

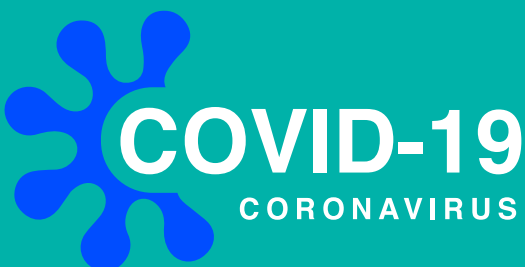


**World
Physiotherapy**

**World Physiotherapy
response to COVID-19**

Briefing paper 9

**SAFE REHABILITATION APPROACHES FOR
PEOPLE LIVING WITH LONG COVID:
PHYSICAL ACTIVITY AND EXERCISE**



June 2021

World Physiotherapy briefing papers

World Physiotherapy briefing papers inform our member organisations and others about key issues that affect the physiotherapy profession.

World Physiotherapy is producing a series of papers in response to COVID-19.

Acknowledgement

In February 2021 World Physiotherapy collaborated with [Long COVID Physio](#) to develop a briefing paper on safe rehabilitation for people living with Long COVID. The purpose was to gather key opinion leaders and stakeholders from the global community in Long COVID and physiotherapy. This briefing paper brings together individuals from across the World Physiotherapy regions, community groups, organisations, interdisciplinary clinical practice, and academia to identify statements on safe rehabilitation approaches for people living with Long COVID.

This paper has been produced with the helpful contributions from the following:

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➤ Introduction

Safe and effective rehabilitation is a fundamental part of recovery from illness and can improve function in people living with disability. Currently insufficient evidence exists to guide best practice for safe and effective rehabilitation in people living with Long COVID. Comparisons have been drawn between the symptoms and experiences of people living with Long COVID and other infection outbreaks such as severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), Chikungunya and Ebola,¹⁻⁷ albeit now on an unprecedented scale. Selected symptoms also overlap with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS), which is often triggered by infection and immune activation.^{8,9} In the absence of evidence for best practice in Long COVID rehabilitation, the heterogeneity of symptom presentation and clinical course in people living with Long COVID, and the lessons learned in people living with ME/CFS, caution may be required when recommending all forms of physical activity. In particular it is currently unknown when and by what amount physical activity (including exercise or sport) is safe or beneficial, so that it does not impair functioning among adults, young people and children living with Long COVID.

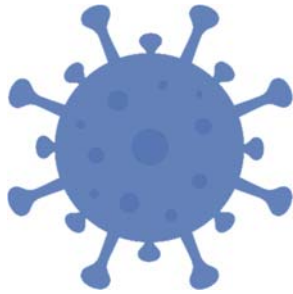
➤ Key messages

Safe rehabilitation



- **Post-Exertional Symptom Exacerbation:** before recommending physical activity (including exercise or sport) as rehabilitation interventions for people living with Long COVID, individuals should be screened for post-exertional symptom exacerbation through careful monitoring of signs and symptoms both during and in the days following increased physical activity, with continued monitoring in response to any physical activity interventions.
- **Cardiac Impairment:** exclude cardiac impairment before using physical activity (including exercise or sport) as rehabilitation interventions for people living with Long COVID, with continued monitoring for potential delayed development of cardiac dysfunction when physical activity interventions are commenced.
- **Exertional Oxygen Desaturation:** exclude exertional oxygen desaturation before using physical activity (including exercise or sport) as rehabilitation interventions for people living with Long COVID, with continued monitoring for signs of reduced oxygen saturation in response to physical activity interventions.
- **Autonomic Dysfunction and Orthostatic Intolerances:** Before recommending physical activity (including exercise or sport) as rehabilitation interventions for people living with Long COVID, individuals should be screened for autonomic nervous system dysfunction, with continued monitoring for signs and symptoms of orthostatic intolerance in response to physical activity interventions.

Long COVID



- Long COVID is an emerging condition that is not yet well understood but can be severely disabling, impacting people regardless of hospitalisation or severity of acute COVID-19.

Assessment



- Asking people with Long COVID about their symptoms and the impact of physical, cognitive, and social activities on symptoms 12 hours or longer after exertion, may help to identify people experiencing post-exertional symptom exacerbation.
- Risk stratification is recommended among people with symptoms suggestive of cardiac impairment before returning to physical activity.
- It is critical to establish the reason or source of chest pain, dyspnoea, tachycardia, or hypoxia, to prevent harm and appropriately guide physical activity including exercise.
- The possibility of persisting low-grade cardiac injury should be considered when assessing protracted COVID-19 illness and providing fitness for work advice, particularly in the context of jobs involving strenuous physical activity.
- Evidence of hyperventilation and breathing pattern disorders identified through careful monitoring can facilitate access to specialist respiratory physiotherapy.

Rehabilitation approach



- Safe and effective rehabilitation is a fundamental part of recovery from illness and can improve function in people living with disability.
- Considering the clinical complexity and uncertainties of Long COVID, functioning therapeutic relationships are critical in maintaining safe rehabilitation approaches through recognition, validation and inclusion of patient experiences as a means of personalising treatment.
- Long COVID rehabilitation should include educating people about resuming everyday activities conservatively, at an appropriate pace that is safe and manageable for energy levels within the limits of current symptoms. Exertion should not be pushed to the point of

fatigue or symptom exacerbation, both during and in the days following exertion.

- In the presence of post-exertional symptom exacerbation, “*Stop. Rest. Pace*”, activity management or pacing, and heart rate monitoring may be effective rehabilitation approaches to support self-management of symptoms.
- Rehabilitation should aim to prevent desaturation on exertion, with awareness that late deterioration of COVID-19 can still occur. Desaturation on exertion $\geq 3\%$ requires investigation.
- When orthostatic hypotension is present, the following interventions could be considered: autonomic conditioning therapy, utilisation of non-upright exercises, use of isometric exercises, compression garments, and patient education for safety.
- Aiming to achieve sustainable symptom stabilisation, whereby symptom fluctuations are reduced to a manageable level over a period of time, can constitute a rehabilitation approach that improves symptom severity and daily functioning.
- Physiotherapists can play an important role in the rehabilitation of people living with Long COVID, to balance activities with rest to optimise recovery, and consider other factors important in symptom management beyond solely physical activity.



Physical activity

- Physical activity of all forms might benefit some people living with Long COVID, but could be contraindicated or exacerbate symptoms in others. Using a cautious approach to physical activity will likely support longer-term recovery.
- Physical activity, including exercise, prescription in Long COVID should only be approached with caution and vigilance, ensuring rehabilitation programmes are restorative and do not make an individual's symptoms worse both during and in the days following.
- Autonomic dysfunction, presenting as breathlessness, palpitations, fatigue, chest pain, feeling faint (presyncope) or syncope, could contribute to the exercise intolerance observed in people with Long COVID.
- Due to the risk of worsening symptoms with overexertion in Long COVID, it is critical that physical activity, including exercise, interventions are applied with caution and careful clinical decision making based on symptoms during and in the days following exertion.



➤ **Context**

World Physiotherapy comprises 125 [member organisations](#) across five regions and from low, middle and high resource settings. Hence, there is great diversity in the delivery of physiotherapy and rehabilitation services in the countries and territories of its member organisations.

We note that there are various contexts in which practice takes place and a diversity of health care delivery systems in which physiotherapy is practised globally. Moreover, the trajectory and impact of the COVID-19 pandemic over time mean that as cases rise and fall in different regions, societies and communities will be affected in different ways and at different times. We recognise that the statements in this current briefing paper require consideration of available health care resources and acknowledgement that health care disparities are affected by social determinants.¹⁰

World Physiotherapy is in close contact with its member organisations across all settings and has been collating resources generated nationally and publications emerging via its [COVID-19 knowledge hub](#). We will continue to provide links to resources to inform practice, drawing on resources from within the profession and other global organisations.

➤ **Purpose**

This briefing paper aims to support physiotherapists and other healthcare professionals in the provision of safe and effective Long COVID rehabilitation practice, research and policy until further good quality evidence pertaining to physical activity (including exercise or sport) in Long COVID is available.

Statements are provided with supporting rationale and actions, to indicate when caution with prescribing physical activity as rehabilitation interventions must be applied. Physical activity of all forms might benefit some people living with Long COVID, but could be contraindicated or exacerbate symptoms in others. Using a cautious approach to physical activity will likely support longer-term recovery. This paper is not a guideline, standard, or policy. It is a consensus opinion statement based on the experience of experts in the field of Long COVID, rehabilitation, lived experience, and related impairments and conditions. The paper does not cover acute COVID-19 presentations managed in hospital or community settings. This paper is a “living document” and will be updated as evidence continues to emerge in the context of rehabilitation, physical activity, and Long COVID. This paper may also be relevant to people living with other chronic illnesses commonly associated with infections.

➤ **Key opinion leaders and stakeholders: bringing diverse perspectives**

Physical activity, including exercise or sport, as rehabilitation approaches for people living with Long COVID and other conditions commonly triggered by an infection, such as ME/CFS, has generated debate. This necessitates considerations for the knowledge, skills and perspectives of rehabilitation professionals, clinicians, academics and policymakers. Key opinion leaders and stakeholders were assembled to generate statements on safe physical activity-based rehabilitation approaches from diverse perspectives including people living with Long COVID, physiotherapists, physicians - including physical medicine and rehabilitation physicians - exercise physiologists, psychologists, occupational therapists, academics, advocacy groups, and people living with ME/CFS, from regions including Africa, Asia Western Pacific, Europe, North America Caribbean, and South America.

➤ What is Long COVID?

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the virus that causes coronavirus disease (COVID-19).¹¹ COVID-19 can cause persistent ill-health. A quarter of people who have had the virus may experience symptoms that continue for at least a month, more than 1 in 10 may remain unwell after 12-weeks,¹²⁻¹⁵ and others may have ongoing symptoms for longer than 6 months.¹⁶⁻¹⁹ The post-acute sequelae of COVID-19 have been described by patient groups as “Long COVID”,²⁰⁻²² and as “post-COVID conditions” by the World Health Organization (WHO) and United States Centers for Disease Control and Prevention (CDC).^{23,24} Long COVID is an emerging condition that is not yet well understood but can be severely disabling,^{13,15,25} impacting people regardless of hospitalisation or severity of acute COVID-19.^{2,26-34} We do not yet know the risk factors for developing Long COVID, who is more likely to recover, or how it can be treated. Research is urgently needed to better understand the underlying pathophysiological mechanisms.²⁰ Current knowledge demonstrates that Long COVID can affect multiple body systems including the respiratory, cardiac, renal, endocrine and neurological systems.^{15,16,19,26,28,35-38} People present with clusters of overlapping symptoms such as fatigue or exhaustion, chest pressure or tightness, shortness of breath, headache, and cognitive dysfunction.^{16,38} Long COVID can be multi-dimensional, spanning symptoms and impairments, activity limitations and social participation restrictions.^{15,39-43} Long COVID may also be experienced as episodic and unpredictable in nature, with symptoms fluctuating and changing over time.^{32,38} As such, Long COVID impacts people’s functional ability, social and family life, ability to work, and quality of life.^{12,15,19,25,40,44-48} Dealing with such complexity requires a multidisciplinary approach and patients’ involvement.^{3,49}

➤ What is Rehabilitation?

Rehabilitation is defined as a set of interventions to optimise functioning in everyday activities, support people to recover or adjust, achieve their full potential, and enable participation in education, work, recreation and meaningful life roles.⁵⁰⁻⁵⁴ Along with recognition and research, access to rehabilitation emerged as one of the three pillars of Long COVID campaigning,⁵⁵ and succeeded in making rehabilitation a Long COVID research priority,³ due to the disability experienced by people living with Long COVID.¹⁶ Rehabilitation is a fundamental health service under Universal Health Coverage,⁵⁶ addressing the impact of a health condition on a person’s life by focusing on improving functioning and reducing experiences of disability.⁵⁴ Rehabilitation is highly person-centred and goal-oriented, meaning that the interventions and approaches selected are tailored to an individual depending on their symptoms, goals and preferences.⁵⁴ Physical activity (including exercise or sport) is a rehabilitation intervention, often used in conjunction with other approaches, for a range of different health conditions, to enhance function and wellbeing.^{57,58}

Person-centred rehabilitation

Person-centred approaches to Long COVID rehabilitation will require conscious attention to the therapeutic relationship; the relationship between clinician and patient also known as therapeutic or working alliance.⁵⁹ This important aspect of clinical interaction is a pillar of person-centred rehabilitation,^{60,61} which improves clinical outcomes.⁶²⁻⁶⁴ Therapeutic relationships hinge upon clinicians creating space where patients feel safe to openly engage in rehabilitation,⁶⁵ with meaningful connections established when clinicians acknowledge and believe patients’ lived experiences, actively include them in decision making, and are receptive and responsive to their suggestions, needs and values.⁶⁵⁻⁶⁹ Considering the clinical complexity and uncertainties of Long COVID, functioning therapeutic relationships are critical in maintaining safe rehabilitation approaches, through recognition, validation and inclusion of patient experiences as a means of personalising treatment.

Patient-reported outcome or experience measures (PROM or PREM) such as the [EuroQOL EQ-5D-5L](#), [Consultation and Relational Empathy \(CARE\) Measure](#), and [Working Alliance Inventory](#), can help operationalise personalised treatment. Specific to physiotherapy, the Person-Centered Therapeutic Relationship in Physiotherapy (PCTR-PT) scale (available in Spanish),^{70,71} and Physiotherapy Therapeutic Relationship Measure (available in English),⁷² may support evaluation of therapeutic relationships. Gaps in some areas of rehabilitation research exist, therefore Cochrane Rehabilitation and WHO Rehabilitation Programme developed the COVID-19 rehabilitation research framework to inform best practice and ensure rehabilitation services and health systems can best serve populations affected by COVID-19 and Long COVID.⁷³

What are physical activity and exercise?

“Physical activity” and “exercise” are different approaches that may be considered in the context of rehabilitation. Each term refers to a different concept, however the terms are often confused with one another and sometimes used interchangeably.⁷⁴

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure.⁷⁴ Physical activity in daily life can be categorised into occupational, sports, conditioning, household or other activities. Physical activity should not be confused with exercise, which is a sub-category of physical activity. **Exercise** is defined as planned, structured, repetitive, and purposeful activity focused on improvement or maintenance of physical fitness.⁷⁴

Physical fitness is a set of attributes that are health- or skill-related.⁷⁴ Exercise therapy used to treat health conditions can be broadly categorised into aerobic, resistance, combined aerobic and resistance, and condition-specific exercises used to target specific functional impairments, such as stretches or balance training.^{57,58}

Graded exercise therapy is an approach prescribed by clinicians, based on fixed incremental increases in physical activity or exercise.¹⁹ Although physical activity including exercise is often beneficial for health, this is not always the case,⁷⁵ where different mechanisms can explain the pathophysiology of exercise intolerance in a range of chronic conditions.⁷⁶



Safe rehabilitation statement 1

Box 1: post-exertional symptom exacerbation

Before recommending physical activity (including exercise or sport) as rehabilitation interventions for people living with Long COVID, individuals should be screened for **post-exertional symptom exacerbation** through careful monitoring of signs and symptoms both during and in the days following increased physical activity, with continued monitoring in response to any physical activity interventions.

Rationale

The most common symptom of Long COVID is fatigue or exhaustion,^{6,16-19,28,34,77-84} a symptom which does not result from unusually difficult activity, is not easily relieved by rest or sleep, can limit functioning in day-to-day activities, and negatively impact quality of life.⁸⁵ People living with Long COVID can additionally experience post-exertional symptom exacerbation,¹⁶ also described as post-exertional malaise (often abbreviated to PEM) or post-exertional neuroimmune exhaustion. Post-exertional symptom exacerbation can be defined as the triggering or worsening of symptoms that can

follow minimal cognitive, physical, emotional or social activity, or activity that could previously be tolerated.⁸⁶⁻⁹¹ Symptoms worsened by exertion can include disabling fatigue or exhaustion, cognitive dysfunction or “brain fog”, pain, fever, sleep-disturbance, wheezing, diarrhoea, olfactory dysfunction such as parosmia, and exercise intolerance. Symptoms typically worsen 12 to 48 hours after activity and can last for days or even weeks,^{91,92} but with considerable variability.^{88,92} People may describe experiencing a “crash” or “relapse” when a sustained or marked exacerbation of symptoms lasts longer than shorter episodes or a flare-up, requiring a substantial and sustained adjustment to a person’s activity management.⁹¹ During a relapse, symptoms and level of disability may be similar to illness onset, and relapses can lead to a long-term reduction in a person’s capacity to perform activities.⁹¹

Among a sample of 3,762 people living with Long COVID across 56 countries, 72% reported post-exertional symptom exacerbation.¹⁶ People living with Long COVID describe the episodic nature of Long COVID symptoms and impairments,^{15,16,19,38,83} and note exercise, physical activity, or cognitive exertion as common triggers for symptom relapse.^{16,38,40} While there is evidence that physical activity can reduce fatigue in some chronic conditions where fatigue is a common symptom,⁹³⁻⁹⁷ significant negative impact can result if physical activity is not carefully tailored to the individual.⁹⁸

Quota-based graded exercise programmes can result in harms to patients with post-exertional symptom exacerbation.^{89,99-102} As such, in 2017 the United States Centers for Disease Control and Prevention (CDC) removed graded exercise therapy from ME/CFS guidelines,^{89,99} and the United Kingdom National Institute of Health and Care Excellence (NICE) recently removed graded exercise therapy from draft ME/CFS guidelines.⁹¹ Recognising this, NICE cautioned against the use of graded exercise therapy for people recovering from COVID-19.^{19,103,104}

WHO recommends that Long COVID rehabilitation should include educating people about resuming everyday activities conservatively, at an appropriate pace that is safe and manageable for energy levels within the limits of current symptoms.¹⁰⁵ Exertion should not be pushed to the point of fatigue or symptom exacerbation, both during and in the days following exertion.

Action

Assessment of post-exertional symptom exacerbation occurs by self-report. Asking people with Long COVID about their symptoms and the impact of physical, cognitive and social activities on symptoms 12 hours or longer after exertion, may help to identify people experiencing post-exertional symptom exacerbation.¹⁰⁶ People may describe post-exertional exacerbation of fatigue as worsening tiredness or exhaustion, heaviness in limbs or whole body, cognitive dysfunction or “brain fog”, muscle weakness, and being drained of energy.¹⁰⁷ Post-exertional exacerbation of other symptoms can be described in various ways depending on the symptoms affected, with many people often able to recognise a wave of associated symptoms and their triggers before symptoms worsen.

A brief 5-item questionnaire to screen for post-exertional malaise (Box 2), a sub-scale of the DePaul Symptom Questionnaire validated in people with ME/CFS,¹⁰⁸ may be a useful screening tool in Long COVID. It is designed to assess the frequency and severity of post-exertional symptom exacerbation over a six-month time frame.¹⁰⁸⁻¹¹⁰ A score of 2 on both frequency and severity on any items 1 to 5, is indicative of post-exertional malaise.¹¹¹ These five screening questions are recommended by the National Institutes of Health/Centers for Disease Control and Prevention Common Data Elements (CDE) post-exertional malaise working group.¹¹² Five supplemental questions are also available to examine duration, recovery and exercise exacerbation (Box 2).¹⁰⁸ It may be beneficial to utilise both screening and supplementary questions (questions 1-10) alongside self-report, until psychometric property evaluation of this tool in the context of Long COVID is available. The new DePaul Post-Exertional Malaise Questionnaire is also available to assess key characteristics, triggers, onset, duration, and effects of pacing.¹¹³

Box 2: A Brief Questionnaire to Screen for Post-Exertional Symptom Exacerbation

Symptoms	Frequency:	Severity:
	Throughout the past 6 months , how often have you had this symptom? For each symptom listed below, circle a number from:	Throughout the past 6 months , how much has this symptom bothered you? For each symptom listed below, circle a number from:
	0 = none of the time 1 = a little of the time 2 = about half the time 3 = most of the time 4 = all of the time	0 = symptom not present 1 = mild 2 = moderate 3 = severe 4 = very severe
1. Dead, heavy feeling after starting to exercise	0 1 2 3 4	0 1 2 3 4
2. Next day soreness or fatigue after non-strenuous, everyday activities	0 1 2 3 4	0 1 2 3 4
3. Mentally tired after the slightest effort	0 1 2 3 4	0 1 2 3 4
4. Minimum exercise makes you physically tired	0 1 2 3 4	0 1 2 3 4
5. Physically drained or sick after mild activity	0 1 2 3 4	0 1 2 3 4

Supplementary Questions

6. If you were to become exhausted after actively participating in extracurricular activities, sports, or outings with friends, would you recover within an hour or two after the activity ended?	Yes	No				
7. Do you experience a worsening of your fatigue/energy related illness after engaging in minimal physical effort?	Yes	No				
8. Do you experience a worsening of your fatigue/energy related illness after engaging in mental effort?	Yes	No				
9. If you feel worse after activities, how long does this last?	≤1 h	2–3 h	4–10 h	11–13 h	14–23 h	≥ 24 h
10. If you do not exercise, is it because exercise makes your symptoms worse?	Yes	No				

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Two-day cardiopulmonary exercise testing (CPET) provides an objective measure of exercise intolerance and impaired recovery and may have a role in assessing potential mechanisms of exercise limitation among people with Long COVID.^{114,115} The two-day CPET procedure first measures baseline functional capacity and provokes post-exertional symptom exacerbation, then assesses changes in CPET variables 24 hours later with a second CPET to assess the effects of post-exertional symptom exacerbation on functional capacity.¹¹⁶ Reduced physiological function has been observed on the second CPET test in people living with ME/CFS, including reduced workload at the ventilatory threshold, chronotropic intolerance (blunted heart rate response), and higher blood lactate at a given workload, that is not present in sedentary controls and therefore not a result of deconditioning.¹¹⁷⁻¹²¹ This reduction in physiological function appears to be sensitive to stratifying disease severity.¹²¹ As a result, CPET may provide important objective evidence of physiological and functional impairment used in legal determination of eligibility for social benefits based on disability status.¹²² However, CPET commonly results in symptom exacerbation or relapse so should be used with caution.^{109,116}

Additional approaches validated in other health populations could be conducted remotely, whilst still vigilant to consider risk of symptom exacerbation, such as the 6-minute walk test, accelerometers, and activity monitors.¹²³ Information from commercially available heart rate and activity monitors may be used to both establish objective criteria for pacing programmes, and provide an external prompt

(eg through an audible tone or vibration) when physiological over-exertion may be taking place in real time.

In the presence of post-exertional symptom exacerbation, “*Stop. Rest. Pace*”,¹²⁴ activity management or pacing¹²⁵⁻¹²⁷ (Box 3), and [heart rate monitoring](#)^{106,128-131} may be effective rehabilitation approaches to support self-management of symptoms.

Graded exercise therapy or fixed activity prescription should not be used.^{19,103,104,124} Instead, the National Institute of Health Research (NIHR) suggests “*symptom titrated physical activity*”,¹⁹ where physical activity is continuously monitored and adjusted according to symptoms. This recognises that managing physical activity is complex with no one size fits all recommendation, where advantages and disadvantages of physical activity require careful consideration by clinicians and individuals with Long COVID.¹⁹ Aiming to achieve sustainable symptom stabilisation, whereby symptom fluctuations are reduced to a manageable level over a period of time, can constitute a rehabilitation approach that improves symptom severity and daily functioning.¹³²

Physical activity, including exercise, prescription in Long COVID should only be approached with caution and vigilance, ensuring rehabilitation programmes are restorative and do not make an individual’s symptoms worse both during and in the days following.¹⁰⁶ Physical activity, including exercise, should not be undertaken to the exclusion of an individual’s desired daily activities,¹⁰⁶ or to the detriment of quality of life.

Box 3: Pacing

Pacing, or activity management, is an approach to balancing activities with rest to avoid exacerbation of symptoms.^{126,127,133} Different types of pacing have been described, including quota-contingent and symptom-contingent pacing, the former used to gradually increase activities.¹³⁴ Symptom-contingent pacing for management of post-exertional symptom exacerbation encourages engagement in activities guided by perceived symptom levels to avoid worsening symptoms, conserve energy and enable participation in meaningful activities.¹²⁶ Sustained stabilisation of often episodic and fluctuating symptoms could guide how activities and rest can be modified dependent on symptoms.

Pacing should include realistic goals, monitoring of physical, cognitive and social activities and their effects on energy levels, and avoidance of possible over-exertion which may worsen symptoms.^{127,135} Quality of rest, sleep, and eating patterns may also be considered within the context of activity management and symptom stabilisation. Pacing is not an activity avoidance strategy, rather it is a strategy used to minimise post-exertion symptom exacerbation. Avoiding over-exertion or remaining within a person’s “*energy envelope*” can avoid symptom relapses.^{133,135,136} The “*energy envelope*” theory suggests that by maintaining expended energy levels within the envelope of perceived available energy levels, people are able to better sustain physical and mental functioning while reducing symptom severity and frequency of relapses.¹³³

Fluctuations in symptom severity and delayed recovery from activities due to post-exertional symptom exacerbation, should be considered. Pacing will often be included as part of a number of energy conservation strategies termed “*the three P’s Principle*” which includes *Prioritisation*, *Planning* and *Pacing*, and can also be accompanied by others such as *Posture*, *Positioning* and *Precaution*. Useful resources on pacing are available from the [Long COVID Physio](#) website.



Safe rehabilitation statement 2

Box 4: cardiac impairment

Exclude **cardiac impairment** before using physical activity (including exercise or sport) as rehabilitation interventions for people living with Long COVID, with continued monitoring for potential delayed development of cardiac dysfunction when any physical activity interventions are commenced.

Rationale

Physical activity interventions, including exercise, warrant caution as rehabilitation strategies among people with Long COVID and persistent symptoms of: disproportionate breathlessness on exertion; inappropriately increased heart rate (tachycardia); and/or chest pain. People with Long COVID can have impairments of multiple body systems including the respiratory, cardiac, renal, endocrine, and neurological systems.^{15,16,19,28,36,38} Cardiac injury has been reported among people recovering from COVID-19,¹³⁷⁻¹³⁹ and data from serial multi-organ MRI scans on 201 middle-aged, generally healthy individuals with Long COVID suggested evidence of mild cardiac impairment (32%).²⁸ COVID-19 may cause myocarditis and pericarditis.^{140,141} Exercise restrictions are recommended in acute presentations of these cardiac impairments,¹⁴² because exercising with acute myocarditis or pericarditis can increase the risk of morbidity and mortality.¹⁴²⁻¹⁴⁴

Screening for potential cardiac impairment with cardiac imaging and other tests has been recommended before athletes recovering from COVID-19 return to sport.¹⁴⁵⁻¹⁴⁷ These recommendations, however, focus on highly active people and those who participate in intense exercise training. Therefore, for people with COVID-19 who lost fitness or were inactive for long periods, risk stratification is recommended among people with symptoms suggestive of potential cardiac impairment, before returning to physical activity.¹⁴⁸ The extent to which such recommendations should apply to working populations with Long COVID, and at what level of physical demand, are unclear.¹⁴⁹ Ongoing cardiac symptoms require further clinical assessment, and the return of, or the development of, new symptoms may indicate the need to stop and seek medical advice.¹⁴⁸ This should be followed by rest and recovery with slow and gradual resumption of activity under the guidance of a health care team.^{145,146}

Action

It is critical to establish the reason or source of chest pain, dyspnoea, tachycardia or hypoxia, to prevent harm and appropriately guide physical activity including exercise. Signs and symptoms including recurrent chest pain, shortness of breath (dyspnoea), tachycardia, reduced oxygen levels (hypoxia), palpitations, reduced exercise tolerance, and non-specific malaise, which persist after recovery from acute COVID-19, are common and require a focused medical history and examination.^{140,147,150} Current recommendations for physical activity, including exercise, as rehabilitation interventions suggest a prudent exclusion of cardiac complications.¹⁴⁷ Additionally, the possibility of persisting low-grade cardiac injury should be considered when assessing protracted COVID-19 illness and providing fitness for work advice, particularly in the context of jobs involving strenuous physical activity.¹⁴⁹

Recommended management of potential cardiac symptoms in people with Long COVID, such as inappropriate tachycardia and/or chest pain, suggest investigations including echocardiogram (ECG), troponin, holter monitoring, and echocardiography; noting it may not be possible to exclude

myocarditis and pericarditis on echocardiography alone.¹⁵¹ Referral to cardiology is also suggested for people with chest pain, as a cardiac MRI may be indicated to rule out myopericarditis and microvascular angina.¹⁵¹ A low threshold for excluding cardiac impairment among people with suggestive cardiac symptoms may be warranted, due to high incidence of myocarditis among people with Long COVID following mild acute COVID-19.²⁸ Furthermore, autonomic dysfunction should be considered in people with palpitations and/or tachycardia,¹⁵¹ further discussed in statement four below.

A cardiac evaluation is recommended for people recovering from COVID-19 with confirmed cardiac impairment before resuming exercise.¹⁰⁵ Screening tools such as the [Physical Activity Readiness Questionnaire for Everyone*](#) and supplementary electronic [Physical Activity Readiness Medical Examination](#), may be useful tools to guide safe decision making in community or lower resource settings.



Safe rehabilitation statement 3

Box 5: exertional oxygen desaturation

Exclude **exertional oxygen desaturation** before using physical activity (including exercise or sport) as rehabilitation interventions for people living with Long COVID, with continued monitoring for signs of reduced oxygen saturation in response to any physical activity interventions.

Rationale

Exercise-induced desaturation is a safety consideration for delivering Long COVID rehabilitation.¹⁵² Infection with SARS-CoV-2 primarily causes respiratory illness,¹⁵³ but is also implicated in widespread endothelial dysfunction leading to increased thromboembolic complications.¹⁵⁴ Low oxygen saturation after exertion is observed in people with acute COVID-19,¹⁵⁵ which may not be associated with resting oxygen saturation, the degree of dyspnoea, or feeling unwell.^{156,157} Assessment of oxygen saturation with acute COVID-19 is recommended during hospitalisation, before hospital discharge, and after hospital discharge among people with acute COVID-19.¹⁵⁷

Oxygen desaturation on exertion may also occur during the recovery phase.¹⁰⁵ It is suggested that a fall of 3% in oxygen saturation during or after mild exertion is abnormal, requiring investigation among people with Long COVID.^{158,159} NICE guidelines, from the UK, recommend that people with ongoing symptoms are urgently referred to relevant acute care services, if they have oxygen desaturation with exercise.^{12,32} A decrease in pulse oxygen saturation $\geq 4\%$ has been observed in 32% of people with Long COVID one month after discharge from hospital.¹⁶⁰ Rehabilitation should aim to prevent desaturation on exertion,¹⁰⁵ with awareness that late deterioration of COVID-19 can still occur.¹⁰⁵

Even in the absence of exertional desaturation, hyperventilation syndrome and breathing pattern disorders may be present, hallmarked by an increased respiratory rate and tidal volume during exercise.¹⁶¹ While managing hyperventilation may be desirable, the underlying mechanisms driving hyperventilation in people with Long COVID remains unknown. Clinicians should consider the possibility that hyperventilation may be compensating for an underlying abnormality such as impaired diffusing capacity of the lungs for carbon monoxide (DLCO), or air trapping, regardless of initial

* PAR-Q+ also available as a [PDF](#)

severity of infection.^{162,163} Hyperventilation can result in dyspnoea, chest pain, fatigue, dizziness, tachycardia, and fainting (syncope) on exertion. Considering that physical activity, including exercise, may provoke these symptoms, due caution is warranted.

Action

WHO conditionally recommend using pulse-oximetry monitoring at home for people with symptomatic COVID-19, and at risk of progression to severe disease who are not hospitalised.¹⁰⁵ Pulse oximetry under clinical supervision also has also been recommended to detect reduced oxygen saturation on exertion, using tests such as the 40-step walk and the 1-minute sit-stand.^{32,105,164}

Rapid exercise tests for exertional desaturation should not be attempted outside a supervised care setting if resting pulse oximeter saturation is <96%.^{105,158} Such tests will not be suitable for everyone, for example clinical judgement will be required for people with chest pain, severe fatigue or post-exertional symptom exacerbation.¹² Protocols for such tests are available,^{165,166} but their utility has not been confirmed in Long COVID.¹² Desaturation on exertion $\geq 3\%$ requires investigation. In the presence of exertional desaturation, exclusion of serious pathology, and consultant approval, symptom titrated physical activity could be considered within a rehabilitation programme. Evidence of hyperventilation and breathing pattern disorders, identified through careful monitoring, can facilitate access to specialist respiratory physiotherapy.^{151,161}



Safe rehabilitation statement 4

Box 6: autonomic nervous system dysfunction

Before recommending physical activity, including exercise or sport, as rehabilitation interventions for people living with Long COVID, individuals should be screened for **autonomic nervous system dysfunction**, with continued monitoring for signs and symptoms of orthostatic intolerance in response to any physical activity interventions.

Rationale

SARS-CoV-2 can affect the nervous system.^{36,167-169} Autonomic dysfunction, presenting as breathlessness, palpitations, fatigue, chest pain, feeling faint (presyncope) or syncope, could contribute to the exercise intolerance observed in people with Long COVID.^{170,171} The autonomic nervous system is the involuntary, continuous system regulating blood pressure, heart rate, thermoregulation and other homeostatic functions.¹⁷² The autonomic nervous system is composed of sympathetic and parasympathetic divisions, which have opposing effects by increasing activity of one system while simultaneously decreasing activity of another system, in rapid and precise ways.¹⁷²

The sympathetic nervous system prepares the body for strenuous physical activity (termed "*fight or flight*"), while the parasympathetic nervous system conserves energy and regulates basic body functions (termed "*rest and digest*").¹⁷² Dysautonomia is an umbrella term that refers to a change in the autonomic nervous system that affects health,^{173,174} including postural tachycardia, inappropriate sinus tachycardia, and vasovagal syncope.¹⁷⁵ Emerging evidence describes orthostatic intolerances and postural orthostatic tachycardia syndrome (POTS) among people with Long COVID,^{16,170,171,176,177} characterised by symptomatic changes in heart rate and blood pressure in upright positions.

Differential diagnosis is important in these cases to exclude myocarditis, pneumonia, or pulmonary embolism as a cause of symptoms.^{141,170} However, some studies show that individuals with Long

COVID and autonomic disorders present with concurrent cardiac and pulmonary abnormalities.¹⁷⁸ Screening for orthostatic hypotension and POTS has been recommended.^{170,171}

Safe administration of physical activity interventions for individuals with Long COVID will require informed clinical decision making, carefully designed care plans, and consistent symptom monitoring.

Action

As many symptoms of autonomic dysfunction are difficult to differentiate from cardiac conditions, individuals with chest pain, dizziness, palpitations, presyncope, syncope, or breathlessness, should be referred for a thorough medical examination.¹⁴⁰ Patients with Long COVID should be screened for orthostatic hypotension and heart rate differences,¹⁷⁰ with tests such as the [NASA 10 minute lean test](#),^{179,180} or active stand test.^{170,181} The active stand test measures blood pressure and heart rate after five minutes of lying supine and then three minutes after standing. Orthostatic hypotension is defined as a fall of >20mmHg systolic and >10mmHg diastolic after standing for three minutes, or head up tilt to at least 60°.¹⁸² Diagnostic criteria for POTS includes sustained heart rate of ≥30 beats/min within 10 mins of standing, or head-up tilt, in the absence of orthostatic hypotension.¹⁸² The COMPASS 31 score is a questionnaire that can help to identify autonomic dysfunction.¹⁸³ A range of heart rate parameters such as heart rate variability, heart rate recovery and heart rate acceleration may also be an approach to assessing cardiovascular autonomic regulation.¹⁸⁴

When orthostatic hypotension or POTS is present, the following interventions could be considered for inclusion in the plan of care: autonomic conditioning therapy,¹⁸⁵ utilisation of non-upright exercises, use of isometric exercises, compression garments, and patient education for safety.^{170,186} However, continued monitoring and assessment of post-exertional symptom exacerbation is required. Additionally, review of rest and sleep quality, referral to a physician for pharmacological treatments, and a dietitian referral may be warranted.¹⁴⁰

Some protocols suggest aerobic exercise to treat orthostatic hypotension and POTS.^{170,186-188} For example, autonomic conditioning therapy is a proposed novel and adapted Long COVID rehabilitation protocol for managing autonomic dysregulation, that includes breath work, supine active range of motion exercises, and upon achievement of sustained symptom stability, introduction of symptom titrated submaximal aerobic exercise.¹⁸⁵

Due to the risk of worsening symptoms with overexertion in Long COVID, it is critical that physical activity, including exercise, interventions are applied with caution and careful clinical decision making based on symptoms that may be exacerbated during and in the days following exertion.

➤ Conclusion

This paper presents considerations for safe rehabilitation specific to physical activity, including exercise or sport, for people living with Long COVID. The statements presented may be used by physiotherapists and other healthcare professionals assessing and treating people living with Long COVID, to consider how post-exertional symptom exacerbation, cardiac impairment, exertional oxygen desaturation, and autonomic nervous system dysfunction impact on safe prescription of rehabilitation, including physical activity.

Physiotherapists can play an important role in the rehabilitation of people living with Long COVID, to balance activities with rest to optimise recovery, and consider other factors important in symptom management beyond solely physical activity.

Future collaborations should consider development of evidence informed standards on safe and effective rehabilitation for people living with Long COVID, uniform reporting guidelines for Long COVID rehabilitation research involving any form of physical activity, and establishment of Long COVID rehabilitation research priorities.

Further research is required to better understand the experiences of people living with Long COVID who participate in any physical activity interventions, the underlying mechanisms that may contribute to exercise intolerance that builds from existing ME/CFS research, and rehabilitation interventions that are safe and effective. Involving people living with Long COVID in designing this research is critical.

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