ESC European Society of Cardiology

European Journal of Preventive Cardiology (2022) **00**, 1–5
https://doi.org/10.1093/eurjpc/zwac180

CONSENSUS DOCUMENT
Sports cardiology

Cardiac screening prior to return to play after SARS-CoV-2 infection: focus on the child and adolescent athlete: *A Clinical Consensus Statement of the Task Force for Childhood Health of the European Association of Preventive Cardiology*

Flavio D'Ascenzi [1]*, Silvia Castelletti [2], Paolo Emilio Adami[3], Elena Cavarretta [4,5], María Sanz-de la Garza[6], Viviana Maestrini [7], Alessandro Biffi[8], Paul Kantor[9], Guido Pieles[10,11], Evert Verhagen[12], Monica Tiberi[13], Henner Hanssen [14], Michael Papadakis[15], Josef Niebauer[16], and Martin Halle [17,18]

[1]Department of Medical Biotechnologies, Division of Cardiology, University of Siena, V.le M. Bracci, 16 53100, Siena, Italy; [2]IRCCS Istituto Auxologico Italiano, Cardiomyopathy Unit and Department of Cardiovascular, Neural and Metabolic Sciences, Milan, Italy; [3]Health and Science Department, World Athletics, Monaco, Principality of Monaco; [4]Department of Medical-Surgical Sciences and Biotechnologies, Sapienza University of Rome, Latina, Italy; [5]Mediterranea Cardiocentro, Naples, Italy; [6]Cardiovascular Institute, Hospital Clínic, IDIBAPS, University of Barcelona, Barcelona, Spain; [7]Department of Clinical, Internal, Anesthesiological and Cardiovascular Sciences, Sapienza University of Rome, Rome, Italy; [8]Med-Ex, Medicine and Exercise srl, Medical Partner Scuderia Ferrari, Rome, Italy; [9]Division of Cardiology, Department of Pediatrics, Children's Hospital of Los Angeles, Keck School of Medicine, University of Southern California, Los Angeles, CA, USA; [10]Sports Medicine Department, Aspetar, Orthopaedic and Sports Medicine Hospital, Doh, Qatar; [11]Institute of Sport Exercise and Health (ISEH), University College London, London, UK; [12]Amsterdam Collaboration on Health & Safety in Sports, Department of Public and Occupational Health, Amsterdam Movement Sciences, Amsterdam UMC, University Medical Centers - Vrije Universiteit Amsterdam, Amsterdam, Netherlands; [13]Sport Medicine, Department of Prevention, ASUR Marche Area Vasta 1, Pesaro, Italy; [14]Department of Sport, Exercise and Health, Medical Faculty, University of Basel, Basel, Switzerland; [15]Cardiovascular Clinical Academic Group, St George's, University of London, London, UK; [16]University Institute of Sports Medicine, Prevention and Rehabilitation, Paracelsus Medical University of Salzburg, Salzburg, Austria; [17]Department of Prevention and Sports Medicine, Accredited Centre for Sports Cardiology/EAPC, School of Medicine, University Hospital Klinikum rechts der Isar, Technical University of Munich, Georg-Brauchle-Ring 56, D-80992 Munich, Germany; and [18]DZHK (German Center for Cardiovascular Research), Partner Site Munich Heart Alliance, Potsdamer Str. 58, 10785 Berlin, Germany

Received 6 April 2022; revised 10 August 2022; accepted 16 August 2022

Cardiac sequelae after COVID-19 have been described in athletes, prompting the need to establish a return-to-play (RTP) protocol to guarantee a safe return to sports practice. Sports participation is strongly associated with multiple short- and long-term health benefits in children and adolescents and plays a crucial role in counteracting the psychological and physical effects of the current pandemic. Therefore, RTP protocols should be balanced to promote safe sports practice, particularly after an asymptomatic SARS-CoV-2 infection that represents the common manifestation in children. The present consensus document aims to summarize the current evidence on the cardiac sequelae of COVID-19 in children and young athletes, providing key messages for conducting the RTP protocol in paediatric athletes to promote a safe sports practice during the COVID-19 era.

Keywords Screening • COVID-19 • Return to play • Sports cardiology • Children • Adolescent • Athlete's heart

* Corresponding author. Tel: +39 05 77585377, Email: flavio.dascenzi@unisi.it

Cardiovascular manifestations of SARS-CoV-2 infection in athletes

Individuals younger than 18 years are frequently spared from severe symptoms and remain predominantly asymptomatic during acute SARS-CoV-2 infection,[1,2] although this is not universally the case. Indeed, cardiac sequelae after COVID-19 have been described in all age groups.[3,4] In the initial reports, myocarditis, pericarditis, pericardial effusion, and myocardial involvement have been frequently described in young athletes who had an asymptomatic or mildly symptomatic course of the illness, without cardiac symptoms. The highest prevalence of myocarditis (15%) was reported among 26 college athletes evaluated with cardiac magnetic resonance (CMR) after asymptomatic or mildly symptomatic SARS-CoV-2 infection. However, further studies reported a lower prevalence of myocardial involvement, between 0% and 7.6%.[5–7] In children and adolescents, SARS-CoV-2 infection-related multisystem inflammatory syndrome (MSI-S) has been described: it is a severe but rare hyperimmune response that occurs within 2–6 weeks after the acute infection, leading to severe cardiac manifestations, such as myocardial dysfunction and, in rare cases, to coronary aneurysms.[1,8]

Considering the potential cardiac consequences of SARS-CoV-2 infection in competitive athletes, many scientific societies have suggested cardiovascular screening for adult athletes before the return-to-play (RTP) protocol, with different protocols ranging from a comprehensive evaluation of all athletes to a stepwise approach based on disease severity.[9,10] However, few data are available in children. The different clinical course and potential sequelae of SARS-CoV-2 and the need to avoid barriers to participation in exercise in children need to be balanced when considering screening protocols prior to RTP.

Typical course of SARS-CoV-2 infection in children

The clinical presentation of the SARS-CoV-2 infection in children is usually less severe than in adults, and fatal events are rare. Children without symptoms or radiologic signs of pneumonia range in prevalence from 4.4% to 39% of cases.[11–13] When present, clinical manifestations are usually mild or, more rarely, moderate.[11,14] The most common symptoms are fever (53–59%) and cough (48–56%).[11,12,15] In asymptomatic or mildly symptomatic children, the rate of cardiovascular complications is low, questioning the universal need for cardiac imaging.[16] The use of additional tests, such as cardiopulmonary exercise testing, has therefore also been questioned in young athletes after SARS-CoV-2 infection,[5,17] suggesting that this should be limited to junior athletes with cardiac symptoms limiting their exercise capacity.

Although rare, severe and fatal SARS-CoV-2 has been reported, with a case mortality rate ranging from 0.2% to 2% in children with mild and severe manifestations, respectively.[12] Pneumonia and MSI-S represent the most common clinical presentations of

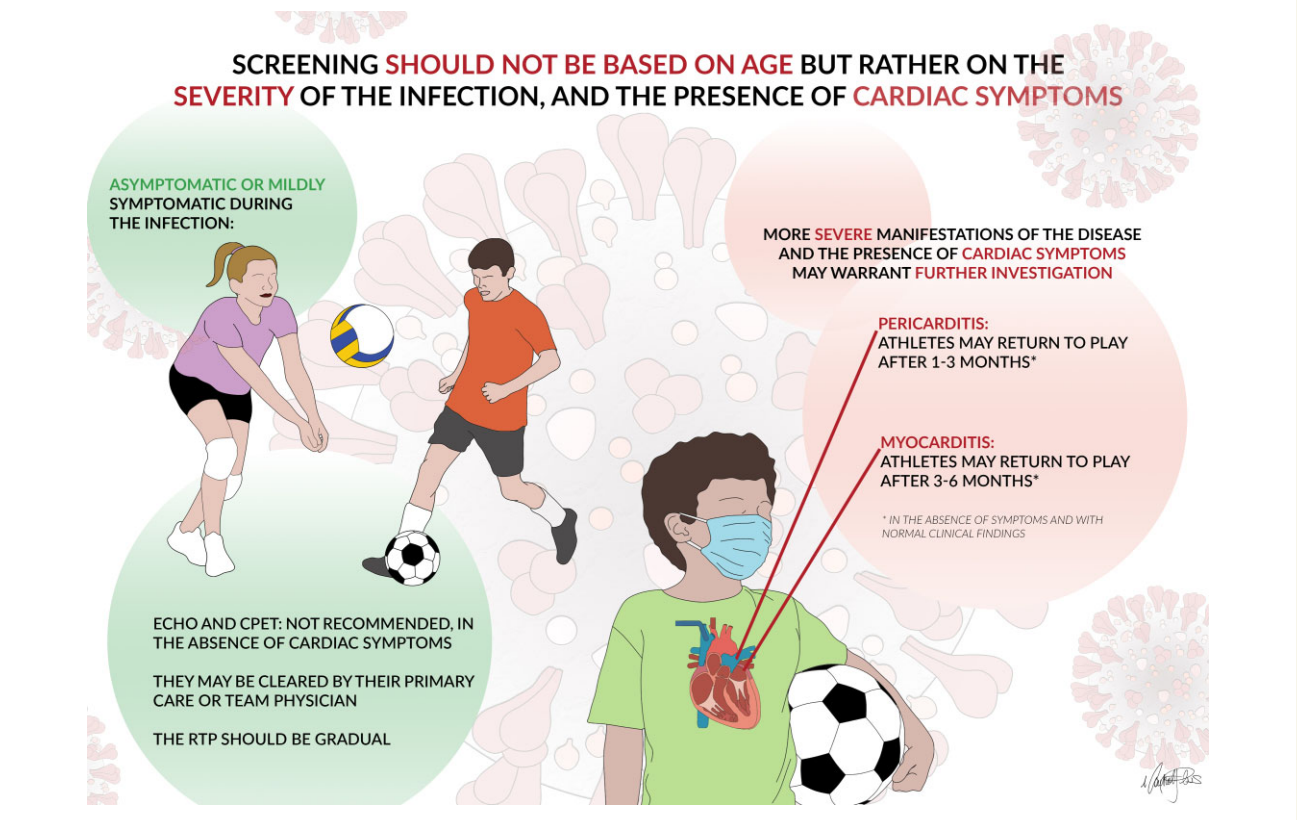

Figure 1 Central illustration summarizing the key elements of the screening after SARS-CoV-2 infection in children practising sport. *CPET, cardiopulmonary exercise testing; RTP, return-to-play.*

Table 1 Key messages for the promotion of a safe sports practice during the COVID-19 era

KEY MESSAGES: promotion of a safe sports practice during the COVID-19 era
The clinical presentation of the SARS-CoV-2 infection in children is usually less severe than in adults, and cardiac sequelae are rare
The RTP in junior athletes after SARS-CoV-2 infection should be as safe as feasible, not limiting their access to sports practice
The need for cardiac evaluation prior to RTP should not be based on age but should be guided by the severity of disease and the presence of cardiac symptoms
Asymptomatic individuals and those with mild symptoms should be cleared by their primary care or team physician, after physical examination and accurate evaluation of medical history
The use of echocardiography is not advised in junior athletes after asymptomatic or mildly symptomatic SARS-CoV-2 infection, in the absence of cardiac symptoms
Resting ECG, exercise testing, and echocardiogram should be included in the PPE of young athletes with protracted or more-than-mild symptoms during SARS-CoV-2 infection
In case of more-than-mild symptoms, cardiac symptoms or abnormal resting ECG, the PPE of junior athletes should include investigations aimed to exclude pericarditis and myocarditis
In the absence of cardiac symptoms limiting exercise capacity, CPET is not advised as a screening tool in junior athletes after SARS-CoV-2 infection
Cardiac magnetic resonance may be performed in junior athletes that had severe cardiac manifestations of the disease or abnormalities at the basal evaluation
Junior athletes diagnosed with pericarditis may return to play after 1–3 months, in the absence of symptoms and normal clinical findings
Junior athletes diagnosed with myocarditis may return to play after 3–6 months, in the absence of symptoms and normal clinical findings
The RTP should be gradual

RTP, return-to-play; PPE, pre-participation evaluation; CPET, cardiopulmonary exercise testing.

moderate-to-severe COVID-19.[18,19] Only a small percentage of children (5–8%) develop acute respiratory distress syndrome,[18] which is rarely fatal. The MSI-S is arguably the most severe clinical manifestation of SARS-CoV-2 infection in children, with an estimated incidence of 2 per 100 000 persons younger than 18 years of age at risk, and 1 in 161 clinically infected individuals.[19] This syndrome is considered a post-infectious complication, and is characterized by unremitting high fever, gastrointestinal symptoms, colitis, ileitis, pleural effusion, rash, conjunctivitis, periorbital swelling, lymphadenopathy, swollen extremities, headache, confusion, irritability, and hypotension.[20] In such cases, cardiac involvement may be evident in 10–20% of those requiring intensive care admission, including malignant arrhythmias, both reduced systolic function (myocarditis) or coronary artery aneurysms. Children admitted to an intensive care unit are more frequently male (60%) and are more often affected by chronic medical conditions (36–50%).[20] This data suggests that, although rare, children may experience cardiovascular consequences of SARS-CoV-2 infection, particularly those with more-than-mild course of the disease.[21] Education on symptom surveillance is important to identify children with long-covid syndrome (*Figure 1*).

Importance of sports participation in children

Investments in children's health have lifelong health, economic and potentially intergenerational benefits.[22] The beneficial effects of regular exercise in children's physical, mental and cognitive health are well-established.[23] Sport participation increases cardiovascular fitness, muscle strength, energy consumption, and leads to more positive youth development, with healthier nutrition habits, safer sexual practices, and reduced substance abuse.[24] Moreover, healthy habits acquired in teenage years tend to be maintained in adult life. Conversely, sedentary behaviours are associated with mental disorders and psychosocial misconduct, increased weight, reduced fitness and cardio-metabolic health,[25] and eventually an increase in cardiovascular risk factors and morbidities. Indeed, higher adolescent BMI is a significant and independent risk factor for self-reported poor health, Type 2 diabetes, and premature myocardial infarction in adults in their 30 s and 40 s.[26]

During the COVID-19 pandemic, the initial lockdown and restrictions on sports practice caused a significant decline in physical activity (PA) levels among all ages but more so for children and adolescents. A significant increase of sedentary behaviour with a large increase of screen time of more than 2 h/day on weekdays was reported.[27] In children, a reduction in weekly and daily minutes time spent in moderate-to-vigorous PA has been demonstrated worldwide.[28,29] While safety is paramount, it is imperative that RTP protocols in children and adolescents do not create unnecessary barriers which may inadvertently limit PA.

Cardiac screening prior to return-to-play

Even though COVID-19 is more benign in children than in adults, a pre-participation examination should not be based on age but rather the severity of the infection and the presence of cardiac symptoms. Asymptomatic individuals and those with mild symptoms should be cleared by their primary care or team physician, after physical examination and an accurate evaluation of medical history. In all individuals, education on surveillance for cardiopulmonary symptoms with return to sports is necessary.[30] In case of more severe manifestations of the disease (i.e., prolonged illness, debilitating symptoms) and particularly in the presence of cardiac symptoms (i.e., palpitations, chest pain, pre-syncope, or syncope), further testing are warranted,

including resting ECG, exercise testing, echocardiogram, 24 h ambulatory ECG monitoring, blood testing, or CMR, as indicated.[31] The clinical evaluation should include the assessment of respiratory symptoms, given the potential consequences of the infection on the pulmonary system. Increased vigilance is prudent in individuals with cardiac symptoms, regardless of the severity of preceding SARS-CoV-2 infection (*Table 1*).

In case of clinical pericarditis or myocarditis, the athlete should be restricted for 1–3 or 3–6 months, respectively, and only resume activities when all indices of inflammation have normalized, as per established ESC guidelines.[32] If the pre-participation evaluation and examination are normal, no further testing is necessary, but a close follow-up is warranted. The RTP should be gradual and should last at least 7 days or longer depending on the exercise tolerability in case of more severe forms of COVID-19.[33]

Conclusions

In conclusion, SARS-CoV2-infection has a benign course in most children. Sports participation is strongly associated with multiple short- and long-term health benefits in children and adolescents and plays a crucial role in counteracting the psychological and physical effects of the current pandemic. Therefore, RTP protocols should be balanced, to promote safe sports practice. In children with cardiac symptoms or with SARS-CoV-2-related symptoms which are protracted or more-than-mild, pre-participation evaluation and RTP should be carried based on the principles in accordance with the current 2020 ESC Sports Cardiology Guidelines.[32] Careful clinical review of the evidence for prior cardiac involvement due to SARS-CoV-2 is necessary when providing safe advice while still enabling children and young adults to benefit lifelong from the protective 'armour' of positive health effects that sport offers.

Conflict of interest: None declared.

References

1. Alsaied T, Tremoulet AH, Burns JC, Saidi A, Dionne A, Lang SM, Newburger JW, de Ferranti S, Friedman KG. Review of cardiac involvement in multisystem inflammatory syndrome in children. *Circulation* 2021;**143**:78–88.
2. Hasan A, Mehmood N, Fergie J. Coronavirus disease (COVID-19) and pediatric patients: a review of epidemiology, symptomatology, laboratory and imaging results to guide the development of a management algorithm. *Cureus* 2020;**12**:e7485.
3. Kim IC, Kim JY, Kim HA, Han S. COVID-19-related myocarditis in a 21-year-old female patient. *Eur Heart J* 2020;**41**:1859.
4. Trogen B, Gonzalez FJ, Shust GF. COVID-19-associated myocarditis in an adolescent. *Pediatr Infect Dis J* 2020;**39**:e204–e205.
5. Cavigli L, Frascaro F, Turchini F, Mochi N, Sarto P, Bianchi S, Parri A, Carraro N, Valente S, Focardi M, Cameli M, Bonifazi M, D'Ascenzi F. A prospective study on the consequences of SARS-CoV-2 infection on the heart of young adult competitive athletes: implications for a safe return-to-play. *Int J Cardiol* 2021;**336**:130–136.
6. Udelson JE, Rowin EJ, Maron BJ. Return to play for athletes after COVID-19 infection: the fog begins to clear. *JAMA Cardiol* 2021;**6**:997–999.
7. Starekova J, Bluemke DA, Bradham WS, Eckhardt LL, Grist TM, Kusmirek JE, Purtell CS, Schiebler ML, Reeder SB. Evaluation for myocarditis in competitive student athletes recovering from coronavirus disease 2019 with cardiac magnetic resonance imaging. *JAMA Cardiol* 2021;**6**:945–950.
8. Belhadjer Z, Meot M, Bajolle F, Khraiche D, Legendre A, Abakka S, Auriau J, Grimaud M, Oualha M, Beghetti M, Wacker J, Ovaert C, Hascoet S, Selegny M, Malekzadeh-Milani S, Maltret A, Bosser G, Giroux N, Bonnemains L, Bordet J, Di Filippo S, Mauran P, Falcon-Eicher S, Thambo JB, Lefort B, Moceri P, Houyel L, Renolleau S, Bonnet D. Acute heart failure in multisystem inflammatory syndrome in children in the context of global SARS-CoV-2 pandemic. *Circulation* 2020;**142**:429–436.
9. Bhatia RT, Marwaha S, Malhotra A, Iqbal Z, Hughes C, Borjesson M, Niebauer J, Pelliccia A, Schmied C, Serratosa L, Papadakis M, Sharma S. Exercise in the severe acute respiratory syndrome Coronavirus-2 (SARS-CoV-2) era: a question and answer session with the experts endorsed by the section of sports cardiology & exercise of the European Association of Preventive Cardiology (EAPC). *Eur J Prev Cardiol* 2020;**27**:1242–1251.
10. Wilson MG, Hull JH, Rogers J, Pollock N, Dodd M, Haines J, Harris S, Loosemore M, Malhotra A, Pieles G, Shah A, Taylor L, Vyas A, Haddad FS, Sharma S. Cardiorespiratory considerations for return-to-play in elite athletes after COVID-19 infection: a practical guide for sport and exercise medicine physicians. *Br J Sports Med* 2020;**54**:1157–1161.
11. Dong Y, Mo X, Hu Y, Qi X, Jiang F, Jiang Z, Tong S. Epidemiology of COVID-19 Among Children in China. *Pediatrics* 2020;**145**:e20200702.
12. Lu X, Zhang L, Du H, Zhang J, Li YY, Qu J, Zhang W, Wang Y, Bao S, Li Y, Wu C, Liu H, Liu D, Shao J, Peng X, Yang Y, Liu Z, Xiang Y, Zhang F, Silva RM, Pinkerton KE, Shen K, Xiao H, Xu S, Wong GWK; Chinese Pediatric Novel Coronavirus Study Team. SARS-CoV-2 infection in children. *N Engl J Med* 2020;**382**:1663–1665.
13. Bellino S, Punzo O, Rota MC, Del Manso M, Urdiales AM, Andrianou X, Fabiani M, Boros S, Vescio F, Riccardo F, Bella A, Filia A, Rezza G, Villani A, Pezzotti P; COVID-19 WORKING GROUP. COVID-19 disease severity risk factors for pediatric patients in Italy. *Pediatrics* 2020;**146**:e2020009399.
14. Cui X, Zhao Z, Zhang T, Guo W, Guo W, Zheng J, Zhang J, Dong C, Na R, Zheng L, Li W, Liu Z, Ma J, Wang J, He S, Xu Y, Si P, Shen Y, Cai C. A systematic review and meta-analysis of children with coronavirus disease 2019 (COVID-19). *J Med Virol* 2021;**93**:1057–1069.
15. Jutzeler CR, Bourguignon L, Weis CV, Tong B, Wong C, Rieck B, Pargger H, Tschudin-Sutter S, Egli A, Borgwardt K, Walter M. Comorbidities, clinical signs and symptoms, laboratory findings, imaging features, treatment strategies, and outcomes in adult and pediatric patients with COVID-19: a systematic review and meta-analysis. *Travel Med Infect Dis* 2020;**37**:101825.
16. Cavigli L, Cillis M, Mochi V, Frascaro F, Mochi N, Hajdarevic A, Roselli A, Capitani M, Alvino F, Giovani S, Lisi C, Cappellini MT, Colloca RA, Mandoli GE, Valente S, Focardi M, Cameli M, Bonifazi M, D'Ascenzi F. SARS-CoV-2 infection and return to play in junior competitive athletes: is systematic cardiac screening needed? *Br J Sports Med* 2022;**56**:264–270.
17. Gervasi SF, Pengue L, Damato L, Monti R, Pradella S, Pirronti T, Bartoloni A, Epifani F, Saggese A, Cuccaro F, Bianco M, Zeppilli P, Palmieri V. Is extensive cardiopulmonary screening useful in athletes with previous asymptomatic or mild SARS-CoV-2 infection *Br J Sports Med* 2021;**55**:54–61.
18. Parisi GF, Indolfi C, Decimo F, Leonardi S, Miraglia Del Giudice M. COVID-19 pneumonia in children: from etiology to management. *Front Pediatr* 2020;**8**:616622.
19. Dufort EM, Koumans EH, Chow EJ, Rosenthal EM, Muse A, Rowlands J, Barranco MA, Maxted AM, Rosenberg ES, Easton D, Udo T, Kumar J, Pulver W, Smith L, Hutton B, Blog D, Zucker H; New York State and Centers for Disease Control and Prevention Multisystem Inflammatory Syndrome in Children Investigation Team. Multisystem inflammatory syndrome in children in New York state. *N Engl J Med* 2020;**383**:347–358.
20. Bailey LC, Razzaghi H, Burrows EK, Bunnell HT, Camacho PEF, Christakis DA, Eckrich D, Kitzmiller M, Lin SM, Magnusen BC, Newland J, Pajor NM, Ranade D, Rao S, Sofela O, Zahner J, Bruno C, Forrest CB. Assessment of 135794 pediatric patients tested for severe acute respiratory syndrome Coronavirus 2 across the United States. *JAMA Pediatr* 2021;**175**:176–184.
21. Borch L, Holm M, Knudsen M, Ellermann-Eriksen S, Hagstroem S. Long COVID symptoms and duration in SARS-CoV-2 positive children - a nationwide cohort study. *Eur J Pediatr* 2022;**181**:1597–1607.
22. Clark H, Coll-Seck AM, Banerjee A, Peterson S, Dalglish SL, Ameratunga S, Balabanova D, Bhan MK, Bhutta ZA, Borrazzo J, Claeson M, Doherty T, El-Jardali F, George AS, Gichaga A, Gram L, Hipgrave DB, Kwamie A, Meng Q, Mercer R, Narain S, Nsungwa-Sabiiti J, Olumide AO, Osrin D, Powell-Jackson T, Rasanathan K, Rasul I, Reid P, Requejo J, Rohde SS, Rollins N, Romedenne M, Singh Sachdev H, Saleh R, Shawar YR, Shiffman J, Simon J, Sly PD, Stenberg K, Tomlinson M, Ved RR, Costello A. A future for the world's children? A WHO-UNICEF-Lancet Commission. *Lancet* 2020;**395**:605–658.
23. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, Carty C, Chaput JP, Chastin S, Chou R, Dempsey PC, DiPietro L, Ekelund U, Firth J, Friedenreich CM, Garcia L, Gichu M, Jago R, Katzmarzyk PT, Lambert E, Leitzmann M, Milton K, Ortega FB, Ranasinghe C, Stamatakis E, Tiedemann A, Troiano RP, van der Ploeg HP, Wari V, Willumsen JF. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med* 2020;**54**:1451–1462.
24. Howie EK, Daniels BT, Guagliano JM. Promoting physical activity through youth sports programs: it's social. *Am J Lifestyle Med* 2020;**14**:78–88.

25. Cavarretta E, D'Angeli I, Giammarinaro M, Gervasi S, Fanchini M, Causarano A, Costa V, Manara M, Terribili N, Sciarra L, CalÒ L, Fossati C, Peruzzi M, Versaci F, Carnevale R, Biondi-Zoccai G, Frati G. Cardiovascular effects of COVID-19 lockdown in professional Football players. *Panminerva Med* 2021. doi:10.23736/S0031-0808.21.04340-8.
26. Nagata JM, Ganson KT, Liu J, Gooding HC, Garber AK, Bibbins-Domingo K. Adolescent body mass index and health outcomes at 24-year follow-up: a prospective cohort study. *J Am Coll Cardiol* 2021;**77**:3229–3231.
27. Kovacs VA, Starc G, Brandes M, Kaj M, Blagus R, Leskosek B, Suesse T, Dinya E, Guinhouya BC, Zito V, Rocha PM, Gonzalez BP, Kontsevaya A, Brzezinski M, Bidiugan R, Kiraly A, Csányi T, Okely AD. Physical activity, screen time and the COVID-19 school closures in Europe - An observational study in 10 countries. *Eur J Sport Sci* 2022;**22**:1094–1103.
28. Dallolio L, Marini S, Masini A, Toselli S, Stagni R, Bisi MC, Gori D, Tessari A, Sansavini A, Lanari M, Bragonzoni L, Ceciliani A. The impact of COVID-19 on physical activity behaviour in Italian primary school children: a comparison before and during pandemic considering gender differences. *BMC Public Health* 2022;**22**:52.
29. Runacres A, Mackintosh KA, Knight RL, Sheeran L, Thatcher R, Shelley J, McNarry MA. Impact of the COVID-19 pandemic on sedentary time and behaviour in children and adults: a systematic review and meta-analysis. *Int J Environ Res Public Health* 2021; **18**:11286.
30. Chowdhury D, Fremed MA, Dean P, Glickstein JS, Robinson J, Rellosa N, Thacker D, Soma D, Briskin SM, Asplund C, Johnson J, Snyder C. Return to activity after SARS-CoV-2 infection: cardiac clearance for children and adolescents. *Sports Health* 2022;**14**:460–465.
31. Feldstein LR, Rose EB, Horwitz SM, Collins JP, Newhams MM, Son MBF, Newburger JW, Kleinman LC, Heidemann SM, Martin AA, Singh AR, Li S, Tarquinio KM, Jaggi P, Oster ME, Zackai SP, Gillen J, Ratner AJ, Walsh RF, Fitzgerald JC, Keenaghan MA, Alharash H, Doymaz S, Clouser KN, Giuliano JS Jr, Gupta A, Parker RM, Maddux AB, Havalad V, Ramsingh S, Bukulmez H, Bradford TT, Smith LS, Tenforde MW, Carroll CL, Riggs BJ, Gertz SJ, Daube A, Lansell A, Coronado Munoz A, Hobbs CV, Marohn KL, Halasa NB, Patel MM, Randolph AG; Overcoming COVID-19 Investigators; CDC COVID-19 Response Team. Multisystem inflammatory syndrome in U.S. children and adolescents. *N Engl J Med* 2020;**383**:334–346.
32. Pelliccia A, Sharma S, Gati S, Back M, Borjesson M, Caselli S, Collet JP, Corrado D, Drezner JA, Halle M, Hansen D, Heidbuchel H, Myers J, Niebauer J, Papadakis M, Piepoli MF, Prescott E, Roos-Hesselink JW, Stuart AG, Taylor RS, Thompson PD, Tiberi M, Vanhees L, Wilhelm M. 2020 ESC Guidelines on sports cardiology and exercise in patients with cardiovascular disease. *Eur Heart J* 2021;**42**:17–96.
33. Elliott N, Martin R, Heron N, Elliott J, Grimstead D, Biswas A. Infographic. Graduated return to play guidance following COVID-19 infection. *Br J Sports Med* 2020;**54**: 1174–1175.