

# Return to Sport Considerations in the Athlete Post COVID-19 Infection



*Department of Sports Medicine, Sport NI Sports Institute, Ulster University, Jordanstown, UK*

## Introduction

Novel coronavirus SARS COV-2 (COVID-19) was first recognized in Wuhan, China in December 2019. The virus has affected all aspects of life including competitive sport. As athletes of all levels begin to return to sport, consideration must be given to potential health risks following previous, current and future infection by COVID-19.[1] This guidance provides an overview of potential issues and considerations for athletes returning to sport after activity and following COVID-19 infection. It is based on the best available information and is subject to change as additional knowledge is discovered about this relatively new infection.

### *Returning to sport after viral infection*

No consensus currently exists on the optimal strategy to return to sport following a viral infection[2]. Returning to high intensity exercise while the body is still experiencing a systemic infection is strongly associated with the risk of significant complications, including viral myocarditis[3]. Myocarditis can predispose to cardiac arrhythmias and even sudden cardiac death. An athlete developing this condition will be required to take a prolonged period of withdrawal from sport of at least 3-6 months, along with additional extensive investigations to ensure their safety[3].

The 'neck check' has been proposed as a mechanism of athlete assessment following a viral illness[4]. If symptoms are confined to the upper respiratory tract (sore throat, coryzal symptoms) participation in exercise is permitted, with symptoms affecting the lower respiratory tract (productive cough) and systemic systems (fever etc.) leading to withdrawal. Although often used as a guide to the relative safety of exercise, the evidence base for this approach is limited[5].

In general, prior to returning to sport an athlete should present with normal markers of infection and inflammation and have no generalised/systemic symptoms. It is widely accepted that a medical screening should be performed to ensure there is no evidence of organ damage that may require

further investigations. On returning to activity, it is usually recommended that a graduated approach is undertaken to build back to the required level of physical activity over the course of several days[2, 4, 5].

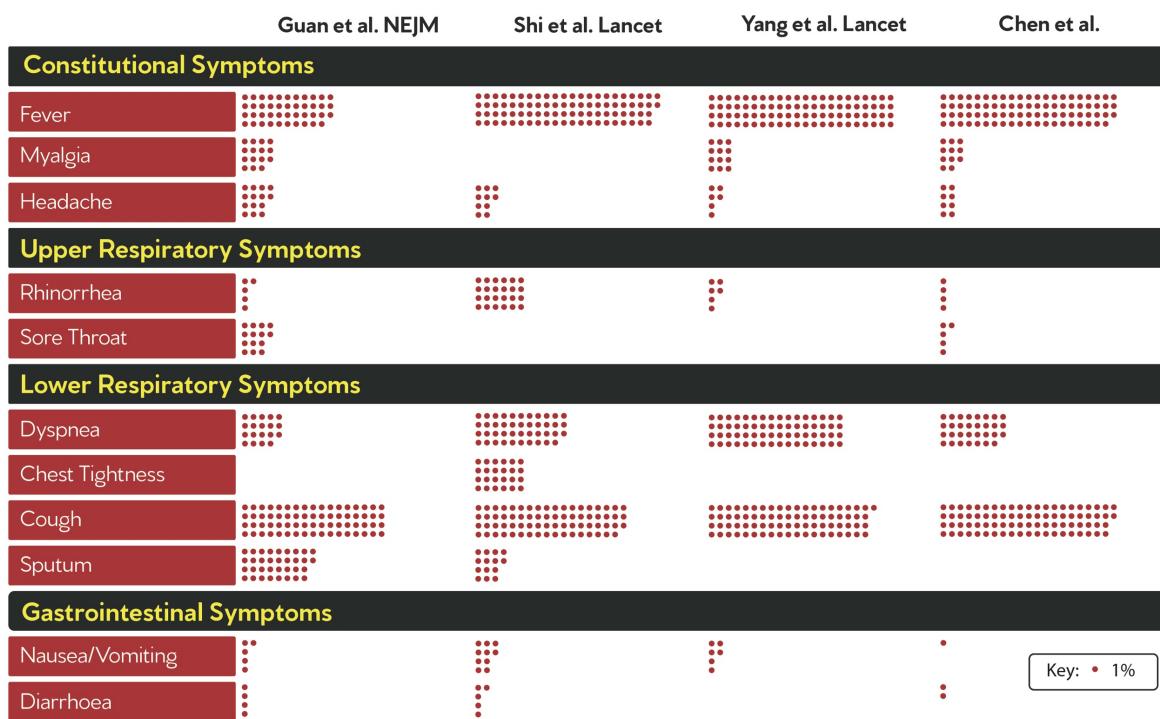
## COVID-19 specific considerations

### *Signs and symptoms of infection*

COVID-19 infection is primarily spread via respiratory droplets from face-to-face contact and via contaminated surfaces[6, 7]. Aerosol spread may occur but its' role in human-to-human spread remains unclear. It is widely estimated that between 48 to 62% of transmission can occur via pre-symptomatic carriers[6].

The common symptoms in hospitalized patients are shown in the Figure 1[8-11]. They include fever in 70 to 90%, dry cough in 60 to 86% and shortness of breath in 53 to 80%[6]. Other common features include fatigue, myalgia, gastrointestinal upset, headache, weakness and rhinorrhoea in 7%[6]. Loss of smell or taste is also associated with the infection and may be the sole presenting complaint in around 3% of individuals with the infection[12]. It is becoming increasingly clear that individuals may carry and transmit the infection while experiencing no symptoms whatsoever[13].

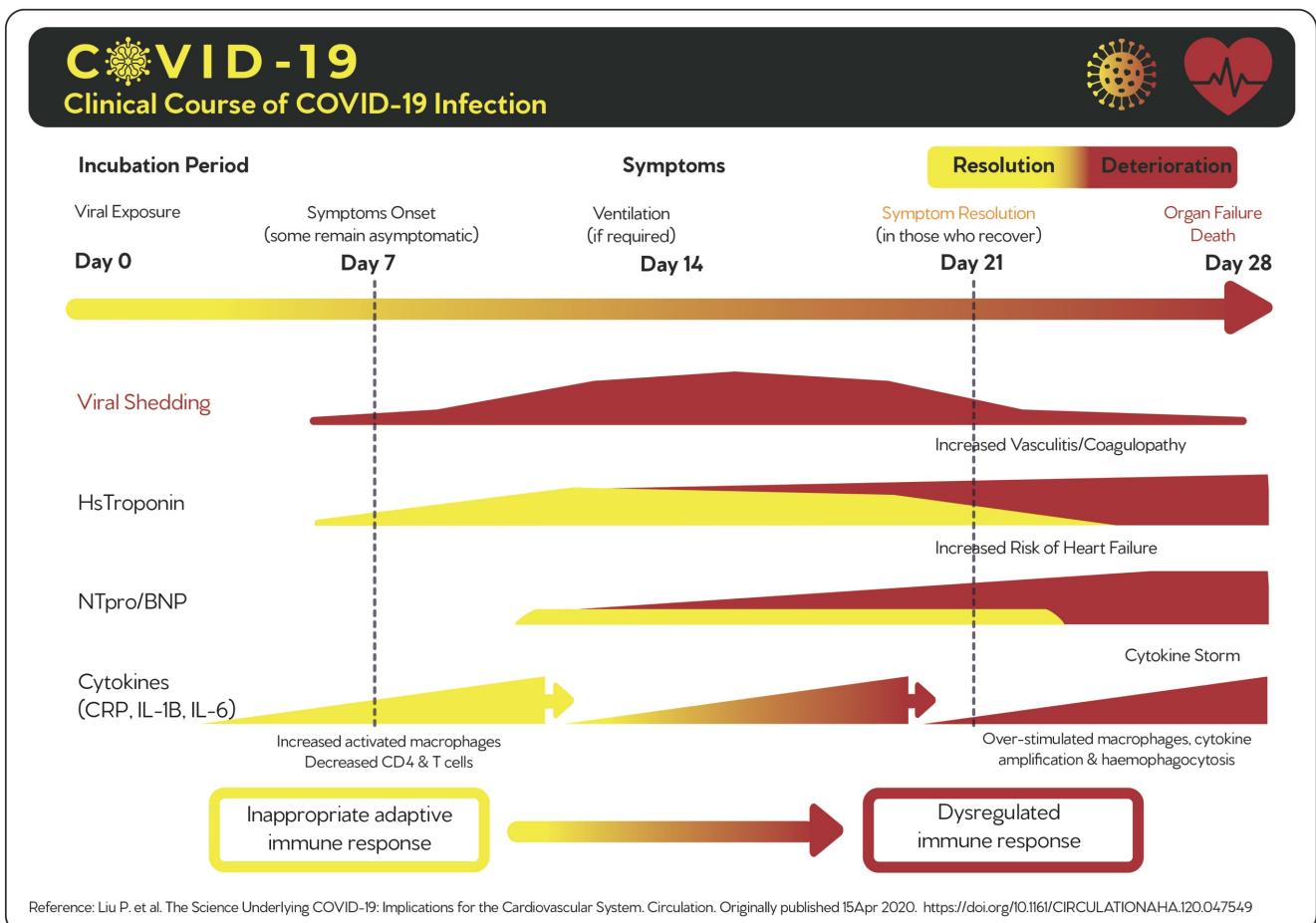
**Figure 1.** Common symptoms of COVID-19 infection



#### *Clinical course of COVID-19 infection*

It is acknowledged that the vast majority of individuals contracting COVID-19 will have a mild infection course[6]. In one of the largest cohorts to date, 81% of patients had mild manifestations with 14% having severe manifestations and 5% having critical manifestations including respiratory failure, septic shock and multiple organ dysfunction[6]. In the UK, a study[14] has reported that out of approximately 20,000 individuals hospitalised with the infection, around 17% were admitted to high dependency or intensive care units. In athletes, the majority of infection is likely to be either asymptomatic or mild. The typical course of the infection is illustrated in Figure 2[15].

**Figure 2.** Clinical course of COVID-19 infection



### Potential complications:

The virus infects cells directly via the ACE-2 receptors, expressed on the surface of multiple cells including pneumocytes, myocytes and endothelial cells. Through direct infection and a subsequent systemic inflammatory response, multiple organ systems can be involved.[1] Caution is therefore warranted when returning to activity after infection. Continuing with physical activity during viral infection is recommended if symptoms are non-systemic and isolated to the upper respiratory tract (the neck check)[4]. The evidence base for this approach is limited and in COVID-19 where systemic involvement is a significant risk, a more cautious approach should be considered[4]. Current guidance on return to sport suggests a minimum convalescence period of 10 days after the onset of symptoms, and that athletes are asymptomatic for seven days.[4, 16]

**Table 1.** Potential organ involvement during COVID-19 infection and potential implications for the athlete

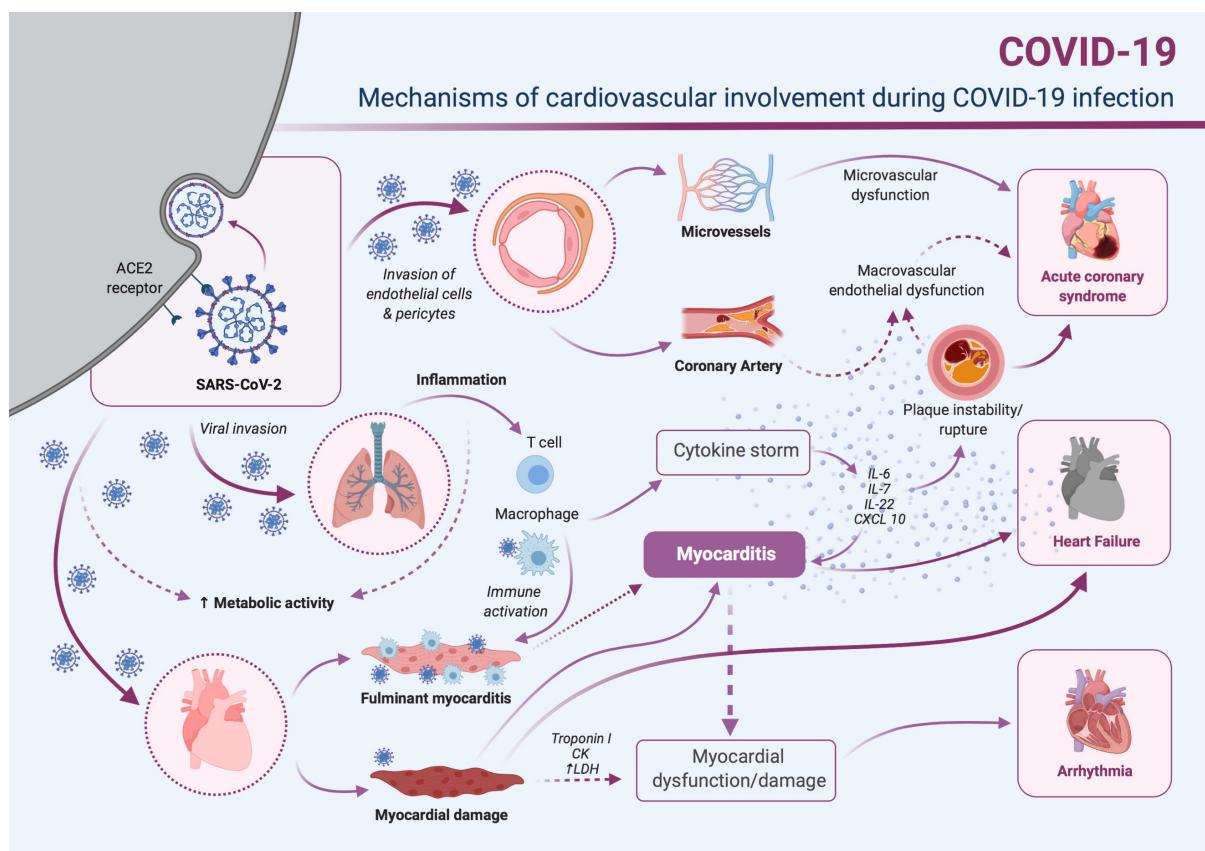
Acute Complications	Potential Implications for Athlete	Assessment/Investigation
<b>Respiratory System</b>  Viral pneumonia, secondary infection, ARDS, pulmonary embolism/thrombosis	Reduced aerobic capacity and increased respiratory distress Potential persisting restrictive lung patterns and reduced diffusion capacity	Clinical assessment Graded exercise test, VO2 Max testing FBP, CRP, D Dimer, spirometry, respiratory muscle testing. USS, CXR, CT Chest, Respiratory review
<b>Cardiovascular System</b>  Cardiomyopathy, myocarditis, pericardial effusion, arrhythmias, acute coronary syndrome	Cardiac complications may make return-to-sport contraindicated  Persisting inflammatory states	Clinical assessment, ECG, Troponin, NBNP, Coag Profile, CRP, ferritin, D-Dimer, CRP, ESR ECG, echo, EST, 24-hr rhythm monitoring, C-MRI Specialist Cardiology review
<b>Neurological System</b>  Guillain-Barre syndrome, Stroke Encephalopathy/encephalitis	Post-intensive care syndrome  Long-term evidence for neurological issues in milder cases not established	Clinical assessment, FBP, D-Dimer MRI brain Specialist Neurology review
<b>Gastrointestinal System</b>  Derranged LFTs Acute GI symptoms Mesenteric ischaemia	Potential differential in GI upset and respiratory symptoms  Increased risk from hepatically excreted medications	Clinical assessment, LFTs, CRP, ESR, faecal calprotectin Specialist Gastroenterology review
<b>Renal System</b>  Acute renal impairment	Persistent sub-clinical renal impairment may be a risk on returning to high-intensity training	Clinical assessment, U&E, eGFR, Urinalysis Specialist Renal review
<b>Fatigue</b>  Commonly associated with viral infection	Post-viral fatigue is known to occur following other viral infections and may occur with COVID-19  Diagnosis of exclusion	Clinical assessment, Exclusion of other causes Monitoring of self-report measures, fatigue symptoms and training loads
<b>Mental Health</b>  Symptoms of anxiety and depression More common in those with less social support PTSD, delirium, memory impairment	Potential risk of PTSD, depression and anxiety Persistent depression and anxiety have been reported following previous coronavirus epidemics in non-athletic populations	Clinical assessment, Screening questionnaires Psychology and psychiatrist review

There are three potential areas of concern for the athlete returning post-COVID-19;

1. Direct organ involvement due to viral infection/systemic response.
2. Complications following prolonged or invasive treatment in hospital.
3. Post-viral complications.

Organ involvement of particular concern in the athlete involves the cardiovascular system, where myocarditis has been observed post COVID-19.[17] Some of the potential mechanisms and outcomes of cardiac involvement in COVID-19 infection are detailed in Figure 3. Other body systems affected include the respiratory system, nervous system, gastrointestinal, renal systems along with ocular involvement.[1] It has also been noted that male hormone profile has been altered in some cases post-infection, which could be of concern for future athlete performance.[18] Mental health considerations are also paramount following this infection and the prolonged period of enforced social isolation.[4, 19]

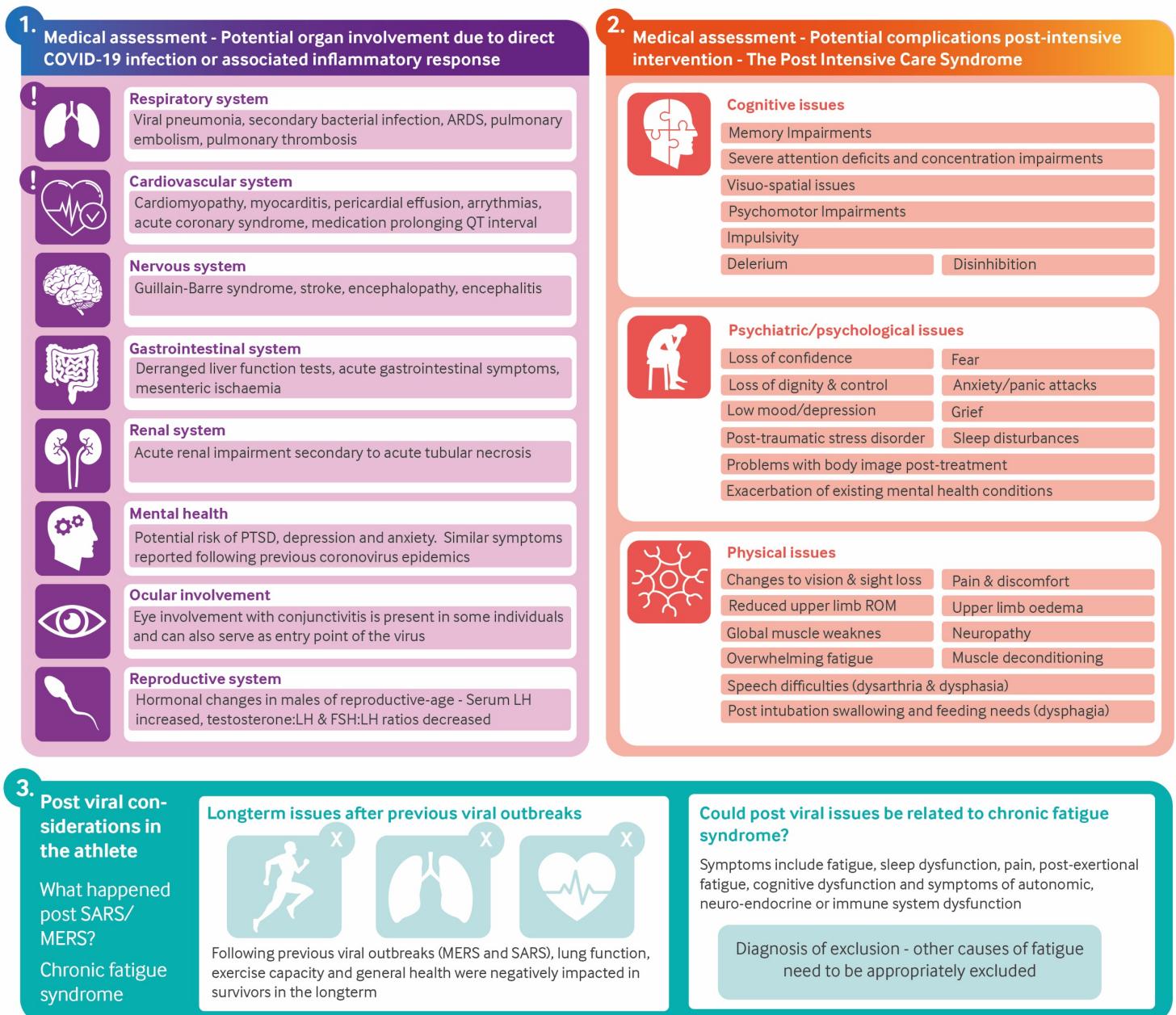
**Figure 3.** Mechanisms of cardiovascular involvement during COVID-19 infection. Modified from Guzik et al[20]



A second area of consideration for rehabilitation post-COVID-19 is for those who have been hospitalised and required intensive treatment. The post intensive care syndrome is a well-recognized constellation of symptoms which include physical, psychiatric and cognitive issues following ventilation, sedation and prolonged immobilisation.[21]

Long-term complications after viral infection are recognized particularly with those who have a more severe infection course. Examples of recent viral epidemics including MERS[22] and SARS[23] have resulted in long term negative impacts on lung capacity, exercise tolerance and general health markers. The potential development of chronic fatigue syndrome is of further consideration. This is a diagnosis of exclusion, requiring extensive investigation of other medical conditions prior to diagnosis.[19] An overview of potential complications and rehabilitation considerations is presented in Figure 4.

**Figure 4.** Potential complications of COVID-19 infection and considerations for rehabilitation



## **Return to Sport:**

### *Time-scale for a safe return*

Prior to returning to sport or a high level of physical activity, it is expected that the athlete should be symptom-free and should have a period of rest to ensure full resolution of infection, recovery of organ systems and a decrease in infectivity. Due to potential complications, it is recommended that an athlete should be at least seven days symptom-free and between 10-14 days post-symptom onset prior to returning to physical activity. This conservative approach is advised until sufficient evidence is available to suggest otherwise[4, 16, 24].

### *Medical screening and considerations*

Before an athlete can return to sport following COVID-19 infection, it would be appropriate to perform a risk assessment to determine the extent of any previous or current infection and to establish the risk of any medical complications. It is widely acknowledged that the rate of medical complications increases with the severity of illness[4, 24, 25].

An athlete may present to their sports physician following asymptomatic or symptomatic infection. If they are asymptomatic and the infection is identified either on antigen or antibody testing, it would be recommended that they rest at least seven days following the identification of a new infection. If they are presenting with a previous infection (positive antibody test only) and they are training fully with no issues, it is anticipated that they can continue to train without any need for further medical assessment[24].

Symptomatic individuals can be grouped as[26];

- Mild illness - less than seven days in duration
- Moderate to severe illness of greater than seven days (managed at home)
- Hospital assessment/admission
- Individual with confirmed end organ damage such as abnormal kidney, cardiac, or other organ system involvement confirmed at hospital admission or otherwise.

Another group of athletes who may require evaluation in the future are those who develop symptoms which do not settle and are ongoing for more than 14 days[24].

After any COVID-19 infection it is recommended that the athlete is at least seven days post-symptoms and at least 10 days after symptom onset[4]. At this stage they should undergo medical

assessment. The degree and extent of this medical assessment is detailed in Table 2 and depends on the severity of the infection and their ongoing presenting symptoms[26]. The athlete should be fully evaluated according to their severity undergoing clinical examination and then further laboratory and special investigations to rule out or confirm the extent of any organ involvement which may be present[2].

**Table 2.** Medical assessment of athletes following COVID-19 infection. Modified from Baggish et al[26]

COVID-19 – Risk Assessment	Focused Medical History	Physical Examination	12-lead ECG	Blood & Other Tests
<b>Asymptomatic infection</b> <i>(Confirmed antibody to SARS-Cooronavirus-2)</i>			Consider ECG if new onset CV symptoms or exercise intolerance	Not routinely advised Consider depending on symptoms or exercise intolerance  Comprehensive clinical evaluation regardless of ECG if new onset CV symptoms or exercise intolerance.
<b>History of mild illness</b> <i>(Non-hospitalised related to confirmed or suspected COVID-19)</i>				Not routinely advised Consider depending on symptoms or exercise intolerance  Comprehensive clinical evaluation regardless of ECG if new onset CV symptoms or exercise intolerance.
<b>Moderate-severe illness</b> <i>(Hospitalized related to confirmed or suspected COVID-19)</i>				Bloods - hs-Tn, NP, D-Dimer, CRP, FBP, LFTs, U&E, Coag profile, Vit D, ferritin Echo, CXR, PFTs, Psych screening Further respiratory investigations if indicated  Comprehensive evaluation prior to return-to-sport in conjunction with a Sports Cardiologist. Consider cardiac MRI.  Myocardial injury more likely in more severe disease.
<b>Covid-19 infection &amp; documented myocardial or other organ injury</b>				Bloods - hs-Tn, NP, D-Dimer, CRP, FBP, LFTs, U&E, Coag profile, Vit D, ferritin Echo, CXR, PFTs, Psych screening Further respiratory investigations if indicated  Comprehensive evaluation prior to return-to-sport in conjunction with a Sports Cardiologist. Gradual return supervised by a cardiologist.  Longitudinal follow-up & imaging may be required.
<b>Confirmed/probable Covid-19 infection with new-onset or ongoing symptoms</b> <i>(Symptoms beyond 21 days since onset or new symptoms during return to sport/ training)</i>				Bloods - hs-Tn, NP, D-Dimer, CRP, FBP, LFTs, U&E, Coag profile, Vit D, ferritin Echo, CXR, PFTs, Psych screening Consider CT chest if suspicious of thromboembolic or intra-pulmonary abnormalities  Comprehensive evaluation prior to return-to-sport in conjunction with a Sports Cardiologist. Consider cardiac MRI.  Myocardial injury more likely in more severe disease.

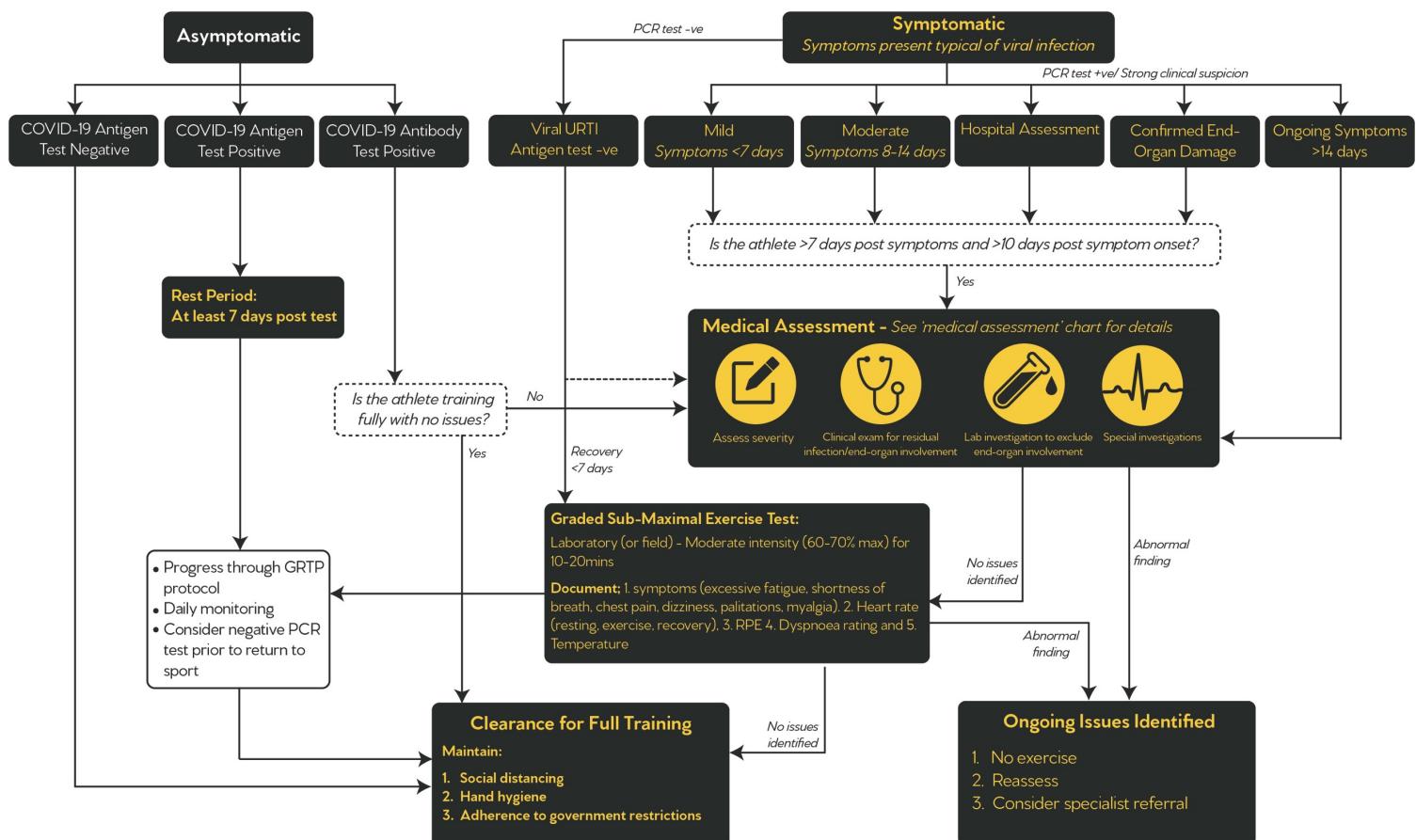
hs-Tn = high sensitivity cardiac troponin, NP = natriuretic peptide; ECG = electrocardiogram; MRI = magnetic resonance imaging

Following medical assessment, should any significant abnormality be identified, the athlete may require further specialist assessment. In these circumstances, they should not undertake any exercise until specialist review is performed. If no abnormalities are identified during the medical assessment, it would be useful to perform a graded submaximal exercise test either in the field or the laboratory (Schwellnus M. RSM 2020 - oral communication)). The athlete should exercise at 60 to 70% of their maximal effort for 10 to 20 minutes, assessing for the presence of symptoms

including excessive fatigue, shortness of breath, chest pain, dizziness, palpitations and myalgia. They should also have their heart rate monitored at rest, during exercise and recovery, along with a rating of perceived exertion and temperature assessment[27].

If the athlete comes through this test with no issues, we would then recommend they undertake a graduated return to sport detailed in the next section. For those athletes who are outside of sports physician assessment undertaking a graduated return to sport as detailed would be important to ensure no specific issues and we would recommend medical assessment either by their sports physician or general practitioner should any issues be identified. An overview of the Sport NI Sports Institute medical screening process is detailed in Figure 5.

**Figure 5. Medical risk assessment and management scenarios**



## *Return to sport screening questionnaire*

Prior to returning to the training environment it is important to screen the athletes for any potential previous COVID-19 infection, establish their risk if they, or a household member are ‘shielding’ or in a vulnerable group and also to assess for any ongoing injuries or potential mental health concerns following the lockdown period. The questions used to screen the athletes at the Institute are shown in Box 2.

Identification of any potential previous infection should trigger a medical assessment, remote initially, followed by in-person clinical evaluation to establish their ability to return to play (Figure 5).

### *Box 2. Initial return to training screening questions*

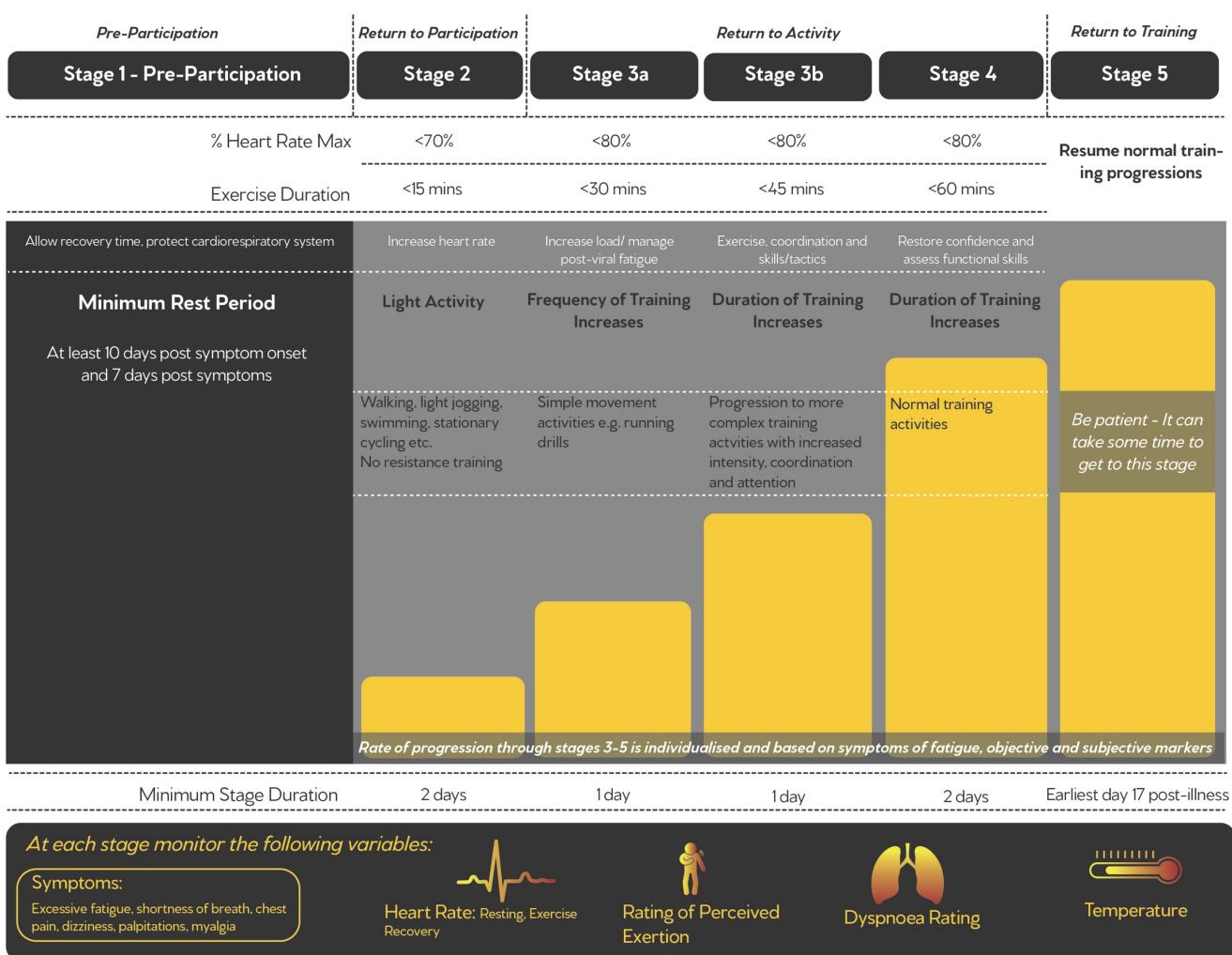
#### **SNISI Initial Return to Training Screening Questions:**

1. Have you any confirmed COVID-19 infection or symptoms listed in keeping with COVID-19 in the past five months? Fever, new persistent dry cough, shortness of breath, loss of taste or smell, diarrhea or vomiting, muscle aches not related to sport or training?  
Yes      No
2. Have you had a known exposure to anyone with confirmed or expected COVID-19 in the last five months (e.g. a close contact, household member)? Y  
Yes      No
3. Do you have any underlying medical conditions? Examples include, chronic respiratory conditions including asthma, chronic heart, kidney, liver or neurological conditions, diabetes mellitus, a spleen or immune system condition, currently taking medicines that affect your immune system such as steroid tablets?  
Yes      No
4. Do you live with or will you knowingly come in close contact with someone who is currently shielding or otherwise medically vulnerable if you return to the training environment?  
Yes      No
5. Do you have any health-related concerns [physical/injury or mental] with regards to return to the training environment?  
Yes      No

## *Graduated return to sport post-COVID-19*

It is anticipated that the athletes should increase their training intensity and duration in a gradual process. During this graduated return to sport (Figure 6), variables should be monitored on daily basis, both pre and post-exercise including resting heart rate, rating of perceived exertion, sleep, stress, fatigue, and muscle soreness, along with psychological readiness to return to sport. This is detailed in the Figure 6, modified from the consensus guide for return to sport post-COVID-19 from the Home Country Sports Institutes[27]. For further details and for a PDF infographic guide, The Graduated Return to Play Guidance Following COVID-19 Infection, is a useful reference for this return to play process[27].

**Figure 6.** Graduated return to sport progression



*Daily screening and actions:*

Once an athlete has returned to the training facility it is important that COVID-19 infection is screened for on a daily basis and that if there is any indication of possible infection, they stay away from the facility, self-isolate and ensure a test is carried out as soon as possible. At the Sport NI Sports Institute, the screening questionnaire in Box 2 should be used on a daily basis and is sent out via text message to the athlete on the evening prior to training. The process for managing a positive response to any of the variables in the questionnaire and the temperature check on arrival are detailed in Figure 7.

**Box 2. Pre-training screening questions**

**SNISI Pre-Training Session Screening Questions:**

Dear athlete,

Please reply to this text **at least one hour before attending** for your appointment or training session at the Sports Institute.

**Note** – Timely completion is a requirement for admission to the Ulster University building.

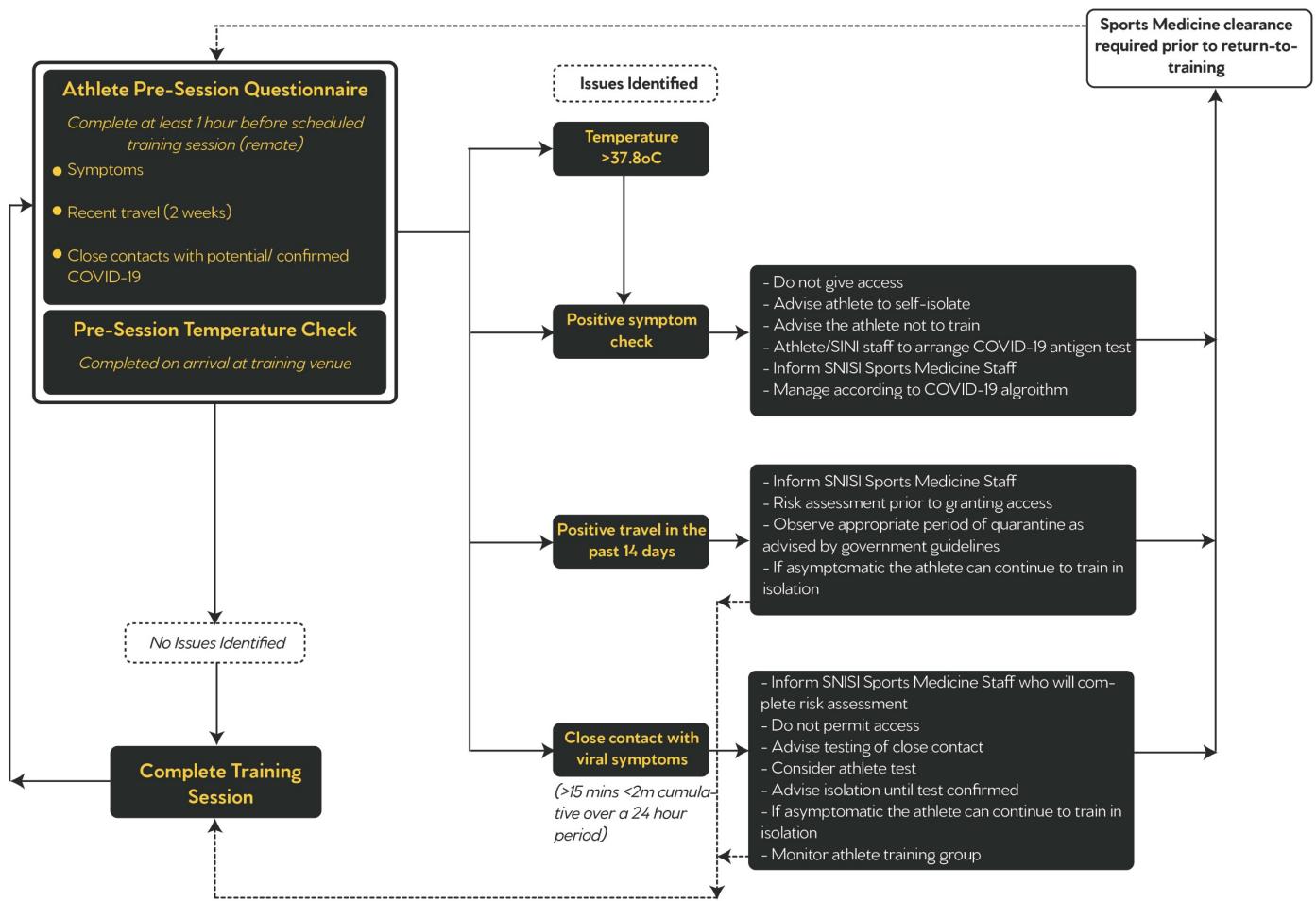
Please read the following three questions carefully - Please reply '**YES**' if the answer is yes to **ANY** of three questions.

Please reply '**No issues**' if the answer is no **to ALL** three questions.

**If the answer is Yes** to any of the three questions, **please do not attend the Institute** but **contact the sender** of this message for further advice.

1. Have you travelled outside of the UK or Ireland in the last two weeks?
2. Are you currently experiencing any of the following symptoms - high temperature, new cough, shortness of breath/difficulty breathing, sore throat, new loss of taste or smell, new skin rashes, diarrhoea or vomiting?
3. Has anyone in your household or a close contact been recently diagnosed with COVID-19 or experiencing any of the symptoms listed in question two?

**Figure 7.** Athlete daily COVID-19 risk assessment



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