



Physical activity and long COVID

Emerging evidence suggests a causal link between physical inactivity and the morbidity and mortality from COVID19 infection. This report aims to progress this field of thought by exploring the available literature on the relationship between physical activity and long COVID. The report will be of use to local public health teams supporting their communities in recovery from infection, as well as local and system partners for integration into long COVID pathways. A series of recommendations will be made at the end of the report.

Section 3.0 and 4.0 of this report are from the Yorkshire and Humber Long COVID impact report by Smith-Connell, L et al (October 2021) which can be accessed [here](#).

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1.0 Statement on physical activity

Low levels of physical activity are a major public health challenge, contributing to the national burden of non-communicable disease and demand on health and social care services. Regular physical activity is proven to help prevent and manage noncommunicable diseases (NCDs) such as heart disease, stroke, diabetes and several cancers. [1] It also helps prevent hypertension, maintain healthy body weight and can improve mental health, quality of life and well-being. [2]

The coronavirus pandemic has adversely impacted on rates of physical activity. Sport England's Active Lives survey reports a 1.9% fall in active adults (710,000 people) and a 2.6% rise in inactive adults (1.2m people) [3]. There has been a 2.3% fall in active children (100,000) with a 10.9% fall in active play and informal activity. [3]. In addition to physical activity, the various Non-Pharmaceutical Interventions (NPI's) aimed at curbing the spread of the virus have increased sedentary time with



people spending more time at home. Certain communities experience greater inequalities in physical activity, these include; Ethnic minorities, women, young people, older adults over 75s, disabled people and people with long-term health conditions. Further information on physical activity inequalities can be found on the Yorkshire and Humber Public Health network website, [here](#).^[4]

Physical activity needed for general health benefits varies for different all age groups, disabled adults, pregnant women and women after childbirth. The overall recommendation for children and young people (5-18yrs) is 60 minutes of activity per day and for adults either 150 minutes of moderate activity per week or 75 minutes of vigorous activity per week, along with minimising sedentary time and strength based exercise twice a week. More detailed recommendations on physical activity can be found [here](#) ^[5]

2.0 Physical activity and COVID19 infection

Emerging evidence suggests that physical inactivity is linked to more severe COVID19 infection and a heightened risk of dying from the disease, and that regular physical activity acts as a protective factor. Four studies were of relevance to this report.

- 1) The most comprehensive study came from a systematic review and meta-analysis in 2021 ^[6] which found that physical activity reduced the risk of infection and mortality and that it “enhances the first line of defence of the immune system, and increases the potency of vaccination” p.1686
- 2) A large observational study of over 48,000 adults from the USA in April 2021 ^[7] found a direct link between inactivity and hospital admission, intensive care admission and death from COVID19. This report concluded that;
“short of vaccination and following public health safety guidelines such as social distancing and mask use, engaging in regular [physical activity] may be the single most important action individuals can take to prevent severe COVID-19 and its complications, including death” p.1105
- 3) A large cohort study of 468,569 people from the UK in 2021 ^[8] added further weight to the USA study by finding that improvements in healthy lifestyle behaviour including physical “and meeting public health guidelines or best practice recommendations could be used as an ancillary measure to ameliorate infectious disease mortality” p.27
- 4) Finally, a review published in the Journal of Sports Medicine and Physical Fitness in November 2021 by Methnani, J et al. ^[9] found that both a lack of physical activity as well as excess sedentary time may put someone at risk of COVID19. The review summarised by saying;
“Moderate to vigorous physical exercise may counteract the latter effects and further prevent progression to severe COVID-19, if the virus is contracted. Simpler approaches, such as breaking up sedentary time, may optimize metabolic health and analogically immune health” p.1544



3.0 Statement on long COVID

The term Long Covid emerged from people who were themselves experiencing symptoms following infection of Covid-19 [10] for a prolonged period, beyond that which would be expected for an infection of this type.

Clinically this syndrome has been captured by NICE¹, SIGN² and RCGP³ guidelines [11] which detail the effects of Covid as distinguished into three stages:

1. Acute Covid-19 infection – symptoms consistent with Covid-19 during the first 4 weeks following infection
2. Ongoing symptomatic Covid-19 – signs and symptoms of Covid-19 beyond 4 weeks but less than 12 weeks following infection, during this period the patient is no longer contagious
3. Post-Covid-19 Syndrome (or Post-Acute-Covid-19 Syndrome) – signs and symptoms that develop during or after infection that continue for more than 12 weeks which are not explained by alternative diagnosis, during this period the patient remains non-contagious

NB – Long Covid is sometimes used interchangeably to refer to both those with ongoing symptomatic and post-Covid-19 syndrome. This term is favoured by people experiencing symptoms, however clinical services are encouraged to use the terms and coding following the NICE guidance terms. For the purposes of this report we will use Long COVID as this is more ubiquitous and is less restrictive when discussing any symptoms beyond 4 weeks.

3.1 Long COVID and older adults

It is plausible that long COVID will lead to further deconditioning in some older adults [12]. The approach to its recovery will be similar to the approach to deconditioning recovery in patients (gradual increase of light exercise), however some patients will require specialised treatment. The 'Wider impacts of COVID-19 on physical activity, deconditioning and falls in older adults report' [12] has a series of recommendations for addressing deconditioning for adults with long COVID, page 64 of the resource [here](#).

¹ National Institute for Health and Care Excellence

² Scottish Intercollegiate Guidelines Network

³ Royal College of General Practitioners



4.0 Estimated prevalence of long COVID

The main source used for overall national prevalence for Long Covid is the ONS [13]. The ONS data set uses self-reports by people completing the Covid Infection Survey (CIS).

- ONS estimates **1.7% (1.1 million)** [13] of people living in private households have self-reported Long Covid symptoms at least 12 weeks following infection. Of those reported to have had Acute Covid-19 13.7% [14] went on to experience at least one symptom lasting over 12 weeks

This estimate is pulled from self report, and does not differentiate between people who experience symptoms and those requiring care, treatment or support, it is also valuable to consider data that demonstrates Long Covid presentations in primary care.

Reporting in primary care electronic health records (EHR) show significantly lower numbers of people seeking support for Long Covid. Individuals known to have Acute Covid-19 going on to seek help for Long Covid symptoms (Post Acute Covid-19 Syndrome code) was found to be 0.3%, however another electronic health provider reported significantly higher rates.

Reporting using EHR should be treated with caution as there was a delay before the code for Long Covid was established, and for some time was only searchable by using Post-acute-Covid-19 syndrome, which was less common terminology at the time.

It is fair to expect that those who were hospitalised would have more significant rehabilitation needs, both as a result of more significant symptoms but also because of treatment and reduced occupational activity during their time in hospital, which could also last 12 weeks or more.

Evidence from a longitudinal cohort study [15] found differences in symptom presentation and number of symptoms. Those who experienced hospitalisation experienced more symptoms overall and were significantly more likely to have cognitive difficulties but were less likely to have myalgia or headaches.

5.0 Physical activity and long COVID

5.1 Available literature

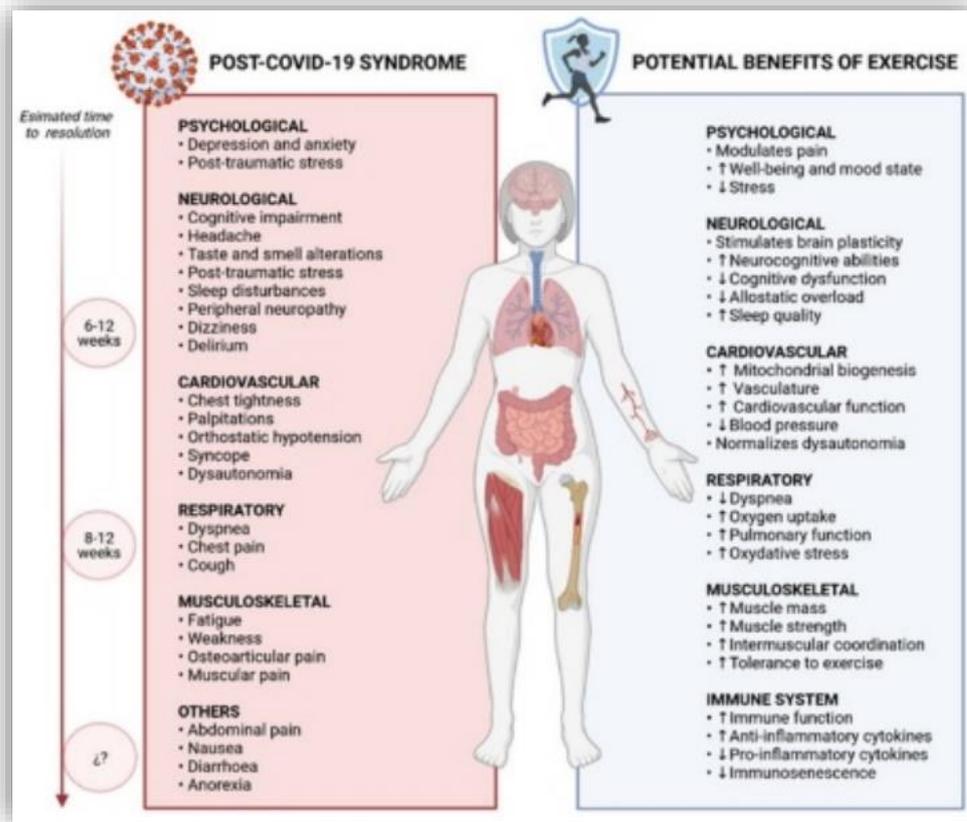
This report found a range of studies and research literature with a varying level of quality. The following section aims to highlight some of the main available literature which present links between physical activity and long COVID.



Reference number	Title	Type	Key summary finding
[16]	Rehabilitation to enable recovery from COVID-19: a rapid systematic review	Systematic Review	“Exercise, early mobilisation and multicomponent programmes may improve recovery following ICU admission for severe respiratory illness that could be generalizable to those with COVID-19” p.4
[17]	The Relevance of a Physical Active Lifestyle and Physical Fitness on Immune Defence: Mitigating Disease Burden, With Focus on COVID-19 Consequences	Review	“HBE (<i>Home Based Exercise</i>) or OBE (<i>Outdoor Based Exercise</i>) models can be a potent strategy to mitigate the progress of infection, and a coadjutant therapy for COVID-19 at all ages and different chronic conditions” p.2
[18]	Exercise Is Medicine for Immune Function: Implication for COVID-19	Review	“There is a growing awareness that COVID-19 can cause sustained morbidity in some patients, and physical training and rehabilitation (tertiary prevention level) can be directed toward improvement in physical fitness, quality of life, and immune health” P.395
[19]	Rehabilitation and physical activity for COVID-19 patients in the post infection period.	Review	“Rehabilitation therapies may help to restore physical function in patients and to reduce the long-term effects of COVID19 infection” p.310
[20]	Lifestyle and rehabilitation during the COVID-19 pandemic: guidance for health professionals and support for exercise and rehabilitation programs.	Expert review	“We recommend daily physical exercise, outdoors or at home, as physical exercise increases the synthesis of anti-inflammatory cytokines” p.1385 and in addition... “The role of the physiotherapist in the hospital environment is of fundamental importance-early mobilization is highly recommended in severe cases of COVID-19” p.1385
[21]	Post-COVID-19 Syndrome and the Potential Benefits of Exercise	Narrative review	In relation to post COVID symptoms... “regular exercise may improve many of these symptoms and could reduce the long-term effects of COVID-19” p.1 “There is sufficient evidence suggesting that tailored and supervised exercise training may be an effective multisystemic therapy for post-COVID-19 syndrome that suits the diversity of the cases and symptoms” p.10 “A multidisciplinary and integrative approach including exercise sciences is essential, where clinical conditions are addressed but must integrate neurocognitive and psychological aspects into the assessment, as well as the social impact that this pathology entails” p.11
[22]	Safe Return to Exercise after COVID-19 Infection.	Journal review	“A gradual return to exercise under the guidance of a specialised medical team to achieve the pre-infection fitness level is of utmost importance” p.376
[23]	Comparative effectiveness study of low versus high-	Randomised Control Trial	“Low-intensity aerobic training exercises are more effective in improving the clinical (muscle strength) and psychological (kinesiophobia and quality

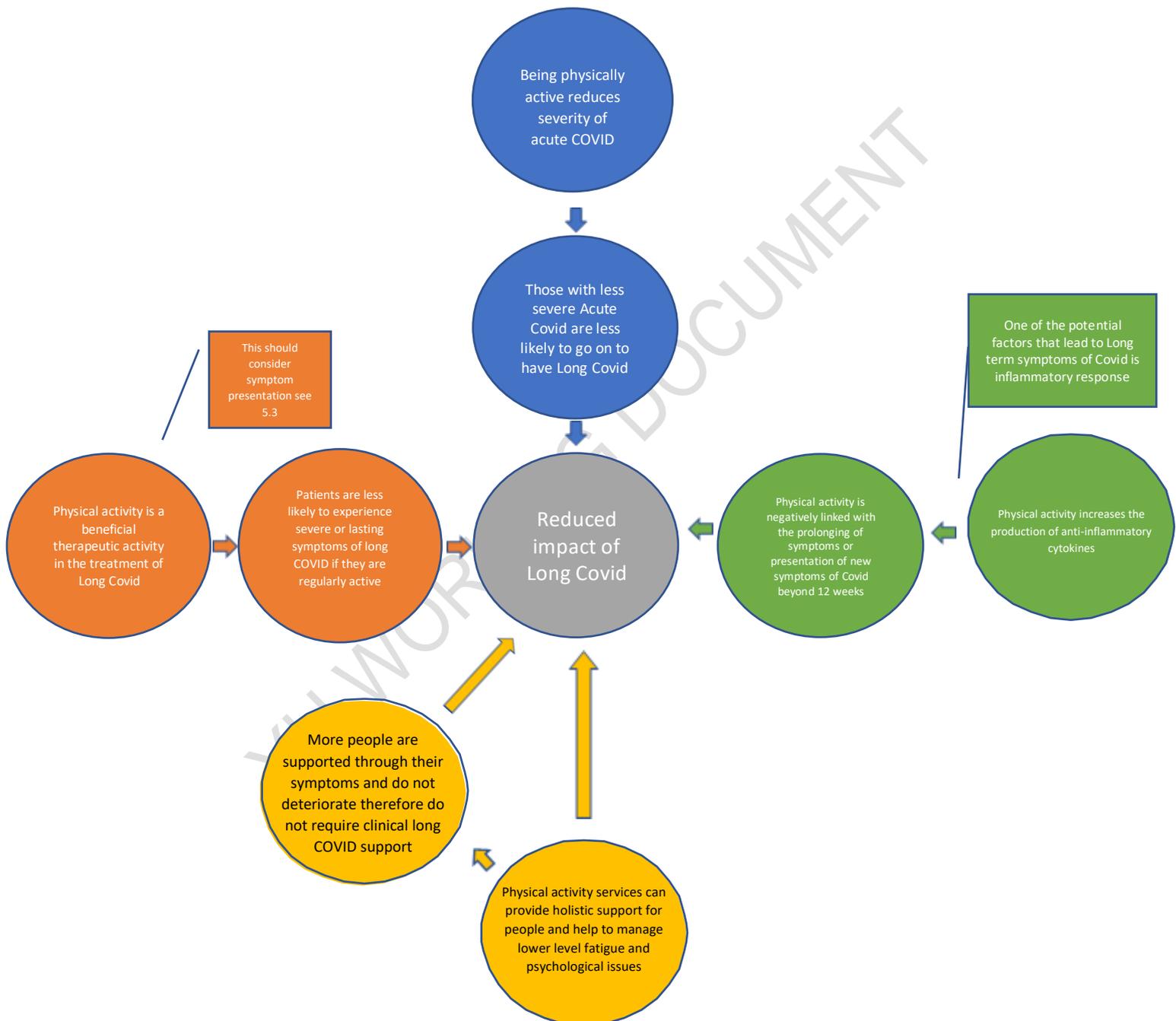
	intensity aerobic training with resistance training in community-dwelling older men with post-COVID 19 sarcopenia: A randomized controlled trial.	<i>(Online preprint)</i>	of life) measures than high-intensity aerobic training in post-COVID 19 Sarcopenia”
[24]	A randomised controlled trial of the effectiveness of an exercise training program in patients recovering from severe acute respiratory syndrome.	Randomised Control Trial	A specific exercise training programme was found to be “effective in improving both the cardiorespiratory and musculoskeletal fitness in patients recovering from SARS” p.218
[25]	Early experiences of rehabilitation for individuals post-COVID to improve fatigue, breathlessness exercise capacity and cognition – A cohort study.	Observational cohort study	“30 individuals (mean[SD] age 58[16]) that completed a 6 week, twice supervised rehabilitation programme demonstrated statistically significant improvements in exercise capacity, respiratory symptoms, fatigue and cognition” p.1
[26]	Exercise intervention and the development of long COVID: A survey of patients admitted to the hospital in Mongolia	Observational cohort study (Ongoing)	Exercise intervention was associated with a lower rate of long- COVID. This suggests the importance of regular exercise after discharge from the hospital.
[27]	Symptoms compatible with long-COVID in healthcare workers with and without SARS-CoV-2 infection – results of a prospective multicenter cohort.	Prospective cohort study <i>(Pre-print not yet peer reviewed)</i>	Physical activity might be protective against neurocognitive impairment/fatigue symptoms after COVID-19
[28]	Use of interval training following covid-19 recovery: A case report. Cardiopulmonary	Individual case report	“It is important for physical therapists to recognize the potential positive effects of IT (<i>Interval Training</i>) on the overall functional mobility of recovering COVID-19 pts, while continuing to provide individualized plans of care” p.1
[29]	Long COVID and the role of physical activity: a qualitative study.	Qualitative study	“Findings highlight the need for greater clarity and tailoring of physical activity-related advice for people with long COVID and improved support to resume activities important to individual well-being” p.1

The review by Jimeno-Almazán, A et al from May 2021 [21] included an informative infographic on the potential benefits of exercise on the most frequent clinical manifestations of post-COVID-19 syndrome. That image is included in this report as follows;



5.2 Yorkshire and Humber Physical Activity long COVID theoretical model

The following theoretical model [30], based on available evidence, helps to visually show the role that physical activity plays in reducing the impact of long COVID.





5.3 Long COVID symptom presentation

Those with Long COVID symptoms often report that their symptom profile is variable, more substantially affecting their daily lives at some times and less so at others. This relapsing remitting [31] presentation is consistent with those with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS)[31]. These fluctuations can be positive but may also present additional challenges for the individual.

It is important that clinical (including physiotherapy) level intervention should consider the role of exercise as a way of managing post exertional malaise to maintain progress and prevent deterioration of condition but it is important that this is based around person centred energy management as per the most recent NICE guidance on Myalgic Encephalomyelitis (ME) [32] .

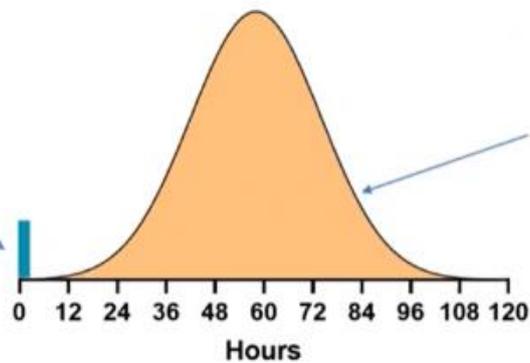
The '*Wider impacts of COVID-19 on physical activity, deconditioning and falls in older adults*' report [12] recommends caution about building up levels of activity levels too rapidly, and the need to refer to post COVID-19 syndrome (long COVID) clinics where symptoms are severe, in order that clinical judgement can be used in relation to graded exercise therapy.

A key aspect that can prolong fatigue is post exertion malaise [33], whereby there is a peak in fatigue, brain fog, muscle aches and flu like symptoms after around 34-48 hours after exertion. This peak can lead to a return or exacerbation of symptoms. A key element of this to consider is that these peaks can overlap, and this has a cumulative effect prolonging the symptoms and, in some cases, leading to deterioration.

The following two images on page 9 are taken from the work of Sheffield Hallam University's Advanced Wellbeing Research Centre [33] and detail the post exertion malaise and its cumulative effect.

Post-exertional malaise/ Post-exertional symptom exacerbation

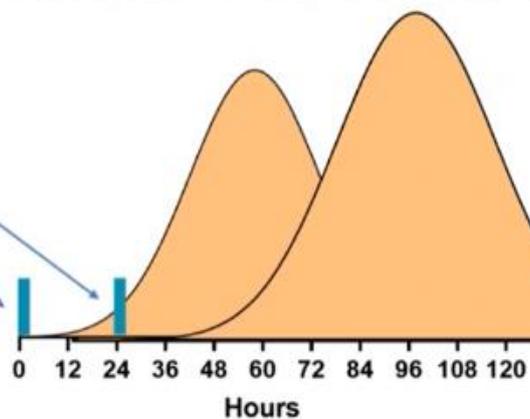
Activity
(physical, cognitive,
emotional)



Symptoms:
Exhaustion
'Brain fog'
Muscle aches/pains
Disturbed sleep
'Flu like' symptoms
Headaches

Post-exertional malaise/ Post-exertional symptom exacerbation – cumulative effect

Activity



Symptom exacerbation/
relapse



A systematic review from November 2021 [34] provided further guidance on management of long COVID fatigue and summarised by stating that its management may be beneficial when:

- “a) physical and psychological support, is delivered in groups where people can plan their functional response to fatigue; and
- b) where strengthening rather than endurance is used to prevent deconditioning; and
- c) where fatigue is regarded in the context of an individual's lifestyle and home-based activities are used” p.2

Further guidance on managing recovery from COVID fatigue, useful for individuals suffering from long COVID, can be found in the Sheffield Hallam fatigue management resource which can be downloaded [here](#).

6.0 Reflections on the physical activity system in Yorkshire and the Humber

The physical activity landscape in Yorkshire and the Humber is a complex but diverse one. Three ‘Active Partnerships’ ([Yorkshire Sport Foundation](#), [North Yorkshire Sport](#) and [Active Humber](#)) support the operational and strategic development of sport and physical activity across the region working alongside local area partners which include local authority public health teams and physical activity/leisure teams and the community voluntary sector. Project Active Yorkshire exists as a strategic partnership to support the direction of physical activity and there are two key networks that exist to help share best practice and develop mutual objectives. ([Healthy Weight and Physical Activity Community Of Improvement](#) and [Yorkshire and Humber Physical Activity Knowledge Exchange](#)).

Work is ongoing with the Office for Health Improvement and Disparities (OHID) regional health and wellbeing team to establish a Yorkshire and Humber system view of sport, physical activity and sedentary behaviour. This work will include a look at the responsibilities of local, system and regional partners, and how physical activity is reflected in wider areas of the health landscape.

7.0 Summary

Physical activity behaviour change can take substantial time and cost, so it is important to recognise that the implementation of the recommendations of this report should consider these factors. It is also important to note that the role that physical activity plays with COVID19 should not just be seen simply as a way to engage inactive people into activity, but as a way for previously active people to return to more normal activity levels for them and a way to enhance individuals recovery from infection, therefore traditional exercise referral programmes may not be the most appropriate tool in this context and should be reviewed where they are part of long COVID pathways.



- A mixture of high-quality published evidence suggests that physical inactivity is linked to increased severity and risk of mortality from COVID19 infection. And conversely being regularly active is a protective factor which can reduce the risk (Hospitalisation and death) of COVID19 infection. [6-9]
- Published evidence also suggests that sedentary behaviour and excess sitting time has a heightened risk of COVID19 infection. [9]
- Evidence suggests that people who experience worse COVID19 infection, including hospitalisation, are more likely to experience greater long COVID symptoms. [15]
- Evidence from a variety of sources including a systematic review, randomised control trials, case controls, and various other reviews, indicate that physical activity should play a role in recovery from long COVID. [16-29]
- Ethnic minority communities have been disproportionately affected by the COVID19 pandemic [35]. It is plausible that these communities will also be disproportionately affected by long COVID, however data isn't available on this in the current modelling. These communities also experience greater inequalities in physical activity participation [4]; therefore, these compounding factors should be given greater consideration when viewing the recommendations of this report.
- The disproportionate impact of COVID19 and lower levels of physical activity are also seen among disabled people [36], those with long term health conditions [36] and older adults [37] and it is plausible that these groups will also be disproportionately affected by long COVID. For disabled people or those with long term health conditions any additional symptoms caused by long COVID are by their very nature multi-morbidity and are likely to hinder any activity to maintain a healthy lifestyle and could therefore lead to deterioration of wellbeing.

8.0 Recommendations

Physical Activity should be seen as an integrated part of long COVID pathways for all levels of severity of post COVID symptoms. An individualised tailored exercise programme is more suitable for those suffering severe symptoms and should consider exercise based on person centred energy management. [13,16,18,19,21,22,24,25,26]

8.1 Local authorities

- Promotion of the NHS '[Your COVID Recovery – Getting Moving Again](#)' website should be prioritised along with local messaging on the importance of physical activity in the recovery from COVID19 infection and long COVID.



- Recommendation for the public that physical activity is helpful at reducing the overall impact of COVID19. For those that have acute COVID, when balanced with formal primary/secondary care treatment, it can reduce the likelihood of their symptoms remaining. For those with long COVID it can support treatment (with practitioner/physiotherapy or Your COVID Recovery) and help rebuild back up to normal activity once in self-care.
- Consider further opportunities to upskill healthcare professionals and non-healthcare professionals (e.g. Community champions, health champions, wellbeing prescribers) with knowledge on brief conversation training for physical activity, the link to COVID infection and to long COVID, to help expand the conversation on physical activity with local communities. For a list of physical activity brief conversation training for healthcare and non-healthcare professionals click [here](#).
- Information provided in this report should also be used to help review physical activity contracts, local physical activity strategies, active lifestyle programmes and the role of traditional exercise referral programmes.

8.2 NHS and the wider healthcare system

- A multi-disciplinary approach to rehabilitation for people with more severe long COVID, which includes physical activity, should also consider the role of exercise science, psychological support and physiotherapies [16,20,21] and the role of post exertion malaise [10,31-34] to help prevent the deterioration of symptoms.
- The risk of further deconditioning in older adults with long COVID should be reflected in long COVID pathways and in referrals to services and should prioritise the role of physical activity. [12]
- Encourage the completion of [PACC](#) (Physical Activity Clinical Champion) training for all healthcare professionals as a preventative measure against poor outcomes from COVID19 infection and long COVID.

8.3 Businesses and workplaces

- This report provides an opportunity for workplaces (and workplace health leads) to understand the role that physical activity has with long COVID which may in turn support a reduction in absenteeism and presenteeism⁴ associated with recovery from infection. The additional knowledge around post exertional malaise and potential symptom relapse can help employers understand the complexity of recovering from long COVID and help limit the effect of presenteeism and further absenteeism.

⁴ the act of showing up for work without being productive because ill-health prevents it



- There is also an opportunity to reframe wider prevention in the workplace with the role of physical activity and limiting sedentary behaviour in helping reduce the impact of, and severity from, future COVID19 infection. This should be seen as particularly important for people that remain unvaccinated, but serves an important role for the physical and mental health of both vaccinated and unvaccinated.

8.4 Further research

This report recommends further research be completed into the role of physical activity for the prevention of, and recovery from, COVID19 infection and long COVID. Any future research should include a more detailed look at:

- The role of sedentary behaviour in COVID19 infection and in particular with long COVID.
- The impact of the cumulative effect of physical activity episodes on long COVID symptoms and recovery

9.0 Further reading

9.1 General rehabilitation including exercises

9.1.1 NICE

Guidance for GP follow up

[Project CARE: Supporting people with a positive diagnosis of COVID-19 and reaching out to those in vulnerable groups | NICE](#)

9.1.2 Leeds Community Healthcare NHS Trust

Long Covid Rehabilitation Booklet, April 2021

<http://flipbooks.leedsth.nhs.uk/LN005039.pdf>

9.1.3 NHS Northern Care Alliance

Post-COVID-19 Rehabilitation and long COVID - Evidence and Resources

<https://www.pat.nhs.uk/education-and-research/covid-resources-rehabilitation.htm>



9.1.4 SPOR models of care

[Microsoft Word - EvidenceReportv7.docx \(sporevidencealliance.ca\)](#)

9.1.5 McMaster COVID-END evidence review. Updated May 2021

[COVID-END in Canada existing resource response #10: What is the best-available evidence about the management of long COVID symptoms and care models for long COVID patients? \(mcmasterforum.org\)](#)

9.2 Physical activity specific advice and exercise referral

9.2.1 BMJ

A review blog in the BMJ

[“Return to exercise” – helping patients to overcome the long tail of covid-19.](#)

9.2.2 NICE

Physical activity pathway updated November 2021

[Encouraging physical activity to prevent or treat specific conditions - NICE Pathways](#)

9.2.3 NICE

Guidance on managing long term impacts of COVID is in the process of being updated.

[Overview | COVID-19 rapid guideline: managing the long-term effects of COVID-19 | Guidance | NICE](#)

9.2.4 NHS England. Your Covid Recovery

Getting Moving Again

<https://www.yourcovidrecovery.nhs.uk/your-wellbeing/getting-moving-again>

9.2.5 Long Covid Physio

Exercise guidance in the June 2021 briefing paper from World Physiotherapy on safe rehabilitation approaches for people with Long COVID specific to physical activity, including exercise and sport.



Exercise — Long COVID Physio

9.2.6 Chartered Society of Physiotherapy (CSP) April 2021 editorial

[Post-covid syndrome | The Chartered Society of Physiotherapy \(csp.org.uk\)](https://www.csp.org.uk/post-covid-syndrome)

9.2.7 Institute of Sport, Exercise and Health (ISEH)

Pathway for athletes struggling to get back to pre-infection levels of fitness (with helpful video)

[LONG-COVID SYNDROME PATHWAY \(iseh.co.uk\)](https://www.iseh.co.uk/long-covid-syndrome-pathway)

9.2.8 Nuffield Health programme open in Hull and Leeds

Covid-19 Rehabilitation Programme (including use of Health and Wellbeing Centres)

[COVID-19 Rehabilitation Programme | Nuffield Health](https://www.nuffieldhealth.com/covid-19-rehabilitation-programme)

9.2.9 Sheffield Hallam University (SHU)

[Sheffield Hallam launches Long Covid research clinics with underserved local communities | Sheffield Hallam University \(shu.ac.uk\)](https://www.sheffieldhallam.ac.uk/news/sheffield-hallam-launches-long-covid-research-clinics-with-underserved-local-communities)

Specialists in sport medicine and rehabilitation from Sheffield Hallam's Advanced Wellbeing Research Centre (AWRC) are offering online consultations with people from the immediate community who are suffering with Long Covid, to understand more about their individual needs and help support recuperation.

9.2.10 Sport England

Nov 21 Consensus statement but it *excludes long covid*

[Physical activity benefits outweigh risks for people with long-term health conditions | Sport England](https://www.sportengland.org/news/physical-activity-benefits-outweigh-risks-for-people-with-long-term-health-conditions)

[Risks from physical activity - Moving Medicine](https://www.movingmedicine.com/risks-from-physical-activity)

9.2.11 Symptoms that may prevent a return to activity

There is a systematic review, currently in pre-print, which looks at the symptoms of long COVID which may impact (return to) physical activity.

To view the prospective:



https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=206245

For more information and the manuscript:

Email matthew.jones@unsw.edu.au

9.2.12 The positive impact of physical activity and exercise on immune function

This is a report from August 2020 that looks at the role physical activity has on prevention and recovery from COVID-19.

[The positive impact of physical activity and exercise Aug2020 web.pdf \(europeactive.eu\)](#)

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