Review article:

The Role of Physiotherapy in Long COVID Management: A South African Perspective

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Abstract

Background: Over 4 million people in South Africa have been infected by COVID-19 with many individuals presenting with long COVID. The multiple complications associated with long COVID include neuromuscular skeletal, cardiopulmonary, mental health, gastrointestinal and dermatological complications. Physiotherapy plays an integral role in the management of these complications. There are multiple resources stipulating physiotherapy best practices in managing people living with long COVID. This evidence statement provides a snapshot into evidence-based physiotherapy techniques to best address the multiple complications associated with long COVID. ***Objectives***: To summarise the best evidence of physiotherapy practices in the management of individuals with long COVID. ***Method:*** This evidence statement was completed using the steps outlined by the EBSCO evidence-based methodology. Sixty-one articles were sourced and analyzed for inclusion in this statement. ***Results and discussion***: Physiotherapy improves outcomes in people living with long COVID. This includes better lung volumes, improved breathing patterns and improved oxygenation levels. People living with long COVID have also reported improved cardiovascular endurance, better mobility, and muscle strength as well as improved overall quality of life through rehabilitation interventions. Other studies have shown decreased shortness of breath and improved mental health with rehabilitation interventions. ***Conclusion***: A holistic approach to physiotherapy plays an integral role in the management of people living with long COVID. This evidence statement supports clinical practice and informs future research when determining which physiotherapy approach is best suited to manage individuals with long COVID.

Keywords: Long COVID, physiotherapy , rehabilitation, physical function

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Introduction

The global prevalence of COVID-19 is over 600 million, with over four million infections in South Africa [5]. As the virus spread through South Africa [14,] many people survived but now present with continued or new symptoms, sometimes months after the infection was initially confirmed. These individuals are referred to as having long COVID.

Long COVID has been noted as a long-term side effect of the COVID-19 infection [50]. However, there is limited information available on the prevalence and implications of long COVID. COVID-19 needs no introduction, and the devastating effect it has had on personal and family lives, the health system, as well as the workplace and economy is well known. What we do not know is what the long-term physical and psychosocial consequences will be for all those affected [10].

People living with long COVID have

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multidimensional symptoms across many different body systems [12]. Studies have also shown that overall quality of life is decreased in people living with long COVID. More noteworthy, is that a lower quality of life was found in people living with long COVID who were admitted into the intensive care unit during their acute phase of COVID-19, as shown by a systematic review of global observational studies which described people living with long COVID [30].

Physiotherapists, due to the scope of practice and expertise, are one of the key healthcare professionals in the multidisciplinary team to consult with and assist people living with long COVID [3]. To guide physiotherapists working within the South African healthcare system, this evidence-based statement has been complied to add weight to the current findings on long COVID.

Physiotherapy is concerned with identifying and maximising quality of life and movement potential [40] . Physiotherapy management further entails restoring and promoting normal function and health, to achieve the highest possible level of independence [29]. Additionally, a randomized control trial in Australia showed a decrease in hospital length of stay and an increase in quality of life associated with a well-designed physiotherapy management [40].

Physiotherapy involves the interaction between healthcare professionals, patients or patients, families, and caregivers, in a process of assessing movement potential and establishing agreed-upon goals and objectives using knowledge and skills.

Methodology

This evidence-based statement (EBS) was developed using the EBSCO evidence-based methodology [26]. We identified evidence by performing a systematic search of all databases Medline and CINAHL (EBSCO), Global Health (Covid), WHO Global Research Database on COVID-19 and LitCovid from 1 January 2020 to August 2022. Existing literature was critically revised and updated systematically as new evidence was published [2]. Articles were assessed for clinical relevance, and each relevant article was further assessed for validity relative to existing content. The most valid articles are used to create an EBS. Determining clinical relevance was the first consideration in systematically selecting the best available evidence from the literature retrieved. In situations where the evidence did not clearly support or refute a clinical fact, opposing views were presented.

Validity was determined by assessing the articles to determine the scientific validity of conclusions and facts presented before consideration for use. Articles were evaluated for methodologic quality and results and the level of evidence determined. The goal was to represent the best available evidence for the specific content under consideration.

The last step in this evidence-based methodology is changing conclusions when new evidence alters the best available evidence. This step is crucial because new evidence is published every day. The Systematic surveillance process and clinical review occurs continuously.

Defining Long-COVID

The post COVID-19 Condition, commonly known as long COVID, can affect anyone exposed to SARS-CoV-2, regardless of age or severity of original symptoms. Long COVID is defined as the continuation or development of new symptoms 3 months after the initial SARS-CoV-2 infection, with these symptoms lasting for at least 2 months with no other explanation [42]. Common symptoms include fatigue, shortness of breath and cognitive dysfunction [37]. These prolonged- symptom can have an impact on everyday functioning and quality of life [43].In addition, a study states that long COVID encompasses a subacute symptomatic phase that includes symptoms and abnormalities present from 4-12 weeks and beyond [34].

Symptoms of Long COVID

Symptoms of long COVID are classified into categories of sequelae such as general, respiratory, cardiovascular, neuropsychiatric, gastrointestinal, and dermatological [1]. Common symptoms found to persist for more than 12 weeks include dyspnoea (26.1% to 80%); fatigue (29.4% to 77%); cough (16.7% to 60%); memory loss/concentration problems (26.7% to 34.2%); insomnia/sleep disorder (26% to 30.8%) and hair loss (20% to 22.4%) [22]. Symptoms continue to persist at a high rate, and across many categories of sequelae, signifying the wide range of bodily systems that are affected by long COVID [16,22,23].

Impact of Long COVID in Vulnerable Groups

Women and Children

Studies found that long COVID is more commonly reported in females and in younger population groups (30-59 years) [13]. Another study shows that amongst this population of children and adolescents, almost half of them report psychological issues as well. Infants and children with long COVID present with a milder clinical presentation in general, are asymptomatic and have a better prognosis than adults [10]. Several child health services including immunisations and child development monitoring, especially in rural areas in countries in Africa were also significantly affected and the impact of this will have profound consequences for child health [7].

People living with Disability

Globally, more than one billion individuals have a disability with approximately 80% of individuals living with disability are in low to middle income countries such as South Africa. This figure highlights the importance of a disability-inclusive approach to the management of long COVID [4]. Persons with disabilities are at a higher risk of contracting COVID-19 as well as being more susceptible to secondary complications [17]. This, coupled with the reduced access to healthcare according to a study [27], particularly in middle to lower-income countries places people with disability at a higher risk of secondary complications from long COVID than persons without disabilities [17]. These include worsening impairments that influence participation such as, but not limited to: poor posture and feeding; increasing changes in body structures such as deformities; chest infections and pressure sores.

The COVID-19 pandemic restrictions resulted in limited access to health care for those living with pre-existing conditions or comorbidities. The already challenging situation of long COVID is exacerbated by the lack of frameworks to support health care and service delivery for persons with disabilities [27].

People living in Low Socioeconomic Settings

People living in low socioeconomic settings are disproportionally affected due to poor access to health information about long COVID and ways to prevent themselves from contracting the disease and limited support was offered to those enduring economic hardship.

Another study describes the role of poor lifestyle habits prior to contracting COVID-19 resulting in a higher risk of patients becoming long-haulers [7]. Continuous and worsening social services have undoubtably affected the most vulnerable members of society. For instance, poor and non-existent provision of basic services such as electricity, running water and sanitation, especially in the rural areas, and preventative strategies should receive our urgent attention as physiotherapists to prevent severe disease and mortality [7].

Impact long COVID on the Health System

The COVID-19 pandemic has highlighted the poor collaboration between the private and public health sector. The lack of partnership between the private and public health sectors resulted in the two sectors working independent of each other, exacerbating the inequity that exist in the South African health system. There is still a long way to go in realizing equitable physiotherapy access for the ≥80% South African population that is dependent on the public health sector for services [32].

Within the South African health system where physiotherapists work, there has been a huge influx of patient referrals with other health conditions, from acute tertiary and private hospitals into the district health hospitals and primary health care facilities, including private practices, due to increased admissions of long COVID [36]. This has resulted in the early discharge of these patients and delays in elective surgeries. The district health system and primary health care facilities, especially in public sector, have been negatively affected due to poor funding and human resource allocation, resulting in compromised physiotherapy service delivery [32].

Physiotherapy Management of Long COVID

Evaluation

People living with long COVID need a comprehensive assessment to establish their rehabilitation needs to collate an individualised, holistic, personalised rehabilitation plan. The timing of assessments and outcome measurements used need to be individualised due to the fluctuating nature and varying clinical presentations of long COVID [29]. Outcome measures should be personalised and repeated as part of ongoing assessment, monitoring response to rehabilitation and informing the rehabilitation treatment plan[33].

Currently used outcome measures in people living with long COVID include The Medical Research Council Dyspnea Scale, Generalised Anxiety Disorder Assessment as well as the Patient Health Questionnaire[33]. However, further validation of the use of these tools in long COVID is required [45]. Following a thorough physiotherapy assessment, long COVID complications can be identified, and the goals of treatment can be planned around this [48,49].

Physiotherapy Interventions for Long COVID

There have been numerous studies which have explored long COVID symptoms and the effects of physiotherapy among people with long COVID [19,47] . Another study shows that 78% percent of patients experienced abnormal cardiovascular changes following a recovery from COVID-19, cardiovascular changes lead to decreased cardiovascular endurance [48,49]. This can be addressed through a thorough physiotherapy rehabilitation programme [44].

Another study showed the importance of patient education and knowledge, as misconceptions about recovery and long COVID can have negative consequences on patient recovery [9]. Physiotherapeutic patient and family counselling is integral to this with the respective. Other common complications in long COVID include fatigue, myalgia, shortness of breath, persistent coughing, and palpitations [43].

Fatigue

There are varied presentations of fatigue among people living with long COVID and therefore it should be screened and assessed thoroughly[39]. The person is often unable to continue with normal activities of daily living and is completely exhausted [19]. There is an overlap of reduced exercise tolerance and breathlessness, cognition, and psychological distress[25]. Recommended interventions for fatigue include, self-management guidance, education and assistance with pacing strategies, progressive build-up of activities and exercise[41]. Energy-conservation strategies include breathing pattern retraining which also aid in improving symptoms of fatigue[25]. Additional techniques include vagal nerve and parasympathetic nervous system stimulation through slow breathing and mindfulness practices. In terms of the reduced endurance and breathlessness, a specific respiratory muscle training and pulmonary rehabilitation programme should be designed and implemented [19].

Mental Health Conditions

Psychiatric problems such as depression, sleep disturbances or non- restorative sleep, hallucinations and brain fog are becoming a highly associated with long COVID. In addition to the effect of the disease, the financial burden on patients contributes to these symptoms [8,15] . Physiotherapists have a key role to play in managing some of these problems. Another study supports the use of breathing exercises, exercise, and pain management to relieve the symptoms of anxiety and depression [28]. It has also been shown that exercise is an effective intervention to prevent sleep disturbances.

Neurological Complications

Commonly reported neurological problems amongst patients who have had COVID-19 include paralysis, stroke, extreme weakness especially of the distal limbs and core muscles, Guillain Bare symptoms [6,38]. The role of physiotherapists in managing and preventing neurological complications is integral [35]. These interventions may include rehabilitation programmes to address balance, muscle strengthening, management of daily activities as well as return to work .

Muscle/joint Pain

The inflammatory nature of long COVID has been shown to result in myalgia and joint pain. In addition, deconditioning of the musculoskeletal system occurs after extended periods of inactivity and hospitalisation as described above [19]. Mild to severe muscle and joint weakness and pain are the result[39]. Treatment protocols are aimed at decreasing the sensitivity of the neuro immune system through pain neuroscience education, stress management, relaxation techniques and graded exercise therapy[47]. Once the amount of pain experienced on exercise has stabilised an exercise protocol aimed at regaining musculoskeletal and cardiovascular fitness can be undertaken. Physiotherapy manual techniques including soft tissue massage and joint mobilisation may assist in pain management[41].

Respiratory complications

Dyspnoea

Dyspnoea can present as breathlessness at rest, with minimal activity or with exertion and a thorough

understanding of when and how the shortness of breath is presenting and affecting the patient is imperative [33,39]. Education about dyspnoea and dyspnoea-anxiety cycle. Other techniques include breathing pattern retraining, pacing strategies, recovery breathing and positions and pulmonary rehabilitation[47,46].

Cough

This presents mostly as an irritable, dry cough; coughing fits; irritable and reactive airways, especially in cold, dry weather, and when trying to take deep breaths. If the cough is productive, it is recommended to utilise the active cycle of breathing technique (ACBT), postural drainage, manual vibrations and shaking[46]. If indicated, oscillating positive expiratory pressure devices can be utilised. Additionally, breathing pattern retraining and cough control techniques can be implemented[47].

Return to Work

Return to work rates show substantial portions of population groups that were not recovered enough to return to work [29]. Only one study reported on return-to-work rates 12 weeks post COVID infection and found that 67.9% had not returned to work [21]. Physiotherapist can advocate for employees who may have special work requirements. For instance, employees requiring motivation for extended absence from the workplace due to compromised cardiopulmonary or physical function [24].

Employees who are struggling with continued and new symptoms will often feel overwhelmed, anxious, and fearful, and many are finding it difficult to reintegrate back into the workplace [18]. Research into this aspect of long COVID is evolving, but a graded return to work, managed by a multi-disciplinary team, is encouraged to ensure full recovery and reintegration for these patients [24]. The employer should identify these employees and encourage and recommend they seek assistance from their healthcare professional and physiotherapist as part of this proposed wellness programme [21].

Conclusion

Long COVID is a complex condition, with multiple sequalae, but if managed holistically by the physiotherapist, it can have many benefits in improving the quality of life and health outcomes of people living with long COVID.

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Authors's contribution:

Data gathering and idea owner of this study: Naeema A.R. Hussein El Kout and Natalie Benjamin-Damons

Study design: Natalie Benjamin-Damons

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References

1. Aiyegbusi, O. L., Hughes, S. E., Turner, G., Rivera, S. C., McMullan, C., Chandan, J. Symptoms, complications and management of long COVID: a review. Journal of the Royal Society of Medicine. (2021); 114(9): 428-442.
2. Almonacid-Fierro, A., Sepúlveda-Vallejos, S., Valdebenito, K., Montoya-Grisales, N., & Aguilar-Valdés, M. International Journal of Educational Methodology. (2023); 3(2): 3-7.
3. Antony Leo Asser, P., & Soundararajan, K. The vital role of physiotherapy during COVID-19: A systematic review. Reading, Mass. (2021); 70(3): 687–694. https://doi.org/10.3233/WOR-210450
4. Armitage, R; Nellums. The COVID-19 response must be disability inclusive. The Lancet Public Health. (2021); 5(5):257.
5. Binyane E. M, Mfengwana, H. A Review on the Prevalence, Risk Factors, and Management of COVID-19 Disease in South African Children in Comparison to the World. COVID-19 Epidemiology in Children. IntechOpen; (2023); 1(3): 1-3. Available from: http://dx.doi.org/10.5772/intechopen.110297
6. Bungenberg, J., Humkamp, K., Hohenfeld, C., Rust, M. I., Ermis, U., Dreher, M. & Reetz, K. Long COVID-19: Objectifying most self-reported neurological symptoms. Annals of Clinical and Translational Neurology.(2022); 3(5): 1-7.
7. Buonsenso, D., Piazza, M., Boner, A. L., & Bellanti, J. A. Long COVID: A proposed hypothesis-driven model of viral persistence for the pathophysiology of the syndrome. In Allergy and Asthma Proceedings. OceanSide Publications (2022); 43 (3): 187
8. Caldirola, D., Cuniberti, F., Daccò, S., Grassi, M., Torti, T., & Perna, G. Predicting new-onset psychiatric disorders throughout the COVID-19 pandemic: a machine learning approach. The Journal of Neuropsychiatry and Clinical Neurosciences, appi-neuropsych. (2022); 9(2): 4-5.
9. Callard, F., & Perego, E. How and why patients made Long COVID. Social science & medicine. (2021); 19(2): 268, 113426. https://doi.org/10.1016/j.socscimed.2020.113426
10. Chen, C., Haupert, S. R., Zimmermann, L., Shi, X., Fritsche, L. G., & Mukherjee, B. Global Prevalence of Post-Coronavirus Disease 2019 (COVID-19) Condition or Long COVID: A Meta-Analysis and Systematic Review. The Journal of infectious diseases. (2022); 226(9): 159–160. https://doi.org/10.1093/infdis/jiac136
11. Connors, C., McNeill, S., & Hrdlicka, H. C. Occupational and Physical Therapy Strategies for the Rehabilitation of COVID-19 -Related Guillain-Barré Syndrome in the Long-term Acute Care Hospital Setting: Case Report. JMIR Rehabilitation and Assistive Technologies. (2022); 9(1): 30-34.
12. Desai, A. D., Lavelle, M., Boursiquot, B. C., & Wan, E. Y. Long-term complications of COVID-19 . American Journal of Physiology-Cell Physiology. (2022); 322(1): 1-11.
13. de Souza, F. S. H., Hojo-Souza, N. S., da Silva, C. M., & Guidoni, D. L. Second wave of COVID-19 in Brazil: younger at higher risk. European journal of epidemiology. (2021); 36 (1): 41-43.
14. Dryden, M., Mudara, C., Vika, C., Blumberg, L., Mayet, N., Cohen, C.& Jassat, W. Post-COVID-19 condition 3 months after hospitalisation with SARS-CoV-2 in South Africa: a prospective cohort study. The Lancet Global Health. (2022); 10(9): 12-15.
15. Edinoff, A. N., Chappidi, M., Alpaugh, E. S., Turbeville, B. C., Falgoust, E. P., Cornett, E. M. Kaye, A. D. Neurological and Psychiatric Symptoms of COVID-19 : A Narrative Review. Psychiatry International. (2022); 3(2): 158-168.
16. Elseidy, S. A., Awad, A. K., Vorla, M., Fatima, A., Elbadawy, M. A., Mandal, D., & Mohamad, T. Cardiovascular complications in the Post-Acute COVID-19 syndrome (PACS). IJC Heart & Vasculature. (2022); 40(1): 1-2.
17. Garjani, A., Middleton, R. M., Nicholas, R., & Evangelou, N. Recovery from COVID-19 in Multiple Sclerosis: A prospective and longitudinal cohort study of the United Kingdom Multiple Sclerosis Register. Neurology-Neuroimmunology Neuroinflammation. (2022); 9(10): 1.
18. Garzillo, E. M., Cioffi, A., Carta, A., & Monaco, M. G. L. Returning to work after the COVID-19 pandemic earthquake: a systematic review. International journal of environmental research and public health. (2022); 19(8): 4-5.
19. Goodwin, V. A., Allan, L., Bethel, A., Cowley, A., Cross, J. L., Day, J. & Lamb, S. E. Rehabilitation to enable recovery from COVID-19: a rapid systematic review. Physiotherapy. (2021); 1(11): 4-22.
20. Gorna, R., MacDermott, N., Rayner, C., O'Hara,

M., Evans, S., Agyen, L. & Hastie, C. Long COVID guidelines need to reflect lived experience. The Lancet. (2021); 397(10): 455-457.

21. Gualano, M. R., Rossi, M. F., Borrelli, I., Santoro, P. E., Amantea, C., Daniele, A., ... & Moscato, U. Returning to work and the impact of post COVID-19 condition: A systematic review. (2022); 43 (3): 1-9.

22. Han Q, Zheng B, Daines L, Sheikh A. Long-Term Sequelae of COVID-19: A Systematic Review and Meta-Analysis of One-Year Follow-Up Studies on Post-COVID Symptoms. Pathogens. (2022); 11(2): 269. doi: 10.3390/pathogens11020269. PMID: 35215212; PMCID: PMC8875269.

23. Herman E, Shih E, Cheng A. Long COVID: Rapid Evidence Review. Am Fam Physician. (2022); 106(5):523-532. PMID: 36379497.

24. Jacobsen, P. A., Andersen, M. P., Gislason, G., Phelps, M., Butt, J. H., Køber, L., ... & Kragholm, K. Return to work after COVID-19 infection–A Danish nationwide registry study. Public Health. (2022); 203 (1): 116-122.

25. Kalirathinam, D., Guruchandran, R., & Subramani, P. Comprehensive physiotherapy management in covid-19–a narrative review. Scientia Medica. (2020); 30(1): 30-31.

26. Kogut, A., Foster, M., Ramirez, D., & Xiao, D. Critical appraisal of mathematics education systematic review search methods: Implications for social sciences librarians. (2019); 6(5): 3-4.

27. Kout NA, Pilusa S, Masuku KD. A review of the framework and strategy for disability and rehabilitation services in South Africa. African Journal of Disability (Online). (2022); 11(1):1-7.

28. Ledbetter, O., Mould, L., Breach, J., & Baxter, J. Training physiotherapists to support the delivery of a COVID 19 rehabilitation programme. Physiotherapy. (2022); 114(1): 59-60.

29. Lowe, A., Littlewood, C., & McLean, S. Understanding physical activity promotion in physiotherapy practice: A qualitative study. Musculoskeletal science & practice. (2018); 35(1): 7. https://doi.org/10.1016/j.msksp.2018.01.009

30. Malik, P., Patel, K., Pinto, C., Jaiswal, R., Tirupathi, R., Pillai, S., & Patel, U. Post-acute COVID-19 syndrome (PCS) and health-related quality of life (HRQoL)—A systematic review and meta-analysis. Journal of medical virology. (2022); 94(1): 3-6.

31. Manivannan, M., Jogalekar, M. P., Kavitha, M. S., Maran, B. A. V., & Gangadaran, P. A mini-review on the effects of COVID-19 on younger individuals. Experimental biology and medicine. (2021); 246(3): 293-297.

32. Mbunge, E. Effects of COVID-19 in South African health system and society: An explanatory study. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. (2020); 14(6): 9-14.

33. Moonen, H. P. F. X., Strookappe, B., & van Zanten, A. R. H. Physical recovery of COVID-19 pneumosepsis intensive care survivors compared with non-COVID pneumosepsis intensive care survivors during post–intensive care hospitalization: The RECOVID retrospective cohort study. Journal of Parenteral and Enteral Nutrition. (2022); 46(4): 7-8.

34. Nalbandian, A., Sehgal, K., Gupta, A. Post-acute COVID-19 syndrome. Nature Medicine. (2021); 27(1): 1-3. https://doi.org/10.1038/s41591-021-01283-z.

35. Nilsson, B. Early physiotherapy management of patients with Covid-19 admitted to a university hospital in Norway (March 2020 to July 2021). Physiotherapy Research International. (2023); 199(8): 3-5.

36. Nguse, S., & Wassenaar, D. Mental health and COVID-19 in South Africa. South African Journal of Psychology. (2021); 51(2): 304-313.

37. Notarte, K. I., Catahay, J. A., Velasco, J. V., Pastrana, A., Ver, A. T., Pangilinan, F. C. & Fernández-de-Las-Peñas, C. Impact of COVID-19 vaccination on the risk of developing long-COVID and on existing long-COVID symptoms: A systematic review. EClinicalMedicine, (2022); 53(1): 2-5.

38. Ogundunmade, B. G. Physiotherapy Interventions in Stroke in COVID-19 –A Case Report. Editorial Advisory Board. (2022); 16(2): 32.

39. Onu, I., Iordan, D. A., Matei, D., Hrisca-Eva, O. D., Buculei, I., Galaction, A. I., & Gherghel, R. Impact of Physiotherapy on Patients Suffering from COVID-19: An Observational Study. Applied Sciences. (2022); 12(12): 5-7.

40. Peiris, C. L., Shields, N., Brusco, N. K., Watts, J. J., & Taylor, N. F. Additional Saturday rehabilitation improves functional independence and quality of life and reduces length of stay: a randomized controlled trial. BMC medicine. (2013); 11(1): 1-11.

41. Postigo-Martin, P., Cantarero-Villanueva, I., Lista-Paz, A., Castro-Martin, E., Arroyo-Morales, M., & Seco-Calvo, J. A COVID-19 rehabilitation prospective surveillance model for use by

physiotherapists. Journal of Clinical Medicine. (2021); 10(8): 16-19.

42. Rando, H. M., Bennett, T. D., Byrd, J. B., Bramante, C., Callahan, T. J., Chute, C. G., & Haendel, M. A. Challenges in defining Long COVID: Striking differences across literature, Electronic Health Records, and patient-reported information. MedRxiv. (2021); 3 (5): 1.

43. Raveendran, A. V., Jayadevan, R., & Sashidharan, S. Long COVID: An overview. Diabetes & Metabolic Syndrome. (2021); 15(3):8-9. https://doi.org/10.1016/j.dsx.2021.04.007

44. Shakerian, N., Mofateh, R., Rezaei, N., Saghazadeh, A., & Rezaei, N. Potential prophylactic and therapeutic effects of respiratory physiotherapy for COVID-19. Acta Bio Medica: Atenei Parmensis. (2021); 92(1): 1.

45. Sivan, M., Wright, S., Hughes, S., & Calvert, M. Using condition specific patient reported outcome measures for long COVID. BMJ. (2021); 37(6): 2-3. .

46. Thomas, P., Baldwin, C., Beach, L., Bissett, B., Boden, I., Cruz, S. M., & Patman, S. Physiotherapy management for COVID-19 in the acute hospital setting and beyond: an update to clinical practice recommendations. Journal of physiotherapy. (2022); 68(1): 8-25.

47. Wijaya, S. A., Nazir, A., & Nusjirwan, R. Rehabilitation Management to Improve Respiratory Function in Severe and Critical COVID-19 Survivors: A Literature Review. Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal). (2023); 18(3): 11-17.

48. Yelin, Dana. Long-term consequences of COVID-19 : research needs. The Lancet Infectious Diseases. (2021); 20(10): 15 – 17.

49. Yelin, D., Moschopoulos, C. D., Margalit, I., Gkrania-Klotsas, E., Landi, F., Stahl, J. P., & Yahav, D. ESCMID rapid guidelines for assessment and management of long COVID. Clinical Microbiology and Infection. (2022); 28(7): 5-9.

50. Yong, S. J. Long COVID or post-COVID-19 syndrome: putative pathophysiology, risk factors, and treatments. Infectious diseases. (2021); 53(10): 3-7.