NAS SEQUELAS PÓS-COVID 19

TRATAMIENTOS FISIOTERAPÉUTICOS RELEVANTES EN SECUELAS TRAS COVID-19

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ABSTRACT
To compile and discuss physiotherapeutic treatments after sequelae from COVID-19. This is a literature review for methodological purposes. As a guiding question, the following question was elaborated: "What are the relevant physiotherapeutic treatments in post-covid sequelae and their importance?". Searches for articles in the PEDRO, VHL, MEDLINE, and PubMed databases were used, using the descriptors Post-Acute COVID-19 Syndrome, rehabilitation, and physiotherapy. After reading titles, abstracts and, when necessary, reading in full, the manuscripts were selected, seeking a direct relationship with the objective and guiding question of the study. We found 864 articles that, after screening, identified 19 studies within the scope of this review. It was found that those patients with sequelae acquired by COVID-19 can benefit from early mobilization in a hospital environment, post-discharge exercises, and tele-rehabilitation services.
Keywords: *COVID-19; Post-Acute COVID-19 Syndrome; Rehabilitation; Physiotherapy*.

RESUMO
Compilar e discutir sobre os tratamentos fisioterapêuticos pós-sequelas advindas da COVID-19. Trata-se de uma revisão de literatura para fins metodológicos. Como questão norteadora, foi elaborada a seguinte pergunta: “Quais os tratamentos fisioterapêuticos relevantes nas sequelas pós-covid e sua importância?”. Foram utilizados procurados por artigos nas bases de dados PEDRO, BVS, MEDLINE e PubMed, utilizando os descritores Síndrome Pós-COVID-19 Aguda, reabilitação e fisioterapia. Após leitura de títulos, resumos e, quando necessária, a leitura na íntegra, os manuscritos foram selecionados, buscando a relação direta com o objetivo e a questão norteadora do estudo. Foram encontrados 864 artigos que, após triagem, identificaram-se 19 estudos dentro do escopo desta revisão. Foi constatado que aqueles pacientes com sequelas adquiridas por COVID-19 podem-se beneficiar de mobilizações precoce em ambiente hospitalar, exercícios pós-alta hospitalar e serviços de tele reabilitação.
Descritores: *COVID-19; Síndrome Pós-COVID-19 Aguda; Reabilitação; Fisioterapia*.

RESUMEN
Recopilar y discutir tratamientos fisioterapéuticos tras secuelas de COVID-19. Esta es una revisión de la literatura con fines metodológicos. Como pregunta orientadora se elaboró la siguiente pregunta: “¿Cuáles son los tratamientos fisioterapéuticos relevantes en las secuelas post-covid y su importancia?”. Se utilizaron búsquedas de artículos en las bases de datos PEDRO, BVS, MEDLINE y PubMed, utilizando los descriptores Síndrome Post Agudo de COVID-19, rehabilitación y fisioterapia. Después de la lectura de títulos, resúmenes y, cuando fue necesario, lectura completa, los manuscritos fueron seleccionados, buscando una relación directa con la pregunta objetivo y orientadora del estudio. Se encontraron 864 artículos que, después de la selección, identificaron 19 estudios dentro del alcance de esta revisión. Se encontró que aquellos pacientes con secuelas adquiridas por COVID-19 pueden beneficiarse de la movilización temprana en un ambiente hospitalario, ejercicios posteriores al alta y servicios de tele-rehabilitación.
Descriptores: *COVID-19; Síndrome Post Agudo de COVID-19; Rehabilitación; Fisioterapia*.

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INTRODUCTION

At the end of 2019, in the city of Wuhan, China, there was an outbreak of pneumonia of unknown cause. The disease quickly spread, causing great concern due to the high number of people infected and dead[1]. In Brazil, the first confirmed case was on February 25, 2020, and on March 11, the World Health Organization (WHO) classified COVID-19 as a pandemic[2]. In February 2022, there were more than 26 million confirmed cases, with approximately 635,000 deaths in the country[3].

Patients with COVID-19 have varying degrees of impairment in their respiratory, physiological and psychological functions. Those who are discharged and return home after hospitalization are at high risk of adverse health effects, such as decreased respiratory movement, muscle weakness and decreased metabolism rate[4]. In addition, it has been noted that community-acquired pneumonia affected by COVID-19 has resulted in a decrease in Activities of Daily Living (ADL) and Quality of Life (QOL), accompanied by a decrease in physical and mental function[5].

Studies point to acute shortness of breath, myalgia and fatigue as symptoms[6], which resemble other serious respiratory illnesses, such as influenza. However, it has also been recognized that ongoing symptoms can last for several months after being infected, including pain, fatigue, difficulty thinking, dizziness and insomnia[7]. Health services have been working exhaustively and are mainly focused on maximizing the survival of those infected, emphasizing the improvement of health care facilities and sufficient pharmacological treatments, along with mass vaccination.[6]

Some of the short- and long-term symptoms may be responsive to rehabilitation to aid recovery, such as pain and fatigue, which will impact on functional capacity, participation and quality of life[8]. The International Classification of Functioning, Disability and Health has highlighted the importance of rehabilitation after COVID-19, starting from the hospital environment and then moving on to secondary and tertiary care, in which each patient must be assessed, as the sequelae and previous comorbidities in the respiratory system and other systems will be the basis of the treatment plan to be created individually[9].

Pragmatic recommendations were quickly developed, including the management of recovery soon after illness[10]. The physiotherapist is one of the professionals considered extremely important in the management of these patients. By determining the severity of the dysfunction observed in them, treatment is essential to improve physical and cognitive functioning and reduce the risk of disability and morbidity[11]. Observing the number of positive cases of the disease in Brazil, it is assumed that many patients will require physiotherapeutic interventions for functional recovery in the medium and long term. With this in mind, the aim of this study is to compile and discuss physiotherapeutic treatments after COVID-19.

METHODS

This study is a literature review for methodological purposes. This research design makes it possible to synthesize and evaluate the available evidence on the subject under investigation in its final product, providing a composite of the current state of knowledge and reflections for complementing new interventions[12]. Between October 2021 and

February 2022, searches were carried out for publications, as well as texts and reliable articles, indexed in the following databases: PEDRO, BVS, MEDLINE and *PubMed*, in which different articles on the subject of the study were defined and cataloged.

The guiding question was: "What are the relevant physiotherapy treatments for post-COVID sequelae and their level of evidence?"

The following health descriptors (decs.bvs.br) were used to select the articles: *Post-Acute COVID-19 Syndrome, rehabilitation* and *physiotherapy* in Portuguese, *Post-Acute COVID-19 Syndrome, physiotherapy* and *rehabilitation in* English and Síndrome *Post Agudo de COVID-19 e rehabilitacíon* in Spanish.

The inclusion criteria for the study were only articles with texts that addressed physiotherapy treatment in sequelae after severe respiratory syndromes, including COVID-19, as well as its definition and benefits to the participant, published in Portuguese, Spanish and English. The exclusion criteria were epidemiological studies, simple and expanded abstracts, articles that did not address the topic in question and those that were not available to read in full. It should also be noted that articles found in more than one database were only counted once.

The selection was made by reading the titles, abstracts and, when necessary, reading the texts in their entirety in order to select them according to the inclusion and exclusion criteria. The articles were evaluated, looking for a direct relationship with the study's objective and guiding question.

RESULTS

In the database search, 864 studies were identified; of these, 845 were excluded after screening the full text or abstract because they did not meet the inclusion criteria. A total of 19 studies were finally included in the results and discussion.

Evidence Results by Intervention

EARLY MOBILIZATION IN A HOSPITAL ENVIRONMENT

A systematic review with meta-analysis[13], which included 23 clinical trials and more than 2,300 participants, found a significant reduction in the incidence of ICU-acquired weakness after physiotherapeutic interventions, especially early mobilization, which included flexibility, strength training and mobility training. However, muscle strength was not altered or improved after discharge from the ICU. Despite this, the findings of these clinical trials show that, regardless of the technique and periods of mobilization the patients underwent, there is evidence that early mobilization appears to be safe to start in the ICU environment. In addition, there is evidence that this early mobilization seems to reduce the incidence of muscle weakness acquired in the ICU, helping to improve functional capacity, as well as providing a greater number of patients who are able to stand, reducing the number of days on mechanical ventilation and, above all, improving the discharge rate without a concomitant increase in the rate of adverse events[13].

The ideal time to start mobilization was reported in another meta-analysis[14] by Ding and colleagues, which found that 48 to 72 hours of mechanical ventilation is the ideal time to start these interventions, with improved clinical results. Despite this

suggested timeframe, the clinical team that monitors each patient should consider the most appropriate time to start the mobilization of maneuvers. Despite the findings of this study, the authors do not rule out the need to assess the long-term repercussions of this early mobilization[14].

There are many benefits to early mobilization; however, walking and functional capacity are the outcomes most likely to improve after treatment[15]. Adverse events, when reported, were few, and no mortality events were found[13]. Despite these findings, the efficacy of early mobilization for critically ill and mechanically ventilated patients in the intensive care unit is still inconsistent and uncertain, since the evidence available to date is still scarce and of low quality. The possible adverse effects have also been analyzed. Studies still differ widely on the type, timing, intensity and progression of interventions carried out on critically ill patients in the ICU[15].

Despite this, it is important to consider strategies that can improve and/or optimize patients' recovery, in order to reduce the sequelae of post-Covid, whether due to the problems caused by the infection itself, or the immobilization time resulting from hospitalization, which can extend over a prolonged period, varying from patient to patient.

POST-DISCHARGE EXERCISES

In two clinical trials and a qualitative study[17,18,19] involving 223 participants with an average age of 65, in which exercise interventions were evaluated, no adverse events were observed. Lau and colleagues[17] show the effectiveness of a six-week intensive physical training program supervised by a group of physiotherapists. The effects of this training could be seen in the improvement of cardiorespiratory and musculoskeletal performance in patients recovering from severe acute respiratory syndrome (SARS). However, no impact of this training on health-related quality of life was identified.

On the other hand, although Battle et al. did not find a significant improvement in physical function, probably due to the size of the sample or the lack of sensitivity in the test applied to the patients, they did reveal a significant improvement in anxiety and balance levels at 12 months, when compared to the control group[18]. This finding shows the importance of the gradual reintroduction of physical activities after hospitalization, aimed not only at the patient's physical improvement, but also at rehabilitation and overall improvement after the hospitalization period.

Ferguson and colleagues[19] found that carrying out an exercise program led to feelings of improvement in physical and mental health recovery. However, engagement in exercise was impaired in those with lower levels of physical ability and mental health, while individually tailored programs provided confidence and motivation.

A clinical trial[20] showed that, in addition to exercise, mobility techniques, bronchial hygiene after long critical stays is safe and has a beneficial effect on respiratory muscles, lung function and quality of life. In this study, maximum inspiratory/expiratory pressures, forced volumes, blood gases, dyspnea, respiratory rate, disability, peripheral strength measures, perceived health status, patient compliance/satisfaction, safety and costs were evaluated.

TELE-REHABILITATION

Although it has come to the fore in Brazil with the progression of the COVID-19 pandemic and the impossibility of physical contact or moving users across territories, tele-rehabilitation had already been discussed and studied years before the first case of SARS-CoV-2 appeared, a virus from the coronavirus family that causes COVID-19. Remote rehabilitation was originally intended to be a solution to the growing demand, especially from elderly patients, and to the shortage of resources and trained staff[21]; thus, it appears to be a treatment opportunity, but one which, like all others, has advantages and disadvantages.

According to Esquivel et al[21], the main advantage of telerehabilitation is the possibility of changing patient behavior, since in this type of care, patients are enabled to be active participants in their own recovery, interfering in lifestyle changes with healthier habits, encouraging independence and avoiding trips to face-to-face treatments. In the long term, these changes can have a financial impact, especially in terms of reducing costs for patients. However, for this type of service to become sustainable and feasible in the long term, health services need to be reorganized.

On the other hand, as disadvantages or challenges imposed by telerehabilitation, we can clearly see those related to the use of technology. Thus, the profile of the patients for whom the telerehabilitation program is being designed must be considered, as well as the human resources available to implement and support this service, and their level of training and mastery of the technology. In addition, in order to ensure usability and adherence to telerehabilitation, a system must be designed based on simplicity of design, ease of use, understanding and management, and security[21].

Clinical rehabilitation services in this model are diverse, including assessment, monitoring, prevention, intervention, supervision, education, consultation and counseling. Even before the emergence of COVID-19 cases, Marquis et al. proposed the use of pulmonary telerehabilitation for patients with chronic obstructive pulmonary disease (COPD)[22]. Through an *online* program that included physical training and self-management education, they proposed an effective treatment for patients with moderate to very severe COPD[22].

For healthcare teams, the benefits include a smaller flow of patients and companions in person at the clinic, since all that is needed for a telerehabilitation service is a small workspace and two therapists, one of whom watches the screen, ensuring patient safety, and the other demonstrates the exercises to be performed, and also helps to maintain social distancing within the workplace. Virtual waiting rooms can be created and monitored remotely by an administrator, making it more cost-effective. As disadvantages in telerehabilitation, the use of digital products and applications can be extremely difficult for some patients, although using a basic telephone installation as a minimum tool for screening assessment is already a remote support reality for most services. Nowadays, most people have access to a telephone, although internet access is not universal[10].

DISCUSSION

Post-COVID-19 syndrome, defined by the UK National Health Service (NHS) as unexplained and persistent signs or symptoms over 12 weeks, developed during or after COVID-19 infection, includes ongoing symptomatic COVID-19 (4 to 12 weeks) and post-COVID-19 syndrome (≥12 weeks). The true prevalence of post-COVID-19 syndrome is not yet known. According to data from the UK Office for National Statistics (ONS), on April 1, 2021, of the more than 20,000 people who tested positive between April 26, 2020 and March 6, 2021, mainly not hospitalized (90%), 13.7% remained symptomatic after 12 weeks of evolution[23].

It is estimated that post-COVID-19 clinical manifestations last two weeks in mild cases and between 3 and 12 weeks in more severe cases. It was later realized that these periods are only indicative, as these symptoms are more correlated to the individuality presented by each patient, such as age, pre-existing comorbidities[23]. Fatigue associated with neurocognitive symptoms are the most debilitating characteristics and have the greatest impact on the quality of life of patients with post-COVID-19 syndrome[24], which corroborates the study carried out by Davis et al[25] in which they showed that the most common symptoms reported by a sample of 3,762 respondents from 56 countries, after 6 months of contamination, were: fatigue (77.7%), post-stress malaise (72.2%) and cognitive dysfunction (55.4%).

There have been several intervention strategies to help improve the sequelae of COVID-19. This study found that early mobilization, exercises associated with post-discharge mobilization and telerehabilitation showed significant results in reducing functional symptoms, and that these techniques complement each other for effective treatment. Early mobilization has been associated with a reduction in post-hospitalization weakness acquired in the ICU through physiotherapeutic techniques, as well as reducing the period of need for mechanical ventilation and speeding up hospital discharge[13]. However, studies on this subject are still scarce. It is possible to state that this intervention is safe and that it facilitates functional recovery, predominantly in terms of gains in muscle strength and performance of some activities. There is no consensus on the intensity, frequency and duration of interventions, but there is evidence to suggest that structured and individualized programs can facilitate the recovery of the critically ill[16].

A number of studies have emerged providing recommendations for the rehabilitation of those recovering from COVID-19[26]. Physical exercise has been shown to be beneficial in multiple diseases, with which the post-COVID-19 syndrome shares similarities, both in terms of symptoms and their possible pathogenic mechanisms. It is worth considering the potential favorable effect this can have on the recovery of these patients. Valenzuala and collaborators[28] mention that exercise reduces immunosenescence, maintaining the peripheral space of T cells and natural *killer* cell compartments, which suggests an improvement in the immune response to SARS-CoV-2 antigens.

In a summary of recommendations[29], it is shown that, in the absence of a full cardiorespiratory assessment (including a stress electrocardiogram), it is recommended to offer low-intensity functional exercises, with a perceived exertion (dyspnea and muscle fatigue) ≤ 3 on the 10-point modified *Borg Scale*. It is important to bear in mind that

patients can deteriorate quickly. Sessions should last between 20 and 30 minutes, 3 to 5 times a week. On the other hand, it should be noted that exhaustive and excessive exercise training can cause induction of a deregulated systemic inflammatory response, due to mitochondrial functional impairment, thus being detrimental to health[23]. Thus, exercise prescriptions should be carried out in an individual, monitored manner, tailored to each individual with COVID-19 sequelae, which is essential to bring about positive adaptive changes to improve immune function.

Due to the current circumstances related to the pandemic, with the impact on care and the availability of professionals able to provide face-to-face care, tele-rehabilitation offers a quick and easily available means of therapeutic provision and can be used to increase the delivery of therapy to patients[10]. Remote rehabilitation can improve the quality of health service provision. Methods using remote means for rehabilitation are not new. Countries with isolated communities have had to use technology to offer access on a par with face-to-face services and provide more efficient use of professionals' time and costs[21].

Telerehabilitation systems in physiotherapy treatment are advantageous for remote monitoring of prescribed exercises, which can be performed *online* and *offline*, and for monitoring oxygen saturation status and cardiovascular parameters. It is recommended that this resource be used by patients who are independent in their activities of daily living[30]. On the other hand, the disadvantage of this resource is that the complexity and the patient's understanding of how to navigate the systems chosen to provide care often hampers clinical effectiveness due to restricted participation.[10]

Finally, the limitations of this study include the fact that it was decided to conduct a literature review, which may not have covered the complexity of the subject, considering the recent SARS-CoV-2 infection. For this reason, it was necessary to use articles that consider the rehabilitation of patients in contexts other than just coronavirus infection *per se*, but that can be extrapolated to this, considering that the period of hospitalization in an intensive care unit can reach long periods, and is not exclusive to the treatment of this disease.

CONCLUSION

Based on the evidence researched, this literature review found that patients with sequelae acquired by COVID-19 can benefit from early mobilization in a hospital setting, post-discharge exercise, and physiotherapy telecare services. However, due to the novelty of the disease, it is suggested that more in-depth studies are needed to determine and establish the management of intensity, load, and individuality of exercises, both early and post-COVID-19, and to improve patient adherence to remote care.

REFERENCES

1. Ghelichkhani P, Esmaeili M. Prone Position in Management of COVID-19 Patients; a Commentary. Arch Acad Emerg Med [Internet]. 2020 [cited 2022 Feb 16]; e48–8. Available from: https://pesquisa.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/resource/en/covidwho-100663

2. Cascella M, Rajnik M, Cuomo A, Dulebohn SC, Di Napoli R. Features, Evaluation, and Treatment of Coronavirus [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2020. Available from: https://pubmed.ncbi.nlm.nih.gov/32150360/
3. BRASIL. Coronavírus Brasil [Internet]. covid.saude.gov.br. 2022. Available from: https://covid.saude.gov.br/
4. Prvu Bettger J, Thoumi A, Marquevich V, De Groote W, Rizzo Battistella L, Imamura M, et al. COVID-19: maintaining essential rehabilitation services across the care continuum. searchbvsaludorg [Internet]. 2020 [cited 2022 Feb 17]; Available from: https://search.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/resource/pt/covidwho-213425
5. Mikolajewska A, Witzenrath M. Ambulant erworbene Pneumonie bei Erwachsenen. DMW - Deutsche Medizinische Wochenschrift. 2020 Mar;145(06):359–70.
6. Docherty AB, Harrison EM, Green CA, Hardwick HE, Pius R, Norman L, et al. Features of 20 133 UK patients in hospital with covid-19 using the ISARIC WHO Clinical Characterisation Protocol: prospective observational cohort study. BMJ [Internet]. 2020 May 22;369. Available from: https://www.bmj.com/content/369/bmj.m1985
7. Goodwin VA, Allan L, Bethel A, Cowley A, Cross JL, Day J, et al. Rehabilitation to enable recovery from COVID-19: a rapid systematic review. Physiotherapy. 2021 Feb;
8. Scheiber B, Spiegl C, Wiederin C, Schifferegger E, Schiefermeier-Mach N. Post-COVID-19 Rehabilitation: Perception and Experience of Austrian Physiotherapists and Physiotherapy Students. International Journal of Environmental Research and Public Health [Internet]. 2021 Aug 18;18(16):8730. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8394152/
9. Sheehy LM. Considerations for Postacute Rehabilitation for Survivors of COVID-19. JMIR Public Health and Surveillance. 2020 May 8;6(2):e19462.
10. Salawu A, Green A, Crooks MG, Brixey N, Ross DH, Sivan M. A Proposal for Multidisciplinary Tele-Rehabilitation in the Assessment and Rehabilitation of COVID-19 Survivors. International Journal of Environmental Research and Public Health. 2020 Jul 7;17(13):4890.
11. Shan MX, Tran YM, Vu KT, Eapen BC. Postacute inpatient rehabilitation for COVID-19. BMJ case reports [Internet]. 2020 [cited 2022 Feb 17]; Available from: https://pesquisa.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/resource/pt/covidwho-725540
12. Mowbray PK, Wilkinson AJ, Tse HHM. An Integrative Review of Employee Voice: Identifying a Common Conceptualization and Research Agenda [Internet]. papers.ssrn.com. Rochester, NY; 2015 [cited 2022 Feb 17]. Available from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2628427
13. Zhang L, Hu W, Cai Z, Liu J, Wu J, Deng Y, et al. Early mobilization of critically ill patients in the intensive care unit: A systematic review and meta-analysis. Patman S, editor. PLOS ONE. 2019 Oct 3;14(10):e0223185.
14. Ding N, Zhang Z, Zhang C, Yao L, Yang L, Jiang B, et al. What is the optimum time for initiation of early mobilization in mechanically ventilated patients? A network meta-analysis. Bhatt GC, editor. PLOS ONE. 2019 Oct 7;14(10):e0223151.
15. Doiron KA, Hoffmann TC, Beller EM. Early intervention (mobilization or active exercise) for critically ill adults in the intensive care unit. Cochrane Database of Systematic Reviews. 2018 Mar 27;
16. Azevedo P, Gomes B. Effects of early mobilisation in the functional rehabilitation of critically ill patients: a systematic review. Revista de Enfermagem Referência. 2015 Jun 30; No5(IV Série):129–38.
17. Lau HM-C, Ng GY-F, Jones AY-M, Lee EW-C, Siu EH-K, Hui DS-C. A randomised controlled trial of the effectiveness of an exercise training program in patients recovering from severe acute respiratory syndrome. The Australian Journal of Physiotherapy [Internet]. 2005;51(4):213–9. Available from: https://pubmed.ncbi.nlm.nih.gov/16321128/
18. Battle C, James K, Temblett P, Hutchings H. Supervised exercise rehabilitation in survivors of critical illness: A randomised controlled trial. Journal of the Intensive Care Society [Internet]. 2018 Apr 4;20(1):18–26. Available from: https://journals.sagepub.com/doi/pdf/10.1177/1751143718767061
19. Ferguson K, Bradley JM, McAuley DF, Blackwood B, O'Neill B. Patients' Perceptions of an Exercise Program Delivered Following Discharge From Hospital After Critical Illness (the Revive Trial). Journal of Intensive Care Medicine [Internet]. 2017 Aug 22 [cited 2019 Nov 10];34(11-12):978–84. Available from: https://journals.sagepub.com/doi/full/10.1177/0885066617724738

20. Vitacca M, Barbano L, Vanoglio F, Luisa A, Bernocchi P, Giordano A, et al. Does 6-Month Home Caregiver-Supervised Physiotherapy Improve Post-Critical Care Outcomes? American Journal of Physical Medicine & Rehabilitation. 2016 Aug;95(8):571–9.
21. Esquivel KM, Nevala E, Alamaki A, Condell J, Kelly D, Davies R, et al. Remote rehabilitation: a solution to overloaded & scarce health care systems. Trends in Telemedicine & E-health [Internet]. 2018 Aug 27 [cited 2022 Feb 16];1–19. Available from: https://cora.ucc.ie/handle/10468/7271
22. Marquis N, Larivée P, Saey D, Dubois M-F, Tousignant M. In-Home Pulmonary Telerehabilitation for Patients with Chronic Obstructive Pulmonary Disease: A Pre-experimental Study on Effectiveness, Satisfaction, and Adherence. Telemedicine and e-Health [Internet]. 2015 Nov [cited 2020 Apr 16];21(11):870–9. Available from: http://www.telereadaptation.com/wp-content/uploads/2015/09/Article-T%C3%83%C2%A9l%C3%83%C2%A9MPOC1_efficacit%C3%83%C2%A9.pdf
23. Jimeno-Almazán A, Pallarés JG, Buendía-Romero Á, Martínez-Cava A, Franco-López F, Sánchez-Alcaraz Martínez BJ, et al. Post-COVID-19 Syndrome and the Potential Benefits of Exercise. International Journal of Environmental Research and Public Health [Internet]. 2021 May 17 [cited 2021 Sep 2];18(10). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8156194/
24. Halpin S, O'Connor R, Sivan M. Long COVID and chronic COVID syndromes. Journal of Medical Virology. 2020 Oct 30;93(3):1242–3.
25. Davis HE, Assaf GS, McCorkell L, Wei H, Low RJ, Re'em Y, et al. Characterizing long COVID in an international cohort: 7 months of symptoms and their impact. EClinicalMedicine. 2021 Jul;101019.
26. Danbury C, Brown C. Rehabilitation in the wake of Covid-19 - A phoenix from the ashes British Society of Rehabilitation Medicine (BSRM) [Internet]. [cited 2022 Feb 17]. Available from: https://www.bsrm.org.uk/downloads/covid-19bsrmissue2-9-5-2020-forweb11-5-20.pdf
27. Sales EMP, Santos JKM, Barbosa TB, Santos AP dos. FISIOTERAPIA, FUNCIONALIDADE E COVID-19: REVISÃO INTEGRATIVA: PHYSIOTHERAPY, FUNCTIONING AND COVID-19: INTEGRATIVE REVIEW. Cadernos ESP [Internet]. 2020 Jul 22 [cited 2022 Feb 17];14(1):68–73. Available from: https://cadernos.esp.ce.gov.br/index.php/cadernos/article/view/368
28. Valenzuela PL, Simpson RJ, Castillo-García A, Lucia A. Physical activity: A coadjuvant treatment to COVID-19 vaccination? Brain, Behavior, and Immunity. 2021 May;94:1–3.
29. Smondack P, Gravier F-É ., Prieur G, Repel A, Muir J-F ., Cuvelier A, et al. Kinésithérapie et COVID-19 : de la réanimation à la réhabilitation à domicile. Synthèse des recommandations internationales. Revue des Maladies Respiratoires [Internet]. 2020 Dec [cited 2021 Oct 5];37(10):811–22. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7552976/pdf/main.pdf
30. Agostini M, Moja L, Banzi R, Pistotti V, Tonin P, Venneri A, et al. Telerehabilitation and recovery of motor function: a systematic review and meta-analysis. Journal of Telemedicine and Telecare. 2015 Feb 22;21(4):202–13