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Long Covid Research

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1. Long Covid – What is it?

Definitions

Long Covid: when a person has recovered from COVID-19 but is still experiencing certain symptoms (World Health Organization). The acute phase of COVID-19 infection can last up to 2 weeks, but beyond that, someone potentially has a post-acute illness, or what is now called long Covid.

- Potentially infection related-symptoms (up to 4–5 weeks)
- Acute post-COVID symptoms (from week 5 to week 12)
- Long post-COVID symptoms (from week 12 to week 24), and persistent post-COVID symptoms (lasting more than 24 weeks).
- 10%–20% of people with COVID-19 experience long-term symptoms

Ongoing symptomatic COVID: When symptoms continue for more than 4 weeks.

Post COVID Syndrome: When ongoing symptoms continue for longer than 12 weeks and cannot be explained by any other reason.

Possible Causes of long Covid:

- Reduced or lack of response from the immune system.
- Relapse or reinfection of the virus.
- Deconditioning, which is a change in physical function due to bed rest or inactivity.
- Post-traumatic stress.
- Inflammation or reaction from the immune system. Increased activity in the immune system may cause an auto-immune response (ie. the immune system attacks the body's own tissues, not just the virus), which can occur in people with strong immune systems/ responses.
- The virus itself damaging the body's cells may explain some symptoms like brain fog and a loss of smell and taste, while damage to blood vessels in particular could lead to heart, lung and brain problems.
- Fragments of the virus remaining in the body, possibly lying dormant and then becoming reactivated.

Diagnosis

There are probably several different syndromes that cause long Covid. In other words, long Covid isn't just one thing (Professor Gail Matthews from the Kirby Institute, UNSW Sydney).

There is no specific test to diagnose long Covid, but tests may be run to rule out other possible causes of symptoms, including testing to check:

- Full blood count
- Electrolytes
- Kidney function
- Liver function
- Troponin, to test for heart muscle damage
- Inflammation levels
- Muscle damage

- D-dimer, to check that no blood clots are present
- Heart health
- Iron levels
- A chest X-ray
- Exercise tolerance tests
- A urine test
- An electrocardiogram to check for heart problems
- Thyroid function tests

2. Long Covid Symptoms

- Extreme tiredness (fatigue)
- Shortness of breath
- Chest pain or tightness
- Problems with memory and concentration ("brain fog")
- Difficulty sleeping (insomnia)
- Heart palpitations
- Dizziness
- Pins and needles
- Joint pain
- Depression and anxiety- A May 2021 study found that a third of COVID-19 patients had been diagnosed with neurological or psychological symptoms, including anxiety, depression, post-traumatic stress disorder (PTSD), and psychosis, in the 6 months after they contracted COVID-19 (The Lancet Psychiatry, Vol. 8, No. 5, 2021)
- Tinnitus, earaches
- Feeling sick, diarrhoea, stomach aches, loss of appetite
- A high temperature, cough, headaches, sore throat, changes to sense of smell or taste
- Rashes
- Hallucinations
- hearing/ vision loss
- Short term memory loss
- Speech and language issues

The severity of symptoms varies, but many have been left unable to perform tasks like showering, grocery shopping and remembering words.

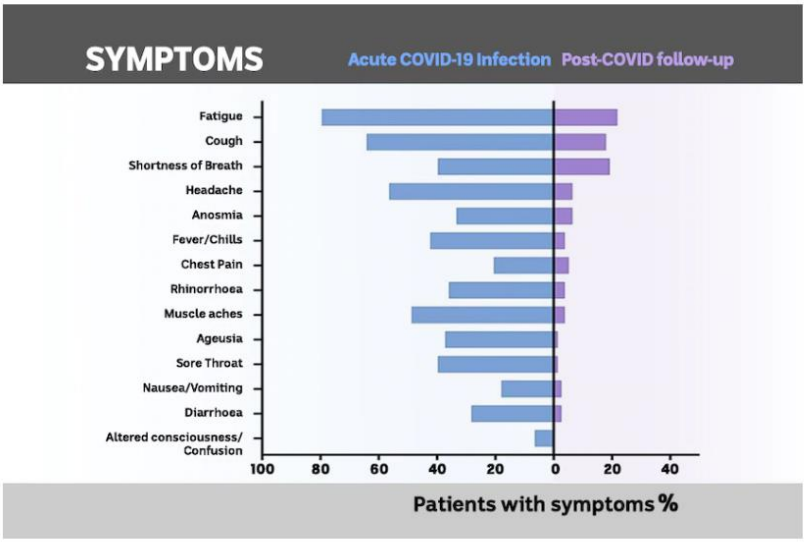
Respiratory and CV Symptoms	Generalised Symptoms	Neurological Symptoms	GI (digestive) Symptoms
• Breathlessness • Cough • Chest tightness and/or pain • Palpitations	• Fatigue • Fever • Pain	• Cognitive impairment (loss of concentration or memory issues) • Headache • Sleep disturbance • Pins and needles • Dizziness • Delirium (in older people)	• Abdominal pain • Nausea • Diarrhoea • Anorexia and reduced appetite (in older people) • Weight loss
Musculoskeletal Symptoms	**Psychological / Psychiatric Symptoms**	**Ear, Nose and Throat Symptoms**	**Dermatological Symptoms**

- **Joint pain**
- **Muscle pain**
- Symptoms of depression
- Symptoms of anxiety
- Tinnitus
- Earache
- Sore throat
- Loss of taste and/or smell
- Skin rashes

3. Long Covid prognosis

Each individual will experience COVID recovery differently and the course of recovery does not appear to be related to the severity of the initial infection. Most recent studies have shown that even non-hospitalised subjects with mild acute illness and without any significant comorbidities are also experiencing prolonged symptoms and multi-organ derangement following acute COVID-19. The following table from the ABC demonstrates this (ABC, 2020):

More than one-third of those with ongoing symptoms had a mild illness and were not sick enough to be hospitalised when they had COVID-19.



The study looked at participants' symptoms at diagnoses compared to 69 days afterwards. *(Supplied: St Vincent's Health Network)*

Indicators for Long Covid and Poor Prognosis

- Changes in laboratory results If the laboratory results such as the levels of white blood cell (WBC), lymphocyte, etc. are abnormal, the patients may have poor prognosis.
- Changes in CT findings: The imaging features and total CT score vary throughout the course of the disease, from initial diagnosis until patient recovery. According to the analysis of imaging features, pleural effusion is rare in cases of COVID-19. Hence, the presence of pleural effusion and diffuse alveolar damage patterns might suggest poor prognosis, as do the high incidences of consolidation, linear opacities, crazy-paving pattern, bronchial wall thickening, lymph node enlargement and pericardial effusion. In summary, analysis of CT findings might be useful to predict the clinical outcome and patient prognosis. If clinicians can deduce specific patterns of lung abnormalities from CT scans, patient prognosis can be efficiently predicted.
- Elderly individuals and those with chronic underlying diseases.
- Differences in host susceptibility to viruses and immune systems.
- Myocardial injury caused by coronavirus infection.
- Diabetes or some other comorbidities.

- Time span between illness onset and antiviral treatment are major factors.

On the other hand, some researchers have reported that some factors can strengthen the immune system such as diet with enough proteins, nutrition, exercise and adequate sleep. Unhealthy lifestyle, medication or radiation, occupational or environmental factors may weaken a person's immune system, increasing the likelihood of them developing long Covid.

Long Term Prognosis

Currently, it is extremely difficult to predict long-term outcomes for people with long Covid due to its recent nature. Some sources state that people may experience symptoms for 60-90 days but may feel tired for up to 6 months. Other research has stated that for some people, long Covid symptoms may continue for many more months or even years where one study stated that for over 90% of respondents, recovery exceeded 35 weeks. The most frequently symptoms after month 6 were found to be fatigue, post-exertional malaise and cognitive dysfunction.

4. Long Covid risk factors i.e. pre-existing physical and mental health conditions, stressors i.e. workplace, community etc

Age

Long Covid has been found to be more likely with increasing age where people ≥50 years have the greatest odds for developing it. The average age of someone presenting with long Covid is 4 years older than people who have had 'short COVID'.

Sex

Long Covid is twice as common in women as in men as well as in individuals with a higher body mass index (BMI).

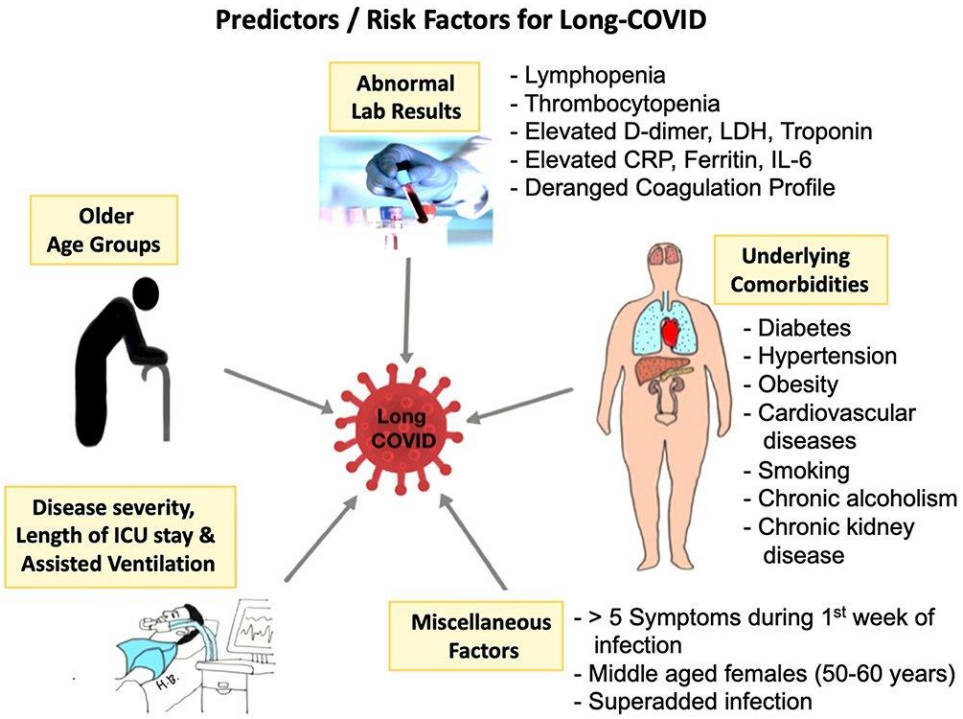
Pre-Existing Medical Conditions

- Hypertension
- Obesity
- Psychiatric condition
- Immunosuppressive condition
- Asthma
- Poor mental health
- Poor general health

Severity of Acute COVID

A cross-sectional study identified an association between the severity of the acute covid-19 infection and post-recovery manifestations in people who have had covid-19, showing that a more severe acute phase may transform into the development of more severe symptoms of long Covid. Further studies have shown that patients with more than five symptoms during the initial covid-19 infection and those that required hospital admission were more likely to experience long Covid symptoms. In particular, if the following symptoms are experienced within the first week of infection, an individual is 2-3 times more likely to develop long Covid symptoms:

- Persistent cough
- Hoarse voice
- Headache
- Diarrhoea
- Skipping meals
- Shortness of breath



Source: Image summarising all the predicting factors of Long Covid (Garg et al., 2021).

5. Long Covid treatment modalities

Treatment options are currently limited as there is insufficient understanding of the mechanisms that underpin long Covid. Despite these uncertainties concerning the optimal treatment of patients with long Covid, a number of countries have produced clinical guidelines to assist clinicians. Patients may require multidisciplinary care involving the long-term monitoring of ongoing symptoms, identification of potential complications for clinical intervention, physical rehabilitation, mental health support and social services support.

Physical rehabilitation

Patients with severe acute COVID-19 who are managed in intensive care units may develop muscle weakness, deconditioning, myopathies (muscle disease) and neuropathies (nerves damage or dysfunction), which are the physical domains of post-intensive care syndrome. It is recommended that appropriate rehabilitation to prevent this syndrome should start in intensive care units as soon as sedation and clinical stability permit. Pulmonary rehabilitation, including oxygen supplementation, may help improve patients' breathing, exercise capacity, muscle strength, quality of life and functional outcome. Early mobilisation would help to improve functional, cognitive and respiratory conditions in these patients and may shorten hospital stay.

Non-hospitalised patients with long Covid may also require physical rehabilitation, especially those with cardiopulmonary problems who may need significant rehabilitation, in order to improve their ability to engage in activities of daily living. However, identifying this group of patients may be challenging due to under-recognition and under-investigation of symptoms. There is also a risk that non-hospitalised patients with long Covid with mild-to-moderate symptoms, who are likely to represent a significant proportion of long Covid sufferers, may not be prioritised for follow-up care.

Early research has highlighted the utility of prescribed exercise programs in the treatment of long Covid. Aerobic exercises may boost immunity and respiratory functions as well as increased functional capacity of people with long Covid in their self-care or return to work.

Management of pre-existing comorbidities

A significant proportion of patients who experience severe acute COVID-19 have underlying comorbidities. It is therefore essential that these are adequately managed in order to avoid clinical deterioration and the need for readmission in these patients.

Mental health support

Psychological and mental health issues such as anxiety, depression, PTSD and suicidal ideation have been discussed earlier as some of the long-term consequences of long Covid. There is a need to ensure that appropriate mental health support is available and accessible to those patients who require such services. Patients may be screened as part of their follow-up care and those identified as requiring extra support referred for specialist management. However, care should be taken not to pathologise patients as physical manifestations of COVID-19 may distort responses to assessment tools.

Pharmaceutical Intervention

The utility of steroids, anticoagulants and other medications is currently being explored as treatment modalities for long Covid. Special care must be taken when prescribing steroids to avoid secondary fungal infections like aspergillosis, mucormycosis and pneumocystis pneumonia especially in diabetic and immunocompromised patients.

Social services support

Due to persistent symptoms, a significant number of patients with long Covid are unable to return to work and may require long-term governmental financial support. Some patients may be unable to cope with day-to-day living especially if they also suffer significant social isolation and or stigmatisation.These groups of patients would benefit from social services support.

Allied Health Services

Aside from physical rehabilitation and mental health support services, education to patients with long Covid regarding self-management techniques and additional supports available may increase independence in activities of daily living. Education regarding energy conservation and pacing techniques may also be beneficial to improve outcomes and capacities. Assistance with developing return to work plans that are based around gradually upgrading capacity have not been widely discussed in relation to long Covid however, is expected to be an emerging field as ‘societal long Covid’ impacts become more prevalent.

6. If there isn't much evidence for treatment, what are the typical symptoms experienced with long Covid and typical treatments used to address the generic symptoms?

RACGP acting president Ayman Shenouda said some of the persistent symptoms like fatigue and cough could indicate more serious underlying health issues. "It can be in the lungs, where they have shortness of breath and that could be lung disease," he said. While not all patients will have such severe symptoms, the guide suggests GPs should investigate persistent symptoms that could point to things like cardiac complications or pneumonia. It also urges GPs to consider chest x-ray at 12 weeks for those who have had significant respiratory illness.

Respiratory symptoms (cough, breathless, etc)

Respiratory symptoms seem to be best managed with simple breathing control exercises and medication where indicated (such as proton pump inhibitors if reflux is suspected). Pulse oximeters may be extremely useful for assessing and monitoring respiratory symptoms after covid-19.

Fatigue

Patient resources on fatigue management and guidance for clinicians on return to exercise and graded return to performance for athletes with covid-19 are currently all based on indirect evidence. However, suggest that exercise in such patients should be undertaken cautiously and cut back if the patient develops fever, breathlessness, severe fatigue, or muscle aches.

Cardiopulmonary complications (chest pain, Thromboembolism, Ventricular dysfunction, etc)

Chest pain is common in post-acute covid-19. The clinical priority is to separate musculoskeletal and other non-specific chest pain (for example, the symptom described by a large patient-led survey as "lung burn") from serious cardiovascular conditions. Clinical assessment of the post-acute covid-19 patient with chest pain should follow similar principles to that for any chest pain: a careful history, taking account of past medical history and risk factors, a physical examination, backed up as indicated by investigations (infographic). Where the diagnosis is uncertain, or the patient is acutely unwell, urgent cardiology referral may be needed for specialist assessment and investigations (including echocardiography, computed tomography of the chest, or cardiac magnetic resonance imaging). If the patient has been diagnosed with a thrombotic episode, anticoagulation and further investigation and monitoring should follow standard guidelines. It is not known how long patients remain hypercoagulable following acute covid-19. Left ventricular systolic dysfunction and heart failure after covid-19 can be managed according to standard guidelines.

Intense cardiovascular exercise must be avoided for three months in all patients after myocarditis or pericarditis; athletes are advised to take three to six months of complete rest from cardiovascular training followed by specialist follow-up, with return to sport guided by functional status, biomarkers, absence of dysrhythmias, and evidence of normal left ventricular systolic function.

7. What are the NSW dept. of health, long Covid rehab guidelines?

The NSW dept. of health has not publicly issued guidelines for long Covid rehab however, it has been suggested that this will likely involve treating both long Covid and pre-existing comorbidities.

Despite many patients recovering from the acute respiratory effects of COVID-19, many will still require further rehabilitation. These rehabilitation needs may be reduced with early intervention which may range from offering practical advice on how to counter brain fog to helping patients navigate relationship changes and overcome feelings of inadequacy over not being able to work.

The following guidelines have been developed for acute care physicians and allied health professionals on referring people who are recovering from COVID-19 to multidisciplinary rehab assessment and management (NSW Health, 2020).

1. **Settings of MDT services:**
   - Inpatient and outpatient rehab involving transfer to a rehab facility or home.
   - Telerehabilitation and rehabilitation in home for patients while they recover.
   - Important to integrate services with existing single therapy disciplines already involved.

2. **Applicability**
   - For those people who have been diagnosed with moderate to severe COVID-19.
   - For those who have been diagnosed with, or are recovering from extra-pulmonary complications of COVID-19, or those with persistent symptoms who are being managed in the community.
   - For those with disabilities and/or multiple comorbidities living in the community under lockdown or quarantine conditions who have high risk factors for developing moderate to severe COVID-19 should they become infected. This is the concept of prehabilitation

3. **Referrals**
   - There are a number of criteria to consider for referring COVID-19 patients for a multidisciplinary rehabilitation medicine assessment, these may include two or more of the following.
   - Anyone who has spent more than seven days on a ventilator or is expected to be ventilated for more than seven days.
   - Inability to mobilise independently.
   - Inability to self-care, feed, dress, wash and toilet without assistance.
   - Evidence of malnutrition (greater than 10% of weight loss and/or a BMI less than 18.5–20kg/m2), or those who have received parenteral nutrition.
   - Swallowing and/or communication impairment.
   - Intercurrent acute stroke, acute myocardial infarct, acute limb ischemia venous thromboembolism and/ or acute requirement for haemodialysis.
   - Critical care myopathy and/or neuropathy, including Guillain Barre Syndrome.

- New onset of dyspnoea and/or oxygen de-saturation (pulse oximetry below 92% (88% for COPD) on room air after 5m walk).
- Persisting cognitive impairment in a person with no evidence of cognitive impairment pre-COVID-19 diagnosis (MMSE<26/30 when the CAM delirium screening tool is negative).
- Pain significantly impacting function at a VAS >4.
- Any patient with pre-existing disability, including those with developmental disability, neuromuscular disability and intellectual disabilities.
- When a single discipline therapist requests more intensity of therapy or inpatient/in-reach multidisciplinary rehabilitation to improve patient outcomes.
- When clinically, the patient appears unlikely to recover to premorbid level of function by the time of planned discharge.

4. **Ongoing communication**
   Rehabilitation medicine services include ongoing communication strategies with the referring acute teams and the preparation of virtual care teams and community services to continue care in the home for those with ongoing symptoms.

   Types of communication include:
   - written discharge summaries
   - phone contact with GPs
   - email and online communication with virtual care clinics
   - direct phone or online contact with rehabilitation in the home teams and telerehabilitation teams for the purposes of transfer of care.

5. **How to refer**
   Processes for referral for a rehabilitation medicine assessment will vary between and within LHDs but will include referrals to rehabilitation medicine team members made by phone, text, email, online and face to face.

The following guidance has been developed for physiotherapists

1. **Determine risk**
   Consider the risk involved of a patient not receiving immediate rehabilitation on outcomes such as risk of hospitalization, extended hospital stay

   If the therapist continues with a rehabilitation assessment or treatment – point of care risk assessments should be done prior to each patient interaction

2. **Try and do as much as possible without patient contact**

   Find other innovative ways to gather information without direct contact with patients in isolation. Consider telehealth methods to conduct a subjective assessment or a pre-treatment screening or discharge planning; to observe patient mobility, etc)

3. **Determine the type of Personal Protective Equipment (PPE) needed for patient contact**
    - Aerosol Generating Procedures (AGP's)
    - The type of oxygen therapy the patient is receiving and the type of procedure conducted will determine if a procedure is aerosol-generating
    - Therapies that require airborne precautions:
        - High flow nasal oxygen
        - Non-invasive ventilation
        - Nebuliser treatment
        - Tracheostomy tubes with/without mechanical ventilation requiring open suctioning
    - Sputum inducing procedures require airborne precautions
    - Respiratory physiotherapy
    - Activities resulting in expectoration of sputum – moving from lying to sitting, walking, bedside ADL's, prone positioning

4. **Other considerations before starting direct contact treatment**
    - It is critical to have a step-by-step process for donning and doffing PPE to avoid contamination
    - Use the minimum amount of people required to safely administer a treatment session
    - Careful consideration is needed with regards to equipment use. Be sure that it is line with infection control measures and that any equipment can be properly decontaminated. Avoid moving equipment between COVID-19 and non-COVID-19 areas. Opt for using single patient use, disposable equipment (i.e, Theraband instead of hand weights)

8. What are the risk factors from a RTW perspective?

Societal and Medical Attitudes towards long Covid

Since long Covid is a very new concept, there is very little research in this emerging field and as a result, many long Covid patients report dismissive attitudes by medical providers, which can make seeking care—whether psychological or physical—even more challenging. Likewise, many have friends and family who are unfamiliar with the emerging science about long Covid and express doubt or surprise at how severe and persistent the symptoms are. These societal attitudes and lack of understanding of long Covid have resulted in many people avoiding care and a number of online communities of people experiencing long Covid symptoms are emerging where experiences can be exchanged and awareness raised to influence guidelines and societal attitudes. Consequently, it is critical for health professionals to acknowledge and validate patients' symptoms. These attitudes must also be considered in the return to work space where employers and insurers may not be understanding of the difficulties faced by someone experiencing long Covid trying to return to preinjury duties and hours.

Cognitive Function and Mental Health

Patients with long Covid frequently rank cognitive function and mental health at the top of their concerns. When talking with patients who have long Covid, it's important to start by asking about their most prominent concerns and what their goals are. This may include asking the following overarching questions:

- "What are you hoping to get back to?"
- "If you weren't sick, what would you do today?"

Answering these questions can help patients and health practitioners to identify specific goals and start developing a plan for what a meaningful life could look like. It is important for patients to know that their experiences are valid and real and that they can try to alleviate them by making changes to their mood, behavior, and more.

So far, research indicates that COVID-related encephalopathy may lead to other neuropsychiatric outcomes, including psychosis. → it's important to bring in psychologists who can monitor and address any mental health symptoms that emerge.

For patients experiencing issues like brain fog or memory loss, their mental health will affect their cognition. Patients with severe cognitive issues, such as difficulty accessing important memories or lack of executive functioning would require referrals to a specialised psychologist or neuropsychologist.

For patients reporting less acute symptoms, health professionals may provide the following:

- Education on anxiety management strategies
- Coping strategies for irritability, frustration and sadness
- Behaviours patients can engage in to improve emotional states
- Positive, yet realistic thinking strategies

Health professionals can help people with long Covid manage anxiety about what their symptoms may look like in the future by teaching them to focus on the present. Mindfulness therapy can be one avenue for patients to increase awareness and acceptance of their experiences and change their mental and emotional reactions to physical symptoms, and it can help control panic over symptoms like breathlessness. We cannot control what the future holds. All we can control is your behaviors and thought patterns in the present.

Reduction in Work Capacity

Clients with fatigue may need help mapping out plans for how many tasks they can complete that day, and what they can ask their families to take on. Many people with long Covid may not be able to accept having reduced or no capacity to work, leading to a decline in self-worth and independence. Other consequences may include feelings of hopelessness, thoughts of self-harm and suicide, and the fear that COVID could affect the rest of their lives.

Fear returning to workplace

Many people with long Covid experience fear and anxiety returning to the workplace. This may include fear of infecting others, past infection of others and fear of becoming reinfected. This is particularly prominent if they have infected someone previously who has deconditioned or passed away. These are additional factors that must be considered when planning the return to work of someone with long Covid.

Physical Capacity

A number of symptoms of long Covid are related to fatigue, shortness of breath, heart palpitations and pain which may not only affect someone's capacities and abilities to complete pre-injury duties/hours but may also pose a risk to themselves or others in the workplace. Consideration of additional risk factors due to symptoms of long Covid is crucial to facilitate a safe return to work.

The following is a resource introduced in Europe to explain the challenges of returning workers and managing long Covid symptoms:

https://osha.europa.eu/en/highlights/covid-19-and-long-covid-step-step-guidance-getting-back-work-managers-and-workers

It outlines some modifications to workplace duties and hours that may facilitate a return to work and recovery at work plan.

- Alterations to timings and hours
- Alterations to workload
- Taking regular breaks
- Additional support and supervision
- Time off for healthcare appointments
- Phased return to work and option for working from home
- Equipment adjustments

- Counselling

It also outlines what employers can do to assist with facilitating return to work:

- Stay in touch while the worker is absent from work
- Prepare for the worker's return
- Have a return-to-work conversation
- Provide support during the early days of the return to work
- Provide ongoing support and review regularly

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