COVID-19 vaccination in athletes: ready, set, go…

James H Hull[1,2,*], Martin P Schwellnus[3,4], , David B Pyne[5] and Anand Shah[2,6]

[1]Institute of Sport, Exercise and Health, UCL, London W1T 7HA, UK

[2]Department of Respiratory Medicine, Royal Brompton Hospital, London, UK

[3]Sport, Exercise Medicine and Lifestyle Institute, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa

[4]International Olympic Committee Research Centre of South Africa, Pretoria, South Africa

[5]Research Institute for Sport and Exercise, University of Canberra, Canberra, NSW, Australia

[6]Medical Research Council Centre of Global Infectious Disease Analysis, Department of Infectious Disease Epidemiology, School of Public Health, Imperial College London, London, UK

*Correspondence to: j.hull@rbht.nhs.uk

In the fight against the COVID-19 global pandemic, the focus in 2021 has fortunately turned to vaccination strategies. The successful development of several vaccines, and their proven efficacy and short-term safety in large scale multinational trials against severe acute respiratory syndrome coronavirus 2 (SARS-CoV2), offers promise in controlling the pandemic. Many countries are now operationalising their vaccination programmes, and prioritising health-care workers and the most vulnerable individuals within the population—eg, the elderly and those with chronic health conditions.

In the sporting world, COVID-19 has curtailed normal activities considerably and led to the postponement and cancellation of a vast number of national and international events. Several studies within the past year detail COVID-19 transmission occurring in sport, and while the delivery of rigorous infection control procedures is central in preventing SARS-CoV2 transmission, the issue of COVID-19 vaccination in elite and competitive, recreational athletes is fast becoming a pressing issue for individual athletes, sporting teams, and organisations. Sport clinicians are now facing several important considerations, including the impact of exercise on efficacy of vaccines, the potential side effects, the best type of vaccine for a given athlete or group of athletes (if choice becomes relevant), advice regarding the timing of vaccination, and finally whether vaccination prevents SARS-COV-2 transmission.

The issue of vaccination in the sporting community is not new. On an annual basis, many thousands of athletes receive influenza vaccination, and discussion regarding the risks and benefits of vaccination, in this specialist community, has long been debated. Studies in the general population have shown heightened rates of vaccine efficacy , with an increased antibody titre, in individuals who undertook moderate intensity exercise before vaccination. However, the evidence is not conclusive, with other studies showing no appreciable impact of exercise on vaccine response.

A study analysing the effects of regular physical training by a group of elite athletes on vaccine-induced cellular and humoral immunity showed that although both groups had a

marked increase in vaccine-reactive CD4 T-cell levels, which peaked 1 week after vaccination, this increase was more pronounced in athletes when compared with healthy controls. Similarly, the increase in neutralising antibodies was stronger in athletes, suggesting that regular high frequency and intensity of training might enhance vaccine response. Another study in athletes, analysing the impact of the timing of influenza vaccination on antigen-specific T cell responses, showed no appreciable difference between administration 2 and 24 h post training. Overall, the historical data does not appear to indicate that physical training undertaken around the time of vaccination will reduce efficacy, and could in fact improve vaccination response. Studies will be needed to evaluate these outcomes in the context of the novel formulations of COVID-19 vaccination.

A logical concern in the context of COVID-19 vaccination relates to the impact of vaccine-related side effects. Detail on COVID-19 vaccination tolerability in the general population is still emerging (ie, the post-licensing data is still awaited) and will likely differ based on type and formulation of vaccine. In the meantime, preliminary trial data provides reassurance regarding an overall low serious adverse event rate, and that severe systemic effects were reported in only 1–3% of individuals.

A broad range of local and systemic side effects following COVID-19 vaccination have, however, been reported in late-phase trial data. Although these side effects are generally mild (ie, they do not typically impact routine activities), they are more prevalent in younger individuals (ie, those younger than 55 years) and more pronounced following the second dose with some vaccines, within sequential staged vaccine administration. Specifically, in one of the most widely used COVID-19 vaccines to date, the Pfizer/BioNTech vaccine (BNT162b2 mRNA Covid-19), local reactogenicity was encountered in 83% of younger individuals and systemic reactogenicity, with fatigue and headache, was reported in about 50% of all individuals, with around 25% requiring anti-pyretic or analgesic medication. Pertinent to athletes, myalgia was reported in 21% of younger individuals following the first vaccine, rising to 37% following the second vaccine. Notably, there are no published data on the duration (days) of side effects and their impact on ability to perform physical activity; clearly this information will be an important consideration.

Safety analysis from the other main class and widely available vaccine, the Oxford–AstraZeneca vaccine (ChAdOx1 nCoV-19), revealed that around 50% of recipients had localised pain and tenderness at the vaccination site, of mild to moderate severity, which on occasion lasted 4–5 days post first-dose administration despite paracetamol administration. Fatigue and headache were also reported in about 70% of recipients post first-dose with muscle ache and fever present in 60%, although these effects were less frequently reported following the second dose.

The time course of these side effects, lasting in some cases up to a week after administration, is likely to be clinically very relevant for athletes, potentially impacting their training and competition. Thus, it is conceivable that in the absence of high-quality pre-counselling information regarding expected side effects, athletes might be deterred from undertaking vaccination or indeed attending for a second vaccine visit, thus impacting overall efficacy. While the susceptibility of elite athletes to upper respiratory infection has been long recognised, the uptake of vaccination historically has often been suboptimal, given concerns over side effects, timing to competition, and efficacy. It will therefore be important for clinicians to discuss these issues and to plan to carefully monitor symptoms post vaccination. It might also be appropriate to consider a temporary reduction in training load in the first 48–

72 h post vaccine injection, particularly after the second dose. Other general considerations are likely to be important, including, but not limited to, ensuring that the vaccine is administered correctly to reduce local side effects (especially for intramuscular administration), careful selection of the site of administration, and the pre-emptive use and availability of anti-pyretics and simple analgesics.

Given the emergence and recent licensing of several COVID-19 vaccines, a logical question relates to whether there might be a favoured choice of vaccine in athletic individuals. On the basis that COVID-19 vaccination is neither widely available, nor a priority to be administered to athletes in most countries, this consideration is premature and could be viewed as inappropriate and contentious. Vaccine availability will, however, likely evolve over the coming months and years, and selection will be influenced by differing storage and transportation requirements (ie, whether −80°C is needed), real-world evidence regarding side-effect profiles, and dosing regimes. Elite athletes preparing for major competitions typically have a very regimented and pre-planned training schedule, and any interruptions to training can substantially affect preparation.

In this respect, the timing of any vaccination becomes critical if a second dose of vaccine needs to be administered 3–4 weeks (depending on the vaccine) after first, particularly if there are more frequent and severe side effects after the second dose of vaccine. Clinicians will thus need to be cognizant of athlete-specific factors, such as planning vaccination in the context of peak training or the tapering period before major competition, and discussions will likely involve shared decision making with athletes, coaches, and administrators. Having said this, it is conceivable that global health policy might evolve to mandate that vaccination has been undertaken to allow freedom of international travel (ie, without prohibitive quarantine requirements) and indeed the potential participation in certain sporting events.

Given the propensity of mass gatherings and large-scale events to increase COVID-19 transmission, sports events have been considerably impacted with physical distancing, travel restrictions, and careful risk mitigation . Despite the looming availability of effective vaccination, the impact on SARS-CoV2 transmission is still not clear. The only information presently available is the ChAdOx1 nCoV-19 vaccine trial , which showed fewer asymptomatic COVID-19 infections than in the control group in those who received a first half-dose and a second full booster; however, the study was underpowered to generate firm conclusions at this point. In the context of more widespread vaccine rollout, detailed athlete registry data collection is needed before current restrictions and risk mitigation within sporting events can be lifted.

The global COVID-19 pandemic has placed and continues to place unprecedented pressure on global health-care systems and the utmost priority remains to protect the most vulnerable in the population. However, as capacity increases and planning permits, there will be an opportunity to operationalise COVID-19 vaccination for a broader group of individuals, and the athletic community must be best prepared for the challenges this presents. Until this time, sports clinicians can familiarise themselves with vaccine types, likely type to be used in their setting; efficacy; and side effect profiles; and can set up vaccination protocols for their athletes (plan the timing, site, and pre-and post-vaccination training carefully through shared decision making) so they are best prepared.

We declare no competing interests.