



Cardiopulmonary Considerations for High School Student-Athletes During the COVID-19 Pandemic: Update to the NFHS-AMSSM Guidance Statement

Endorsed by the American Medical Society for Sports Medicine (AMSSM) and National Federation of State High School Associations (NFHS).

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Cardiac injury from SARS-CoV-2 infection among hospitalized patients was reported early in the COVID-19 pandemic.¹¹ Concern and uncertainty regarding the risk of cardiac sequelae in young athletes with SARS-CoV-2 infection led to the development of several consensus recommendations for the cardiac evaluation of athletes following SARS-CoV-2 infection.^{1,2,4-6,10,12} These guidelines were based on expert opinion and emerging clinical experience but lacked scientific data.

Recent large cohort studies in athletes have demonstrated a low risk of cardiac involvement and have greatly informed the use of cardiac testing after SARS-CoV-2 infection.^{3,7,8} The Outcome Registry for Cardiac Conditions in Athletes (ORCCA) reported a 0.7% (95% CI: 0.4, 1.1) overall prevalence of cardiac involvement in 3,018 collegiate athletes from 42 universities that had largely undergone cardiac ‘triad’ testing with a resting 12-lead electrocardiogram (ECG), transthoracic echocardiogram (TTE), and troponin blood assay.⁸ The ORCCA study also found that athletes with cardiopulmonary symptoms (e.g., chest pain, dyspnea, palpitations) during the acute illness or upon return to exercise were 3.1 (95% CI: 1.2, 7.7) times more likely to have cardiac involvement.^{8,9} Similarly, a study of 789 professional athletes all of whom had undergone cardiac triad testing reported a 0.6% prevalence of cardiac inflammation.⁷ Notably, all professional athletes diagnosed with myocarditis or pericarditis also had moderate symptoms defined as fever, flu-like illness, or cardiopulmonary symptoms.⁷ Lastly, the Big Ten registry reported a 2.3% prevalence of clinical or subclinical myocardial involvement in 1,597 collegiate athletes who underwent mandatory screening cardiac magnetic resonance imaging (MRI) after SARS-CoV-2 infection.³ Among the 13 universities participating, the reported prevalence ranged from 0 to 7.6%, with 3 sites reporting no myocardial involvement among 189 athletes.³ This marked variation is likely not explained by the underlying pathological process but rather by technical and interpretation variability between sites and the relative absence of normative cardiac MRI data in young competitive athletes. Importantly, none of these large cohort studies in collegiate and professional athletes, despite on-going surveillance, have reported an adverse cardiac event associated with SARS-CoV-2 infection.

In light of these studies, an expert task force from the National Federation of State High School Associations (NFHS) and the American Medical Society for Sports Medicine (AMSSM) reconvened to update guidelines for the cardiac assessment of high school student-athletes with prior SARS-CoV-2 infection before sports participation (Figure 1).⁴ In the absence of large cohort data in high school athletes, findings in college and professional athletes were extrapolated to the high school level. While many classifications of COVID-19 illness severity

have emerged, we used the definitions for mild, moderate, and cardiopulmonary symptoms as applied in large athlete cohort studies.^{3,7,8} Key updates and recommendations include:

- *Asymptomatic and mild symptoms*: Athletes with asymptomatic infections or only mild symptoms (e.g., common cold-like symptoms generally without fever, gastrointestinal symptoms, or loss of taste/smell) do not require formal medical evaluation or cardiac testing. However, athletes with any specific concerns should check-in with a clinician (e.g., physician, nurse practitioner, physician assistant, or athletic trainer) to determine if further clinical evaluation is needed. Athletes should be 3 days from symptom onset or positive test before beginning an exercise progression (while complying with public health guidelines for isolation).
- *Moderate and cardiopulmonary symptoms*: Athletes with moderate symptoms (e.g., fever >100.4°F, chills, flu-like syndrome for ≥2 days) or initial cardiopulmonary symptoms (e.g., chest pain, dyspnea, palpitations) should be evaluated by a clinician. Cardiac testing (e.g., ECG, TTE, troponin) is recommended for athletes with cardiopulmonary symptoms during the acute phase of infection. Athletes with remote infections and moderate symptoms >3 months ago who never received a work-up but have returned to full activity without symptoms do not need a medical evaluation or additional cardiac testing. Cardiology consultation and cardiac MRI should be considered for abnormal results and as clinically indicated. We recommend athletes are 5 days from symptom onset and that moderate symptoms are fully resolved before starting an exercise progression.
- *Severe symptoms*: Athletes with severe disease requiring hospitalization, including those diagnosed with multisystem inflammatory syndrome in children (MIS-C), should undergo formal evaluation with a cardiovascular specialist prior to starting an exercise progression.
- *Cardiopulmonary symptoms on return to exercise*: All athletes with SARS-CoV-2 infections should be closely monitored for new cardiopulmonary symptoms as they return to exercise. In general, athletes should feel well as they return to any level of training and exercise. Athletes with cardiopulmonary symptoms when they return to exercise (e.g., exertional chest pain, excessive dyspnea, syncope, palpitations, or unexplained exercise intolerance) should undergo additional cardiac testing (e.g., ECG, TTE, troponin) if not already performed and be evaluated by a cardiologist with consideration for a cardiac MRI or other investigations as indicated.
- *Return-to-sport exercise progression*: The return-to-sport progression and timeline should be individualized and is based on numerous factors including baseline fitness, severity and duration of COVID-19 symptoms, and tolerance to progressive levels of exertion. Most athletes will require a graded exercise progression. Athletes with systemic symptoms or illnesses of longer duration will require a more gradual exercise progression over at least a few days. Absent special indications, a prolonged return-to-sport timeline is not supported by evidence and further restriction from sports participation can contribute to detraining, increased injury risk, and mental health concerns.
- *Preparticipation Physical Evaluation (PPE)*: Additional history questions during a routine PPE should consider if the athlete had a COVID-19 illness. If yes, consider clarifying: when, what symptoms, and if the athlete is experiencing any new symptoms with exercise, especially chest pain.

- Emergency Action Plan (EAP): The task force again stresses the importance of a well-rehearsed EAP for every sport at every venue with clear access to an Automated External Defibrillator (AED).

Figure 1. Cardiopulmonary considerations for high school student-athletes during the COVID-19 pandemic.

ECG, electrocardiogram; Echo, echocardiogram; GI, gastrointestinal; hs-Tn, high sensitivity troponin; MRI, magnetic resonance imaging

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