

Surfing and Health in the Covid-19 Era: A Narrative Review

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Abstract

Surfing is an increasingly popular sport, with an estimated 37 million participants worldwide—a figure likely to rise following surfing’s appearance at the rescheduled Tokyo 2020 Olympics. The COVID-19 pandemic has and has had an impact on the global surfing community and there is a need for guidelines for safe return for both elite and recreational surfers. Generally, surfing has a low-risk injury profile compared to other sports; however, the risk of drowning and adverse events in the water is ever-present. This risk may be heightened in patients with underlying or recent COVID-19 infection. This narrative review aims to summarise the available scientific evidence on surfing and COVID-19, to help both elite and recreational surfers, surfing organisations, and healthcare professionals consider a safe return to surfing during this pandemic.

Keywords: surfing medicine; ocean safety; covid-19; world surf league; return to play; sports medicine; rehabilitation medicine

1.Introduction

The COVID-19 pandemic, caused by the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), has had a major impact on the global surfing community. Many countries have put into place lockdown measures that have forbidden access to beaches as preventative public health measures to reduce the spread of the disease and the overall burden on local healthcare systems.

Surfing is a widely practiced sport around the globe, with more than 30-million participants annually as estimated by the International Surf Association (ISA) [1]. Surfing, as a sport, has grown significantly over the last five years, with mainstream news coverage increasing, particularly following surfing's inclusion for the Tokyo 2021 Olympic games and the increasing popularity of in-land 'wave-pools'.

Surfing has a complex activity profile in an open and dynamic ocean environment [2]. In order to make accurate assessments of the population and individual health risks during this pandemic, a detailed understanding of the surf activity risk in the context of COVID-19 is needed from a demographic, behavioural, environmental, and sport-specific activity perspective.

While reducing viral transmission is essential, identifying safe means of physical exercise during these times are important. Surfing has shown to be an important form of cardiovascular exercise for all age groups and the benefits have been linked to surfing's nature of high-intensity activity, with short recovery periods and bouts of breath-holding [3]. In addition, surfing is recognized in many countries as a valuable adjuvant therapy for physical and mental health conditions in both adults and children, ranging from stroke rehabilitation, cystic fibrosis, to depression, anxiety and post-traumatic stress disorder [4–6].

However, it must be recognised that surfing is still considered an 'extreme' sport, possessing a degree of inherent risk. Thus, consideration must be given to appropriate safety measures to ensure that no unnecessary burden is placed on local healthcare systems or coastal communities during these times.

At the time of this publication, the COVID-19 pandemic is transitioning into a novel phase with the introduction of vaccines worldwide as well as the emergence of new highly infectious variants. As we reflect on this period and look forward to the years ahead, we must consider how we can provide a safe return to normal surfing activity for both individuals and surfing organisations. This paper provides an overview of key factors required to understand the population health risks associated with surfing during the COVID-19 pandemic, as well as to review the potential impact on individual health outcomes and consequences for return to surf advice.

2. Population Health: Risk Stratification of Surfing during COVID-19

In order to provide insight for individual surfers and communities seeking to regulate activities that may contribute to the further spread of COVID-19 or for those that may put additional strain on health systems, we have outlined surfing behaviour risk into three categories: surfing injury risk, the possibility of adverse events, and transmission risk.

2.1 Transmission Risks

Surfing is a uniquely solitary sport and occurs in an environment where frequent contact with others is relatively uncommon. Literature surrounding the spread of COVID through droplets may be based on a combination of the population density in a given area, the ventilation status of that environment, and the type of communication (i.e., silent, speaking, shouting) [7]. Therefore, the outdoor nature of surfing is considered safe. Where possible, surfers should only travel to local beaches, alone, or within their household bubble in private transport, adhering to mask use and social distancing measures, and avoiding any shared changing/sanitary facilities. Entry into the water is unlikely to pose any additional risk in virus transmission [8]. The nature of surfing itself involves mandatory distance requirements enforced by both the surfboard, as well as surfing etiquette. A minimum 6-foot distribution is assumed between surfers.

2.2 Drowning & Adverse Events in the Water

Drowning carries a low risk of morbidity and mortality in surfers, yet risk of drowning and requirement for resuscitation is ever present [9]. It is well established that management of drowning is most effective through early reversal of hypoxia, typically delivered through rescue breaths and basic life support algorithms [10]. During the COVID-19 era, careful consideration should be made by both surfers and professional emergency medical service members regarding best practices for self-protection during bystander rescue and resuscitation. This is due to the aerosol generating nature of cardiopulmonary resuscitation and the potential risk of COVID-19 transmission in a drowning victim of unknown COVID status. A position statement presented on behalf of the International Drowning Researchers' Alliance (IDRA), International Life Saving Federation – Medical Committee (ILS-MC) and International Maritime Rescue Federation (IMRF) has recommended an alternative drowning resuscitation algorithm. This involves avoiding rescue breaths in the absence of an airway barrier device unless the situation is judged to be low-risk, the patient is a child or if a family member of the victim is willing to provide mouth-to-mouth rescue breaths [11]. Otherwise, compression-only cardiopulmonary resuscitation with full usage of personal protective equipment is recommended [12].

As a result of reductions in overall beach activity, many local lifeguard services are no longer operating at a normal capacity. Extra care should be taken to assess availability of surfing life-saving services during the pandemic. Surfers are frequently involved as first responders in unpatrolled beaches and should, therefore, be aware of the relevant recommendations and updates to cardiopulmonary resuscitation guidelines in the COVID era [13].

2.3 Risk in activity

Despite popular belief, surfing has a low-risk of injury in comparison to other recreational sports and possesses an overall low risk of health system burden [14,15]. The available literature on surfing injury rates shows a range from 0.74 to 1.79 injuries per 1000 hours surfed in non-competitive surfing events; competitive surfing injury rates range from 0.30 to 13 injuries per 1000 hours surfed. Compared to other sports, recreational surfing has a reduced or comparable injury risk [1,16]. Most commonly, these acute injuries occur from trauma from the surfboard itself in advanced or elite surfers; contrary to the notion that beginner surfers are most at risk of injury [17,18]

Table 1: Comparison of Injury Rates of Recreational Surfing to Other Common Sports

(McArthur et al., 2020)

Sport	Mean injury rate per 1000 hours
<i>Professional Rugby</i>	69.0
<i>Football (Soccer)</i>	18.8
<i>Recreational Running</i>	12.8
<i>Skiing</i>	4.5
<i>Recreational Softball</i>	2.3
Surfing	1.3

3. Cardiovascular & Respiratory Physiology for Medical Professionals in Surfing

Throughout the SARS-CoV-2 pandemic, there has been mounting evidence regarding the potential for adverse cardiac and respiratory events following infection with COVID-19. The cardiopulmonary effects of COVID-19 infection are mediated through the binding of the virus to the angiotensin-converting enzyme 2 (ACE-2) receptor, expressed in lung alveolar cells and, therefore, results in cardiovascular and respiratory pathology [19].

3.1 Cardiovascular Impact of COVID-19

Available literature suggests that the SARS-CoV-2 may result in increased risk of myocarditis, tachyarrhythmias, ischemic cardiac conditions, cardiomyopathies, thrombosis, and heart failure [20]. Cardiac involvement has been shown during all phases of disease. COVID-19 induced viral myocarditis could lead to myocardial inflammation, necrosis, and ventricular dysfunction. For these reasons, it is advised that exercise is avoided during the active phase of viral infection [21].

3.3 Respiratory Impact of COVID-19

Once recovered from SARS-CoV-19, patients can sustain several respiratory sequelae including chronic cough, fibrotic lung disease, bronchiectasis and pulmonary vascular/thromboembolic disease [23]. There are also suggestions in the literature that SARS-CoV-2 could trigger bronchospasm. Coughing should become less common within 4 weeks after the last symptoms have disappeared [24].

Pulmonary abnormalities may still be present on CT-scan in COVID-19 patients three months following recovery. Higher levels of D-dimer on admission could predict impaired diffusion (DLCO <80%) after three months recovery. People with elevated D-dimer levels after infection has cleared, are advised to follow a pulmonary rehabilitation program, even in absence of severe respiratory symptoms [25].

The degree of functional respiratory impairment can be disproportionate when compared to the actual physiological impairment. People with COVID-19 seem to be prone to movement-related fatigue and deconditioning induced muscle weakness. Prolonged functional respiratory impairments after COVID-19 infection might be the result of diaphragm muscle abnormalities and neuromuscular respiratory weakness. Gradual re-activation training is essential in this group of patients [26,27].

3.4 Implications of Surfing Following COVID-19 Infection

Literature has summarised the principles of a graded return to sport following COVID-19 infection based on the severity of infection. A two-week period of rest from intense exercise after last symptoms have disappeared is recommended. Following this, a graded return to physical activity should be followed as suggested by N. Elliot *et al.* [28].

As aforementioned, periods of breath-holding during surfing may exacerbate the chronic respiratory effects of COVID-19 infection.

Given the possible cardiac adverse events of COVID-19 infection, cardiac evaluation should be performed before returning to sports following severe or complicated infection in athletes. Various diagnostic tools may be considered based on severity of symptoms and local protocol. These may include: Troponin-T, NT-proBNP, electrocardiography (ECG), echocardiography, exercise testing (ETT or CPET), and cardiac magnetic imaging (CMR) [31].

4. Safe Return to Surf: Implications for Elite and Recreational Surfers

There are several considerations that the authors believe that both recreational surfers and elite surfers (including their respective medical teams) should account for when aiming for a resumption in normal surfing activity. These include the physiological implications, the use of potentially banned substances if being treated for acute COVID-19 infection, and the psychological impact of cancelled competitive events.

4.1 Deconditioning and Physiological Implications

The postponement of competitive surfing events has obvious implications for all involved, particularly the elite athletes who would have otherwise been undergoing rigorous training and preparation. Constraints of international lockdowns and periods of isolation are likely to have resulted in a significant level of deconditioning from a lack of training stimuli. There is debate regarding the pathway for both elite athletes and recreational sports persons to return to sport after testing positive for COVID-19; however, several pathways have been postulated in the literature.

Even after mild COVID-19 infection, a proportion of people may face a long recovery and prolonged difficulty when returning to exercise [32]. Furthermore, the cardiopulmonary implications of “long” COVID have not been quantified [33].

A period of rest for two weeks after cessation of symptoms is generally advised in all patients [29]. Prior to returning to surf, both elite and recreational surfers should build up their general exercise tolerance in a controlled, safe environment. Salman *et al* have recommended a phased return to physical exercise (2021) [33]. Only once a satisfactory, baseline level of cardiovascular function has been achieved should surfers consider returning to the water. There may be ‘knock-on’ effects of surfing with persistent or resolving symptoms of COVID-19 infection [33]. In addition, cardiovascular deconditioning and possible long-term cardiorespiratory effects may heighten the risk of adverse events in the water which, in turn, have serious

implications for drowning. Notably, periods of breath holding during surfing may exacerbate the chronic respiratory effects of COVID-19 infection [34]. Likewise, the potential relationship between exercise, cold water exposure and bronchospasm should be noted, particularly due to the uncertainty on the long-term respiratory impact of COVID-19 infection [29,30]. This not only places the individual at risk, but also surfers, lifeguards, and healthcare providers who may need to act as bystander rescuers.

In particular, recreational surfers who also have underlying medical conditions must consider whether they should consult their physician prior to restarting such rigorous exercise after such a long pause. This is supported by the European Federation of Sports Medicine Associations [35]. This may involve haematological monitoring, cardiac monitoring (via ECG, Echo, ETT), and respiratory function testing [28, 36].

4.2 Impact on Injury Risk

Elite athletes can expect a decline in neuromuscular adaptations after any training cessation, resulting in accelerated muscle disease atrophy. As a result, injuries may be commonplace when the complex interplay of tissue stress and mechanical loading is interrupted for even short periods. Thus, after this period of reduced training during the COVID-19 pandemic, medical teams may expect their elite athletes to have higher rates of injury and it is paramount that these athletes undergo a thorough reconditioning period before recommencing competitive sport. This may include similar cardiovascular training exercises, such as running and other forms of plyometric training in an attempt to avoid musculoskeletal injury.

4.3 Impact on Mental Health & Well-Being

There are a myriad of psychological sequelae resulting from COVID-19 [37]. Thus, emphasis should be placed on the psychological implications on elite athletes whose mental health may suffer not only from COVID-19 infection, but also from self-isolation periods, disrupted training schedules, and the cancellation of competitive events [38]. Elite athletes should be supported by their relevant governing body and medical support teams. Reardon *et al* (2020) have made a number of recommendations to enable this and to support novel approaches regarding athlete well-being during the COVID-19 pandemic, including pharmacological and psychological support [38].

Likewise, the cessation of surfing for children and vulnerable adults as an adjuvant therapy may have had a significant impact on the mental well-being of these patients. This needs to be recognised and the reintroduction of services needs to be supported in a safe manner to ensure that the benefits can continue during the transition phase of the COVID-19 pandemic [4-6].

4.4 Drug Use

Professional surfers and teams have expressed concerns regarding the legal ramifications and use of potentially banned substances in the context of certain treatments being used in the management of COVID-19 [39]. Specifically, discussions have surrounded the use of glucocorticoids, including Dexamethasone and Hydrocortisone, which are available options for COVID-19 therapy. Both substances are currently listed on the World Anti-Doping Agency (WADA) lists of prohibited substances. Therefore, it would be prudent for these athletes to clarify this with their governing body and WADA if appropriate to ensure they are complying with the most recent guidance on anti-doping [40].

5. Implications for Surfing Organisations and Surfers

To safeguard the health of athletes and others involved, major sporting events at all levels have been cancelled. This includes the Tokyo Olympics 2020, which was the first Olympic games with surfing as a recognised sport, and the World Surf League (WSL) World Championship Tour competition. Likewise, organisations providing surf therapy or training are likely to have had their delivery interrupted. Given the aforementioned risk of transmission, Table 2 outlines the recommendations for surfing organisations, elite athletes and recreational surfers when considering their return to surf, to ensure that this is done in a safe and manageable way. Previous similar recommendation around pre-surf, intra-surf and post-surf adjustment suggested by Lima et al.

Any surfing organisations, clubs or training units that have indoor facilities should pay close attention to strict social-distancing measures, mask adherence and cleaning regimes for shared changing facilities. If these organisations usually deliver briefing, warm-up, or instructional sessions indoors, consideration and allowances for this to take place outdoors should be made, if possible, to minimise risk of indoor transmission.

Table 2: Individual & Organisational Recommendations for Surfing During Covid-19

For the Individual surfer	For Elite Athletes and Medical Teams	For Surf Schools, Therapy Units, Wave Pools and Training Facilities
<ul style="list-style-type: none"> • Follow your local health authority regulations. • Surf only at your local break. • Travel alone or within your social bubble as per local authority guidelines. • Avoid public transport where possible. • Maintain social distancing in and out of the water. • Surf within your limitations and avoid extreme conditions in unpatrolled beaches to avoid unnecessary injury. • Understand the risks if you become unwell or encounter a drowning victim (where rescue breaths and close contact may risk COVID-19 transmission). • Trace with local COVID contact tracing if available. • Do your stability, strength and flexibility training at home. 	<ul style="list-style-type: none"> • Follow local guidelines of the governing body. • Adequate PPE provisions for staff. • Consider availability of rapid testing for athletes. • Awareness of up to date recommendations and medical management. • Awareness of and compliance with anti-doping implications (WADA). • Awareness of travel restrictions and rules. • Ensure that exercise tolerance is gradually increased following infection or periods of inactivity. • Consult your physician or the advice of a sports medicine professional where needed. 	<ul style="list-style-type: none"> • Find alternatives to group sessions (for example socially distanced, solo training or activities). • Reduce class sizes to comply with local measures. • Follow local health authority and government regulations. • Have clear guidance and information around entry requirements with regards to recent symptoms, contacts or test results. • Wear a face covering during the land-learning parts of the classes. • Use e-learning methods and materials if possible as an alternative. • Consider risk of exposure for at-risk or vulnerable patients participating in surf therapy programmes. • Deliver instructional sessions / briefings outdoors where possible. • Ensure shared facilities are cleaned appropriately on a regular basis (including changing rooms).

6. Emerging Vaccination Strategy

With the emergence of various COVID-19 vaccinations worldwide, many countries are easing restrictions based on the reduced burden of infection, hospital admissions and mortality.[42] Whilst this is encouraging for health professionals, travellers and surfers alike, caution should still be maintained when travelling; with adherence to local government rules about national and international travel.

The clinical relevance of the vaccine to elite athletes are the potential side effects following administration. These can be trivial such as myalgia, fatigue, headache and fever, however more serious complications have been reported which may impact on the elite athletes training regime; and thus, the timing should be planned with training and competition schedules in mind.[43] Surfers who are symptomatic post vaccine administration, should avoid participation in sport, in specific if there are signs of chest pain, shortness of breath, dizziness, or in any other way compromised should be reviewed by healthcare professional, given reported myocarditis post mRNA vaccine.[44]

7. Conclusion

The COVID-19 pandemic has had a major impact on surfing populations around the world, both professional and recreational. The recommendations provided here have taken into careful consideration the physiologic effects of COVID-19, the individual and population health considerations, as well as information to support local surfing communities and organisations in order to make informed decisions surrounding surfing activity.

Overall, surfing is a relatively low-risk form of physical activity that has health benefits for more than thirty-million annual participants globally. Surfing is likely to possess a low risk of viral transmission if the correct strategies are put in place and followed. Due to its complex activity profile, the benefits and risks of surfing in the COVID-19 era needs clear guidance and recommendations for all, from the recreational hobby surfers to the elite professional athletes. These authors believe that a safe return to

surfing can be achieved if each individual takes responsibility for their own health and the health of their local surfing communities.

Disclaimer

The content of this document and its recommendations do not propose to replace official local or national regulations. Instead, this document serves as a supplementary information resource which provides specific information in relation to surfing as a sport in the context of COVID-19. It is essential that individuals and organisations connect with their local health and legal authorities before introducing changes to current regulations.

Abbreviations

WADA: World Anti-Doping Agency (WADA)

SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus-2

IDRA: International Drowning Researchers' Alliance

ILS-MC: International Life Saving Federation – Medical Committee

IMRF: International Maritime Rescue Federation

Practical Implications

What is already known?

- There are more than 30 million people who participate in surfing worldwide; however, many nations have banned surfing during national lockdown periods.
- Major competitive surfing events, including the 2020 Tokyo Olympics, have been postponed due to the COVID-19 pandemic.
- Surfing is, for the most part, a safe method of physical exercise due to the low injury profile and high proportion of young participants.

What are the new findings?

- The authors believe that individual surfers and surfing organisations should take into account the recommendations of Surfing Medicine International when returning to surf.
- Surfers and surfing organisations should note the updated guidance for bystander rescue in the event of suspected drowning to minimise the risk of COVID-19 transmission.
- Surfers should start with a step-wise rehabilitation plan consisting of land-based activities prior to controlled environment outdoor water training, followed by the return to surf in the ocean environment as the last step.
- Surfers with multiple co-morbidities and surfers that suffered from moderate to severe COVID-19 should make a rehabilitation plan with their physician before returning to surf.
- Surfers who are symptomatic post vaccine administration should avoid participation in sport, especially if there are signs of chest pain, shortness of breath, dizziness, extreme fatigue or in any other way compromised should be reviewed by healthcare professional before return, given reported myocarditis post mRNA vaccine in specific.[43]
- Elite surfers and their corresponding medical teams should account for WADA recommendations in the treatment of COVID-19 and impact of competitive surfing.

Author Contributions

All authors attest to contributing to idea conception, literature review, writing, editing and final review of the manuscript presented here.

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