COVID-19: CONSIDERATIONS REGARDING THE RETURN TO WRESTLING TRAINING

David G. Curby

International Network of Wrestling Researchers
United World Wrestling Scientific Commission

davcurb@gmail.com

Coronavirus disease 2019 (COVID-19) is an acute respiratory disease caused by the Severe Acute Respiratory Syndrome Coronavirus-2 (SARSCoV-2). The World Health Organization (WHO) on March 11, 2020, declared the novel coronavirus (COVID-19) outbreak a global pandemic (Cucinotta & Vanelli, 2020). It has wreaked its havoc world-wide and disrupted almost all aspects of our existence. This includes sport. On 24 March 2020, the International Olympic Committee, the International Paralympic Committee and the Japanese Government formally announced a rescheduling of the Tokyo 2020 Olympic and Paralympic Games 'to safeguard the health of the athletes, everybody involved in the Olympic Games and the international community' (International Olympic Committee, 2020). Training has been stopped or curtailed because of required social isolation. The Coronavirus has turned the Olympic world upside down. Countless athletes made plans to compete in qualifiers and the Games only to have the scheduled events cancelled, postponed or tentatively rescheduled.

The COVID-19 pandemic in 2020 has resulted in widespread training disruption. Some athletes have had access to facilities and equipment, while others have limited or no access, severely limiting their training practices. No doubt that the prolonged isolation training period due to the COVID-19 outbreak has a profound negative effect on the physical capabilities of athletes. As the world begins the slow return to training and competition, there are many considerations that must be taken into account by sporting organizations, governing bodies, medical providers, athletes, and coaches, to name a few.

On return to training, the focus should be on progression of all aspects of training, taking into account the status of individual athletes and must be done with the appropriate physical and psychological preparation. Special attention must be given to athletes who have contracted COVID-19, and will be returning to training.

Following this long absence from training, there will be a significant amount of anticipation and excitement to resume wrestling training. This return to training is prone to a process that is too quick. An accelerated return puts the wrestler at a higher risk for injury. In the context of normal training cycles, a systematic training plan is required to prepare an athlete for the demands of the sport. Proper management of training loads is necessary. Every athlete will return to training having maintained variable levels of wrestling-specific activities and general fitness. Each athlete, during their time away, will have had variable opportunities for recovery and access to care for pre-existing injuries. This necessitates an individualized approach (Kagan et al., 2020)

PHYSIOLOGICAL RECONDITIONING CONSIDERATIONS ON RETURN TO TRAINING:
Restoration of fitness to the pre-COVID-19 levels is of primary importance. Prolonged time away from wrestling, as short as 2-4 weeks, can create a state of "detraining". Although the decreased training load during the initial weeks of lockdown may have had a positive super-compensation and recovery effect, the long-term effects of detraining are detrimental to the training status of elite athletes. Additionally, detraining has a negative impact on muscle activity and range of motion of joints and which can result in a loss of efficiency and fine motor tuning which can lead to small decrements in technique (Mujika & Padilla, 2000a).

It is recommended that coaches and sports scientists should therefore: 1) closely monitor athletes, especially when they start competing again; 2) asses and evaluate the injury risk of each athlete before he/she returns to train; 3) design comprehensive training programs which include endurance and strength components as well as technical and tactical skills training; 4) be selective in choosing events from the competitive calendar; and 5) adopt a flexible training and preparation approach (Lamberts & Gomez-Ezeiza, 2020).

According to Mujika & Padilla, (2000a & b) detraining is the partial or complete loss of training-induced adaptations, in response to an insufficient training stimulus. Detraining characteristics may be different depending on the duration of training cessation or insufficient training. Detraining has been classified as either short term detraining (less than 4 weeks of insufficient training stimulus) and long-term detraining (more than 4 weeks of insufficient training stimulus). Short term cardiorespiratory detraining is characterized in highly trained

athletes by a rapid decline in maximal oxygen uptake (VO_2max) and blood volume. Exercise heart rate increases insufficiently to counterbalance the decreased stroke volume, and maximal cardiac output is thus reduced. Ventilatory efficiency and endurance performance are also impaired. These changes are more moderate in recently trained individuals. From a metabolic viewpoint, short term inactivity implies an increased reliance on carbohydrate metabolism during exercise, as shown by a higher exercise respiratory exchange ratio, and lowered lipase activity, glycogen levels and lactate threshold. At the muscle level, capillary density and oxidative enzyme activities are reduced. Training-induced changes in fiber cross-sectional area are reversed, but strength performance declines are not as great. Hormonal changes include a reduced insulin sensitivity, a possible increase in testosterone and growth hormone levels in strength athletes, and a reversal of short-term training-induced adaptations in fluid-electrolyte regulating hormones.

In a period longer than 4 weeks, the maximal oxygen uptake (VO_2max) of athletes declines markedly but remains above control values during long term detraining, whereas recently acquired VO_2max gains are completely lost. This is partly due to reduced blood volume, cardiac dimensions and ventilatory efficiency, resulting in lower stroke volume and cardiac output, despite increased heart rates. Endurance performance is accordingly impaired. Resting muscle glycogen levels return to baseline, carbohydrate utilization increases and the lactate threshold is lowered, although it remains above untrained values in the highly trained. At the muscle level, capillarization, arterial-venous oxygen difference and oxidative enzyme activities decline, contributing significantly to the long-term loss in VO_2max. Oxidative fiber proportion is decreased in endurance athletes, whereas it increases in strength athletes, whose fiber areas are significantly reduced. Force production declines slowly, and usually remains above control values for very long periods. All these negative effects can be avoided or limited by reduced training strategies, as long as training intensity is maintained and frequency reduced only moderately. On the other hand, training volume can be markedly reduced. Cross-training may also be effective in maintaining training-induced adaptations.

We know that training restrictions and constraints may cause physiological decline. The increased risks are likely to be higher if the time needed to counteract this deconditioning is not granted before returning to competition. This may especially be the case for individuals whose level of training during home confinement has been constrained. Therefore, in deciding how and when to return to competition, it is important that coaches and trainers are aware that their decisions can have health consequences such as increased injury risk.

The lower load or absence of training because of confinement will result in the detraining of certain structures and systems. This can lead to an increased chance for injury and poor performance. Excessive loading upon resumption of training can also lead to injury. Resumption in training must begin with a thorough preparation phase of sufficient duration. This includes with appropriate levels of volume. Excessive volume, insufficient progression, and a sudden increase in the training intensity can negatively impact the wrestlers' assimilation capacity and could result in overload injury.

The balance between short-term training load and long-term training load is critical, with any rapid increases in short-term load leaving athletes vulnerable to injury in the absence of appropriate longer-term load. When these existing risks are combined with limited pre-season preparation, the frequency of injury increases. The most compelling example of this phenomenon was seen in the United States following the 2011 National Football League lockout. This dispute which prevented players from accessing team facilities for 136 days, pre-season training camps were cut from the typical 14 weeks to just 17 days. In the first 12 days of training camp, 10 players ruptured their Achilles tendon and the number of injuries recorded within the first month of the return was more than double the average typically observed over an entire season.

Coaches need to resist the urge to blindly jump straight into regular programming to make up for lost time. Acquiring baseline measures of physical capacities when players return to team facilities should be a priority in order to appropriately assess the damage and evaluate injury risk on an individual basis. Promptly reinstating any training load monitoring processes is also essential, and since tolerance to external load has likely shifted, measures such as heart rate variability and ratings of perceived exertion will be particularly valuable in making sensible load prescription and progression decisions. Importantly, this includes appropriate exposures to general physical preparation as well as skill and tactical training (Impellizzeri et al, 2020; Trackdemic-Blog, 2020; Casais-Martinez et al., 2020).

A dual combat sport like wrestling depends on having an opponent for decision-making that can only be practiced when training with others. Under normal circumstances, athletes would return to structured preparation after a 3- to 6-week off-season and progress to competition over 6–12 weeks. Assuming that wrestlers stayed without wrestling-specific training for ~4-12 weeks and that their workload during that period was about 20-40% of that in the normal competitive period, the recommended time for returning to full training without a high risk of injury is estimated to be 3–5 weeks (Mohr et al., 2020). A general base must be introduced with the gradual addition of specific training with increasing intensity.

Desirable Return Plan *Poor Plan with Negative Outcomes*

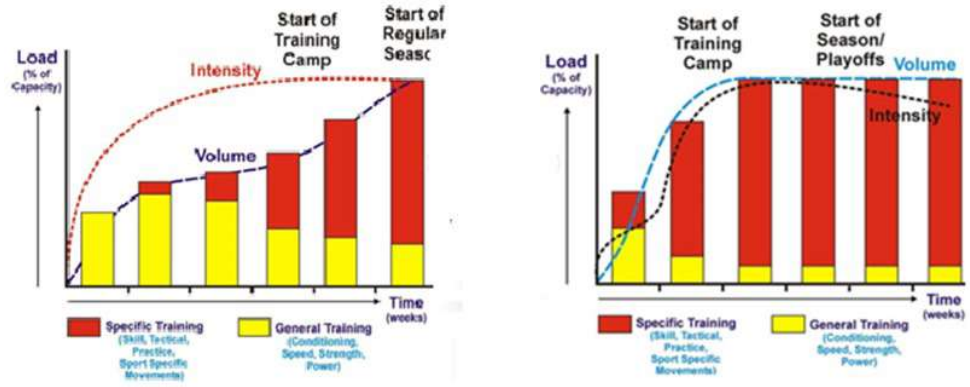

Figure 1. Recommended Loading Plans with Desirable Ratios of General vs Specific Training, Volume and Intensity
(Derek Hansen https://ylmsportscience.com/2020/06/21/managing-the-return-to-sport-after-the-quarantine/)

Training Loads and Susceptibility for COVID-19
Elite athletes can demonstrate relative immune compromise associated with high training load and these factors could increase susceptibility to COVID-19. Further, following relative inactivity there are data linking resumption of training with increased risk of injury, thereby increasing the vulnerability of elite athletes as training resumes. Finally, in addition to training load and volume, stress resulting from poor sleep quality, inadequate nutrition, low mood and ineffective recovery strategies may all negatively impact upon an individual's immune function. (Hamilton et al., 2020). A potential increased risk of illness in periods of high-intensity training is a concern, but mainly in non-competitive recreational athletes. Evidence suggests that elite athletes can continue with high intensity training without a similar increased risk of illness, providing there is no sudden increase in training load (Hull, Loosemore, & Schwellnus, 2020).

Considerations for Female Athletes
Considerations for female athletes may differ from males in several ways. Studies suggest that there are many differences between men and women in the immune response to CoV-19 infection and inflammatory diseases. (Conti & Younes, 2020). Data from China and Italy show that men are more likely to be infected with COVID-19, and are more likely to experience COVID-19-related mortality (70% of the deaths in Italy thus far, were men (Wu & McGoogan, 2020; Remuzzi & Remuzzi, 2020).

A number of underlying causes have been proposed, from lifestyles - men are more likely to smoke, and have comorbidities associated with a greater risk of a worsened outcome from the virus, such as hypertension and diabetes. There are also immunological differences exist between men and women, expressed upon activation with a virus. This has, in part, been attributed to the X chromosome, which appears to have a role in innate and adaptive immunity. More specifically, genes encoded by the X chromosome result in a lower viral load, and less inflammation (Bhopal, & Bhopal, 2020). The Bhopal work holds the view that although the number of male cases is not dissimilar to the number of female cases, men have about twice the risk of death from COVID-19

Bruinvels et al., (2020) emphasize the need to address the specific needs of women athletes as medical personnel monitors their recovery from COVID-19, as well as tracking athletes as they resume training. Among those recommended are resting heart rate and heart rate variability. In menstruating women, it is important to account for physiological changes in basal body temperature and resting heart rate when undertaking daily measurements, as fluctuations in ovarian hormones influence these markers. There is also the potential for menstrual symptoms to be concurrent with COVID-19 symptoms, for example, experiencing achiness, fatigue, nausea and headaches. Tracking menstrual cycles and symptoms alongside temperature, heart rate and potential COVID-19 symptoms would reduce risk of potential ambiguity. Frequent monitoring of resting heart rate, biomarkers of inflammation and oxidative stress, where possible, and menstrual cycle tracking, would further augment athlete care while sport adapts to a new normal and the influence of COVID-19 gradually subsides. They state that history points to a lack of inclusion and consideration of female-specific needs in scenarios such as these, but we have an opportunity to provide parity in athlete care across sport.

Considerations for Young Athletes

Young athletes, generally speaking, represent one of the healthiest and fittest groups in society. Medical providers have wondered how to best counsel athletes with medical conditions that may be associated with increased risk of severe COVID-19, specifically, diabetes, asthma, sickle cell trait (SCT), hypertension, and obesity. The Centers for Disease Control and Prevention (2020a) guidance does not explicitly address young athletes returning to sport but recommends that high-risk individuals of any age take extra precautions, including those with chronic lung disease or moderate to severe asthma, chronic kidney disease being treated with dialysis, diabetes mellitus, hemoglobin disorders, liver disease, serious heart conditions, severe obesity (body mass index [BMI] ≥40 kg/m2), or those who are immunocompromised.

The vast majority of deaths from coronavirus occur in those older than 25 years of age, with those aged 15 to 24 years representing only 0.1% of all deaths (Centers for Disease Control and Prevention, 2020b). Of those younger than 24 years of age who died from the virus, 4% had hypertension, 21% were obese, and 15% had diabetes. Children demonstrate similar prevalence of these conditions, except for diabetes. In the general adolescent population the prevalence rates for hypertension are 4% and obesity, 20.6%, but is much lower for diabetes (0.25%).

Harmon et al., (2020) offer the following guidance for Comorbid Medical Conditions in Young Athletes:

Athletes with diabetes should be counseled regarding the potential for increased morbidity and mortality if infected with COVID-19 and consider delaying return until sports reintegration is confirmed safe and the risk of acquiring a new infection is better understood.

Asthma affects 8.4% of the population from 0 to 17 years of age. Exercise induced bronchospasm is common among athletes, especially during the winter and in endurance sports, but is not known to confer a higher risk of poor outcomes with SARS-CoV-2 infection. Athletes with asthma should be evaluated prior to participation in sports to confirm their treatment regimen is optimized and they are adherent to their medications.

Sickle Cell Trait (SCT) is also common, with 9% of African American/black individuals carrying the gene. Although sickle cell disease and thalassemia are considered by the CDC as higher risk for adverse outcomes with COVID-19 infection, SCT is not. No additional precautions are recommended for returning athletes with SCT; however, if an athlete with SCT contracts SARS-CoV-2, treating physicians should be vigilant for issues related to hypercoagulability both during the acute illness and for several months into recovery. This includes allowing adequate acclimatization and reconditioning while optimizing hydration, minimizing heat stress, and avoiding blood flow restriction devices used for rehabilitation and strengthening.

Obesity, with data often represented by body mass index (BMI) has shown an increased association of poor COVID-19 outcomes with higher BMIs and one study found this to be true especially in younger patients with BMIs ≥30 kg/m^2, and even more so among those with BMI ≥35 kg/m^2 (Lighter, Phillips & Hochman S, 2020). While most athletes are fit, many sports recruit athletes with a larger build, particularly American football lineman or the heaviest classes in wrestling. The CDC groups people with severe obesity (BMI ≥40 kg/m^2) as potentially at risk for severe illness, although the literature associated with COVID-19 employs variable definitions of obesity, some including those with BMI ≥25 kg/m^2. BMI is intended to be a marker of excess fat but may not be a good measure in athletes, as lean muscle mass is typically increased with lower percentages of body fat. As in the general population, those with higher BMI are also more likely to have other comorbidities such as hypertension or diabetes.

Preparticipation guidance for all athletes should include a discussion of risks of SARS-CoV-2. The risk of poor outcomes in those younger than 25 years of age remains low, and youth and high levels of fitness may effectively mitigate the risk of severe COVID-19 outcomes in athletes with pre-existing risk factors (Harmon et al., 2020; Toresdahl & Asif, 2020)

SPECIAL CONSIDERATIONS FOR TRAINING AT ALTITUDE

Many athletes will look to plan at least one altitude training camp in the next 12 to 18 months. During these altitude training camps, athletes will be required to manage changes in training load and to stay socially close to other athletes. Athletes will face physiological adaptations to altitude, and hypoxia-induced stress on the pulmonary, cardiovascular, renal and immune systems that may be exacerbated by prior exposure to COVID-19. Altitude training may also lead to greater susceptibility to COVID-19 infection and its sequelae by increasing the level of hypoxemia and further depressing immune function. It is recommended to adopt specific cautions before, during and in return from altitude exposure. In particular, early symptoms of maladaptation to hypoxia, and respiratory problems should be considered with attention as they can mask COVID-19 symptoms. Specific recommendations for altitude training programming are needed to preserve athletes' health in this post COVID-19 environment (Manferdelli et al., 2020).

PSYCHOLOGICAL CONSIDERATIONS

Sport psychologists report a higher demand for online psychological counseling and diagnosis of psychological disorders among these athletes during the pandemic, including fear of being infected, anxiety of physical recovery if infected, lack of access to fitness centers, disturbed sleep, eating disorders, obsessive-compulsive disorder, and family conflicts. Inability to manage stress and lack of proper coping may lead some to experience short- or long-term depression (Mehrsafar, Gazerani, Zadeh, & Jaenes Sanchez, 2020).

With many events and competitions postponed indefinitely, with no certain confirmation of when some will resume, this is likely to cause a significant amount of stress for athletes. If you struggle to cope with stress, over time it is likely to have a negative impact on mental health, especially if athletes do not seek support or begin to take proactive measures to manage their well-being (Breslin, 2020).

Cancelled events such as World Championships or Last Chance Qualifiers can be a devastating loss to athletes who have trained years to compete or still need to qualify for the Olympics. Some may be wondering if their Olympic dreams are over. Athletes may experience pain similar to a death or an intense life loss.

Wrestlers can be susceptible to the consequence of increased stress due to the inability to train, potential health risks and employment security, and further decreases in physiology due to lack of sleep, poor nutrition and non-planned exercise. There is a potential to have elevated inflammation due to emotional stress/uncertainty and resultant links to injury and illness onset. A survey of athletes aged 18 to 30 indicated that the athletes were mentally exhausted and depressed because of uncertainty of what their future performances will be (Thomas, 2020; Noori, 2020).

The training limitations arising from COVID-19 present a number of psychological considerations that may influence preparation for, and subsequent return to, competition. These include the impact of confinement and isolation, deconditioning effects, deterioration in skill execution/performance, and, the opportunity for recovery and posttraumatic growth.

In addition to the psychological effects from periods of confinement and isolation reported in the general public, such as post-traumatic stress symptoms (i. e. depression, anxiety, confusion and anger), athletes may be at further risk due to the impact on their athletic identity. Athletic identity refers to the extent to which an individual identifies with their role as an athlete. Any challenges to the ability to reinforce this identity through reduced capacity to train, play and achieve goals (typically seen in injured or retired athletes) are associated with feelings of loss, identity crisis and distress. Engaging with social support networks is seen as a key resource to cope with potential threats to athletic identity.

There is limited research has examined the psychological effects of a period of detraining or rest. While acute bouts of rest (e. g. 2-week mid-season break) improve subjective perceptions of some aspects of wellness, such as fatigue and muscle soreness, an abrupt cessation of training by highly trained athletes creates a phenomenon known as detraining syndrome, characterized by insomnia, anxiety, depression, alterations to cardiovascular function, and loss of appetite. These symptoms are usually not deemed pathological and can be reversed, if training is resumed within a short time; however, with prolonged cessation, symptoms may become more pronounced.

In considering the human trauma associated with COVID-19 it is noteworthy that the consequences for mental health and well-being will not be inherently negative. Potential exists for growth in response to traumatic life experiences, where growth involves profound and transformative positive changes in cognitive and emotional life that are likely to have behavioral implications. Both individual and collective psychological growth may be derived from the trauma and adversity athletes, teams and their staff face during the restrictions. The extent to which growth is likely to occur will, however, be influenced by the amount and nature of the support provided before, during, and after the restrictions. In order for an athlete to return to action, he/she must feel psychologically ready to face the new reality. Before returning to team training, a meeting with the coach and / or sports psychologist is suggested, in order to discuss any questions, concerns and peculiarities the athlete has. Coaches should give continuous reminders to the athletes of the initial reasons for engaging in the sport: fun, friendship, healthy competition, and creating a healthy body.

Both coaches and psychologists should intervene at both the individual and team levels to ascertain the level of anxiety and psychological strain. Help the athletes come back to the present, using breathing and cues to come back to center. Stick to your training plan for the next event. Train like competitions are still going to happen. However, separation of external, long-term goals such as participation in a world championship and winning medals, from short-term, internal goals such as, increasing muscular power, improving body composition, or mastering a new technique can be useful. View the changes as an adventure; the unknown is a challenge to be faced (USOPC, 2020; Stokes et al, 2020).

A high level of awareness is required by all support personnel interacting with athletes at this time. Atypical behavior, lack of engagement, loss of motivation, as well as physical changes such as loss of appetite and poor sleep, may all indicate a change in mental state. In addition to maintaining a high level of vigilance for mental health issues, medical practitioners, working closely with psychologists should consider the use of brief mental health assessments. The use of general well-being data (including sleep quality, mood, energy), often collected and collated by a range of disciplines within elite sport, should be used through-out the COVID-19 pandemic. In collaboration with the relevant psychologists, medical practitioners should have an established protocol for reviewing well-being data throughout this period (Hamilton et al., 2020)

AT RISK GROUPS FOLLOWING PERIOD OF TRAINING RESTRICTION

Wrestlers with history of previous injuries or illness: This due to their higher reinjury risk during early sport reintegration. There are also greater residual biomechanical and neurological deficits due to previous injury history. Not being able to access rehab treatment as normal requires assessment and reconditioning by therapists as needed.

Wrestlers who had a COVID-19 infection: Due to possible long-term effects on respiratory and cardiovascular system and potential altered capacity may result in a reduced ability to train effectively on return. Do not share the names of sick athletes unless there is a compelling justification (requested by health authorities, for medical reasons). Ensure privacy rules are respected.

The high inflammatory burden in COVID-19, described as a hyperinflammatory response, is considered to be co-responsible for development of acute respiratory distress, vascular inflammation, myocarditis, and myocarditis-related cardiac events, e.g. arrhythmias. (Schellhorn, Klingel & Burgstahler, 2020). In athletes recovering from COVID-19, even without pre-existing diseases, the development of cardiovascular complications and long-term consequences, e.g. arrhythmias, must be taken into consideration and should be ruled out by means of a medical careful follow-up. In the near future, data about treatment and monitoring of athletes recovering from COVID-19 will be of major importance. The questions of eligibility for sport and long-term consequences of COVID-19 for athletes should be addressed in concert with the medical support team. A conservative approach rather than an accelerated return would be prudent until more evidence emerges. The significance of such findings for optimal human performance is uncertain at this stage and warrants further longitudinal investigation. Although COVID-19 is novel, there have been previous outbreaks of CoV SARS. A prospective cohort study of 94 SARS survivors reported persistent pulmonary function impairment in around a third of patients at 1-year follow-up (Barker-Davies, O'Sullivan, Senaratne, et al., 2020).

Athletes who are returning to the training environment from isolation due to suspected or confirmed cases of COVID-19 or other COVID-19 related reasons must do so under the direction of a physician/medical officer, familiar with the emerging evidence related to post- COVID-19 pathology and following the most up to date return to training steps. For recovered individuals ready to resume training, it is recommended that a careful, clinical cardiovascular evaluation in combination with cardiac biomarkers and imaging. With no symptoms and no objective evidence of cardiac involvement, a return-to-exercise training with close clinical follow-up would be reasonable. If testing suggests cardiac involvement, return to play should be based on myocarditis return-to-play guidelines. (Phelan, Kim, & Chung, 2020; Gov.UK, 2020).

CARDIAC INVOLVEMENT

Cardiac evaluation is of utmost importance due to the direct complications of the disease. In the presence of any positive and in those with serious COVID-19 infection, the management should be similar to other cases of myocarditis, with a further work-up including cardiac magnetic resonance, implantable looping recorders, among others). If the diagnosis of myocarditis or myopericarditis is established, a period of disqualification (3–6 months) is needed, according to the clinical severity and duration of the illness. After this period, it is reasonable to resume training and competition if left ventricular systolic function has returned to the normal range, serum biomarkers of myocardial injury have normalized and clinically significant arrhythmias such as frequent or complex repetitive forms of ventricular or supraventricular arrhythmias are absent on 24-hour Holter monitoring. While COVID-19 myocardial injury, as defined by increases in circulating cardiac troponin levels, has been described in up to 28% of the sickest of patients, its prevalence and clinical implications among infected people who experience mild illness or who remain asymptomatic remains completely unknown. Further, the incidence of silent myocardial inflammation that lingers long after the resolution of typical COVID-19 symptoms, a form of disease that may uniquely affect athletes during resumption of training and competition, is also completely unknown. (Dores, & Cardim, 2020). In some cases, cardiac involvement occurred even in patients without symptoms and signs of interstitial pneumonia, reinforcing the importance of subclinical cardiological investigation and measurement of cardiac biomarkers (Inciardi et al., 2020).

Numerous medical and sporting organizations are developing comprehensive strategies to ensure a safe return to training and competition. This is a complex process that will require a multidisciplinary, team-based approach that balances priorities surrounding athlete health with strategies to protect the general public from further spread of the infection. Ensuring the health of athletes will involve continued strategic use of physical distancing, widespread dissemination of COVID-19 antigen and antibody testing, the use of electrocardiography or blood biomarker testing to screen for occult myocardial injury and inflammation, and definitive diagnostic and therapeutic strategies for those deemed at highest risk. Evidence is limited, and conclusive recommendations regarding these issues will require ongoing research and monitoring of athletes afflicted with COVID-19 (Baggish, Drezner, Martinez, & Prutkin, 2020).

A German study evaluated the presence of myocardial injury in unselected patients recently recovered from COVID-19 illness. In this prospective observational cohort study, 100 patients recently recovered from COVID-19 illness were identified from the University Hospital Frankfurt COVID-19 Registry between April and June 2020. A total of 78 patients recently recovered from COVID-19 (78%) had abnormal CMR findings. CMR revealed cardiac involvement in 78 patients (78%) and ongoing myocardial inflammation in 60 patients (60%), independent of preexisting conditions, severity and overall course of the acute illness, and time from the original diagnosis. These findings indicate the need for ongoing investigation of the long-term cardiovascular consequences of COVID-19 (Puntmann et al., 2020).

Months after recovering from COVID-19, some college athletes are showing signs of heart inflammation brought on by myocarditis that may be linked to SARS-CoV-2 exposure. When they imaged the hearts of more than two dozen of Ohio State University players using cardiac magnetic resonance (CMR), they found evidence of myocarditis in 15 percent, while a further 30 percent had cellular damage or swelling that could not be linked definitively to the condition. (Rajpal et al., 2020)

To assess the presence of myocarditis in college athletes that have recovered from COVID-19, the Rajpal study selected 26 students at Ohio State University, including men and women. None of the participants, who played football, soccer, lacrosse, basketball, or track, had previous heart conditions before being tested. 26 participants had contracted the coronavirus between June and August and had their cases verified using a PCR test. The timing between their diagnosis and their subsequent testing for myocarditis varied between 11 days to almost two months. Twelve of the athletes reported mild symptoms while sick, while the rest were asymptomatic.

Ordinarily, athletes may have their heart health assessed using a battery of tests: a physical examination, an ultrasound, an electrocardiogram, and a blood test to measure for the heart stress protein troponin I. The current study included all these tests, but also added the cardiac magnetic resonance imaging (CMR), which the authors say was the most successful tool at identifying cases of myocarditis.

A leading position paper paper suggests before returning to competitive sports, athletes who initially present with an acute clinical syndrome consistent with myocarditis should undergo a resting echocardiogram, 24-hour Holter monitoring, and an exercise ECG no less than 3 to 6 months after the initial illness.
(Maron et al., 2015)

The response of the Big Ten Conference regarding American football provides an example of the difficulties administrators face to ensure the safety of athletes in light of the many unknowns of COVID-19. After originally canceling the season because of uncertainty over myocarditis, the administrators reversed their decision following a proposal that included strict medical screening and tracking, particularly those athletes who had tested positive for COVID-19.

This plan calls for all COVID-19 positive student-athletes to undergo comprehensive cardiac testing to include labs and biomarkers, ECG, Echocardiogram and a Cardiac MRI. Following cardiac evaluation, student-athletes must receive clearance from a cardiologist designated by the university for the primary purpose of cardiac clearance for COVID-19 positive student-athletes. The earliest a student-athlete can return to game competition is 21 days. Following a COVID-19 positive diagnosis. In addition to the medical protocols approved, the 14 Big Ten institutions will establish a cardiac registry in an effort to examine the effects on COVID-19 positive student-athletes. The registry and associated data will attempt to answer many of the unknowns regarding the cardiac manifestations in COVID-19 positive elite athletes. If an athlete who gets COVID-19, and then shows indications of myocarditis, then they are out for the season.

All COVID-19 positive student-athletes will be required to undergo cardiac testing and must receive clearance from a university-designated cardiologist for the “primary purpose of cardiac clearance for COVID-19 positive student-athletes, with 21 days the earliest a student-athlete can return to competition. (Big Ten Conference (2020, September 16)

Return to Play Guidelines and Algorithms

Various organizations have developed recommendations for return to play plans. Figure 2 is a schematic from the UK.

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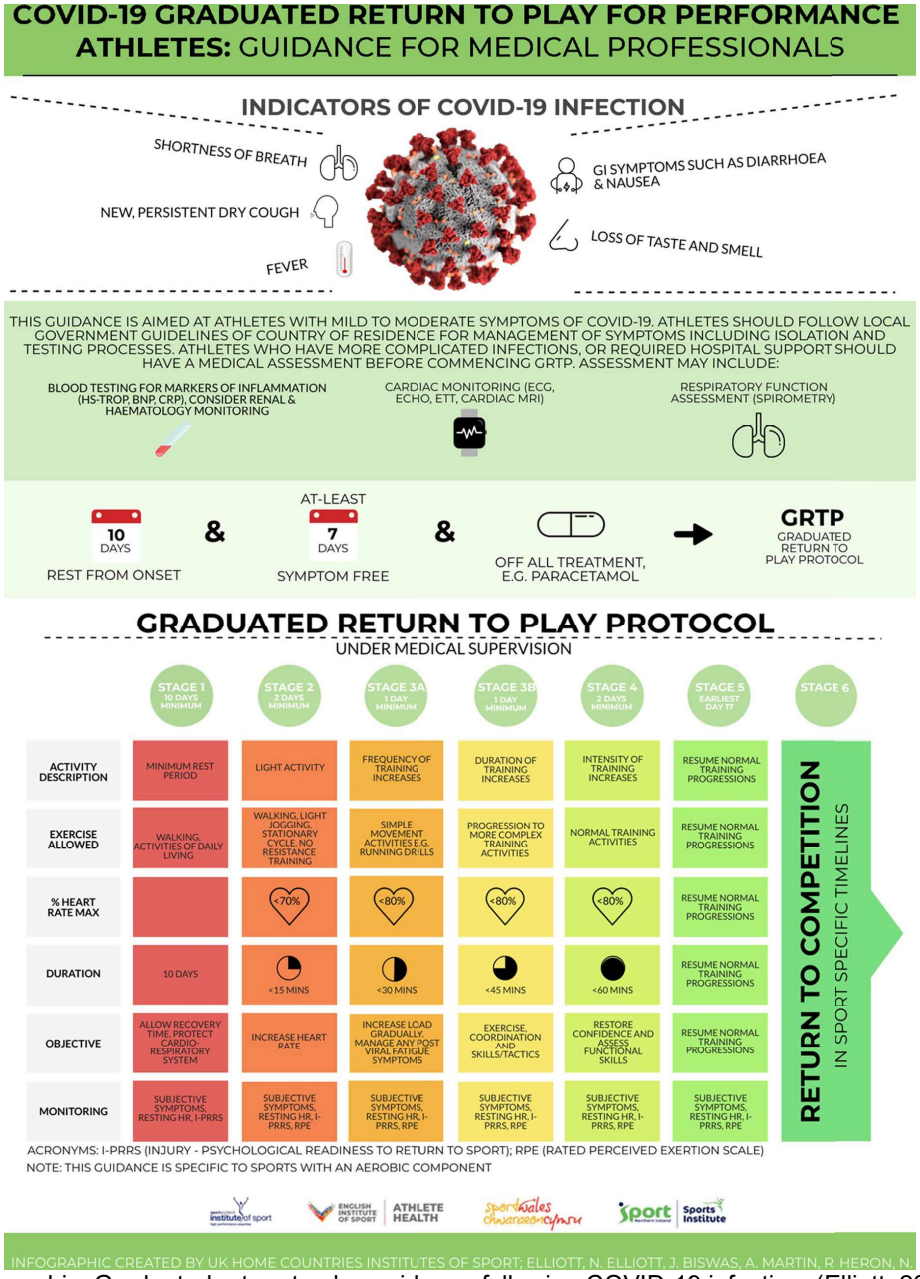

Figure 2. Infographic. Graduated return to play guidance following COVID-19 infection. (Elliott, 2020).

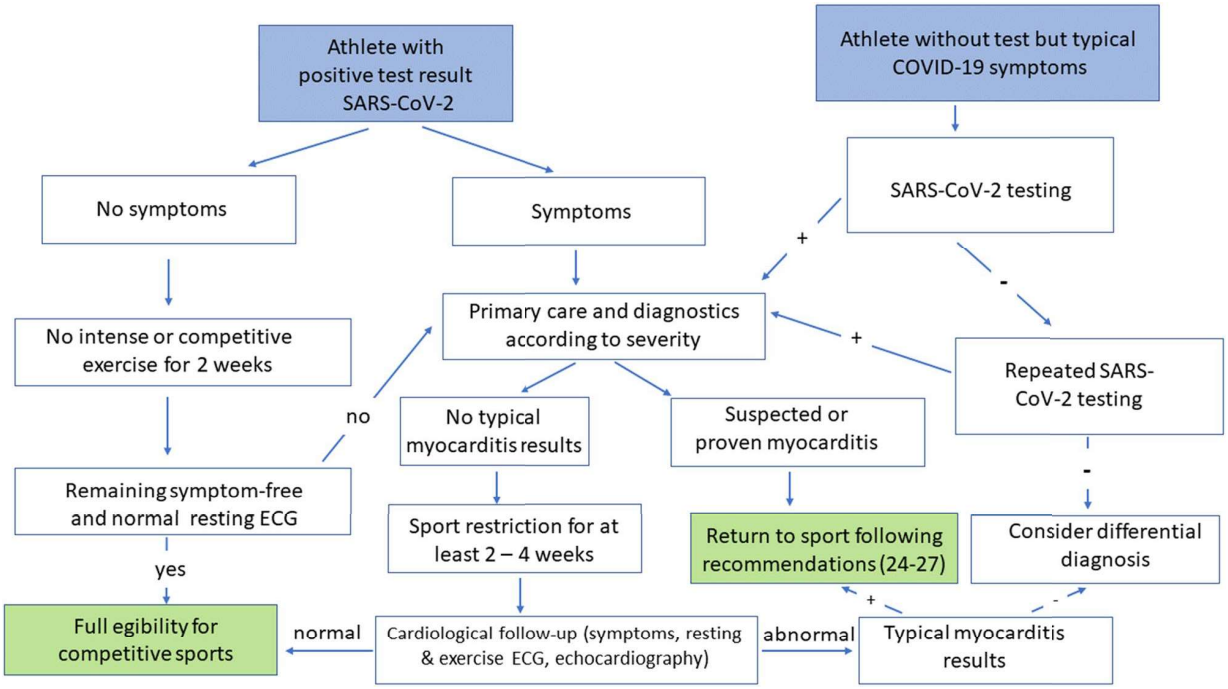

Figure 3. Proposed algorithm for a return to sport for an athlete with positive test result of SARS-CoV-2 or with typical COVID-19 symptoms. Schellhorn, P., Klingel, K., & Burgstahler, C. (2020). Return to sports after COVID-19 infection. Eur Heart J. doi:10.1093/eurheartj/ehaa448

The return to sport recommendations in Figure 3 are based on work by the European Society of Cardiology, the American Heart Association/American College of Cardiology, or the 36th Bethesda Conference. Whether this approach is also applicable in COVID-19-associated myocarditis is presently unclear. Similar return to play plans have been advanced by Oikonomou et al., (2020); Hughes et al., (2020) and Löllgen et al. (2020).

Return to Play for Children and Youth

The American Academy of Pediatrics offers guidelines for youth athletes (Wyckoff, 2020) Youths who have recovered from COVID-19 should be cleared for a return to sports by their physician and undergo evaluation for cardiac symptoms such as chest pain, shortness of breath, fatigue, palpitations or syncope. A positive cardiac screen or other concerning findings should prompt an electrocardiogram (EKG) and potential referral to a pediatric cardiologist, according to AAP recommendations. All patients who have been infected with SARS-CoV-2 or with exposure to SARS-CoV-2, regardless of symptoms, require a minimum 14-day resting period and must be completely asymptomatic for greater than 14 days before returning to exercise and/or competition. They also should be cleared for participation by their primary care physician. Any COVID-19-positive individual who has a history of or current cardiac symptoms or has any cardiac findings on examination is recommended to seek cardiac clearance by the primary care physician, who is encouraged to collaborate with a pediatric cardiologist as necessary prior to participation. Parents need to report if their athlete or a household contact is exhibiting signs or symptoms of COVID-19 or tests positive for SARS-CoV-2, even if asymptomatic. Although children and adolescents play a major role in amplifying influenza outbreaks, this does not appear to apply to SARS-CoV-2. While questions remain, most evidence shows children under age 10 years may be less likely to become infected with SARS-CoV-2 and pass it to others. Those older than 10 years, however, seem to spread it as efficiently as adults.

Return to Play Schedules and Sport Risk Stratification

The chief medical officers of many of the major Olympic, Paralympic and Professional Sports in the UK formed a group to share thinking around how elite sport might best plan for a return at the appropriate time using the following stages:

1 Training-individuals or groups of individuals training, but adhering to social distancing
2 Training-team or group
3 Competition-domestic and no spectators
4 Competition-cross border and no spectators
5 Competition-no restrictions and spectators present (Kemp et al., 2020)

Guidelines put forth by Jonathan Finnoff, the Chief Medical Officer of the United States Olympic and Paralympic Committee, in a letter to national governing bodies, includes risk stratification by sport. Selected excerpts are included here: Although there are not yet any specific scientific studies evaluating the risk of COVID-19 transmission in sport, it is logical that certain sports will have a higher risk than others. Furthermore, since COVID-19 can result in critical illness or death, consideration of the inherent risk associated with different sports should be part of the planning process. The following is a proposed risk stratification scale for COVID-19 transmission in sports:

i. High Risk: sports that involve close, sustained contact between participants, lack of significant protective barriers, and high probability that respiratory particles will be transmitted between participants

   Examples: wrestling, boxing, judo, karate, taekwondo, rugby

ii. Moderately Risk: sports that involve close, sustained contact, but with protective equipment in place that may reduce the likelihood of respiratory particle transmission between participants OR intermittent close contact OR group sports OR sports that use equipment that can't be cleaned between participants

   Examples: bobsleigh, doubles luge, multi-person rowing, multi-person kayaking, multi-person canoeing, basketball, volleyball, baseball, soccer, water polo, gymnastics (if equipment can't be sufficiently cleaned between competitors), hockey, table tennis, tennis, swimming relays, synchronized diving, pole vault, high jump, long jump, artistic swimming, badminton, fencing, cycling in a group, running in a group, triathlon, modern pentathlon, group sailing, cross country skiing, biathlon, Nordic combined, short track speedskating, speed skating in a group.

iii. Low Risk: sports that can be done with social distancing or individually with no sharing of equipment or the ability to clean the equipment between use by competitors

   Examples: Archery, shooting, individual running events, individual cycling events, individual swimming, individual canoeing, individual kayaking, individual rowing, individual diving, equestrian dressage or eventing, golf, individual sailing, skateboarding, sport climbing, trampoline, weightlifting, alpine skiing, single luge, curling, freestyle skiing, individual speedskating, snowboarding, ski jumping.

iv. High risk sports should be avoided until risk mitigation measures can be performed that eliminate the risk of COVID-19 transmission between competitors. Potential ways this could be accomplish include:

   Determining that no competitors participating in the event has COVID-19 by:
   a. Isolating each athlete for 14 days prior to the competition and ensuring they don't develop any signs or symptoms of COVID-19, OR
   b. Having two negative COVID-19 tests 24 hours apart within a few days of the competition and ensuring the athletes are isolated from the time of the tests until the competition.
   (Finnoff, 2020)

Emerging Wrestling Competitions

We have seen a gradual return to sport around the world. Some of the first were European football leagues. We have seen professional golf, UFC, NBA Basketball, Major League Baseball and NFL Football resume in the USA with large amounts of testing. During the month of October there are numerous national championships being held in wrestling. Two are described with the COVID-19 protocols put in place.

USA Wrestling recently conducted its National Championships, October 9-11. Fans were allowed with approximately one half of the 5,000 seats were made available through ticket sales.

- Personal Protective Equipment was required
- Every person entering the venue was subjected to a daily screening (Athletes, Coaches, Spectators, Staff, Officials, Medical, Media…etc.) This included a temperature check as well as an event questionnaire form. Anyone with a fever of 100.4 degrees Fahrenheit or higher was escorted a controlled medical area where the medical director can do an evaluation of their symptoms.
- People were not allowed congregate and should avoid other groups that are leaving the venue from the prior session.
- Signage to direct traffic flow around the venue to maintain social distancing.
- Floor markings were taped, showing between athletes waiting for competition.
- Athletes, coaches and spectators will be expected to ensure 6 ft. between themselves and any others waiting.

- Only one coach was be allowed to sit in the athlete's corner throughout the duration of the match.
- Coaches will also be required to wear a face covering at all times in the venue.
- Athletes were required to wipe themselves down with their own personal towels/wipes before the match, in between periods and after the match.
- When athletes are not competing, they will be required to wear a face covering while inside the venue.
- All officials should wear face coverings and/or shields during the match.
- Officials should sanitize before and after each match.
- A strict no handshake policy will be observed for customary wrestling-related activities such as pre-match and post-match handshakes between athletes, coaches and officials.
- Everyone should practice proper hygiene, wash hands frequently with soap and water for at least 20 seconds, use hand sanitizer, refrain from touching their face, refrain from spitting, and cover their cough or sneeze with a tissue and throw tissue in the trash.
- A post-event survey will be emailed after the event (7-14 days), in order to get data and information for COVID-19 signs and symptoms.

According to Professor José Maria Lopez-Guillon, member of the United World Wrestling Scientific Commission, the first Spanish National Championships to be held since the onset of the COVID-19 pandemic will be held on October 17. This return to competition will follow protocols used by the National Basketball Association used in their re-launch, that attempt to minimize the risks for all participants. It will include:

- Pre-departure COVID testing of all participants (72 hours before competition) and again at venue.
- Transportation to destination with protective and distancing gear.
- Concentration of all competitors in same hotel with competition bubbles and where the Championship will be held.
- Medical check and antigen test for discriminatory screening.
- Unidirectional circulation across all areas.
- Mandatory mask wearing in common areas.
- cleaning hands every use.
- Competition room without spectators and with less than 60 people in the arena.
- Outdoor warm-up area and with bout order visible.
- No contact during presentation of awards.

(Lopez-Guillon, personal communication, October 6, 2020)

United World Wrestling Executive Committee has approved existing plans to host the 2020 Senior Wrestling World Championships December 12-20 in Belgrade, Serbia. The committee approved the championships after receiving commitments from more than 70-percent of National Federations, a participation hurdle it had set for itself last month. The bureau will meet November 6th to discuss any changes to the event due to the ongoing coronavirus pandemic and its impact on participation. "We are cautiously optimistic about wrestling's return in December," said United World Wrestling president Nenad LALOVIC. "The safety of our athletes, coaches, and staff is our top priority and we will be taking every measure to ensure that happens in Belgrade."
(United World Wrestling, 2020, October 12).

The world has learned a great deal in a rather short time about the virus SARSCoV-2 and the disease COVID-19. However, how we deal with COVID-19 is still full of unknowns and uncertainty, and almost daily there is new knowledge shared by researchers from around the world. Those of us in wrestling must remain committed to keeping abreast of of these developments, so that we can move forward using best known practice to keep our wrestling community safe and moving forward.

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