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ARTICLE

A rapid review of recommendations for mitigating COVID-19 transmission in community sport and recreation facilities

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Abstract
Purpose: This rapid review was conducted to develop recommendations that can mitigate COVID-19 transmission in community sport and recreation facilities so that the industry that supports physical activity and mental health can return to a degree of normalcy. **Methods:** Three databases (SPORTDiscus, Web of Science, Scopus) and the WHO COVID-19 database were systematically searched for peer-reviewed literature that provided practical implications for the return to indoor community sport and recreation facilities with the goal of reducing COVID-19 transmission risk. **Results:** The search and screening processes yielded 59 articles for full text review. The analysis resulted in 25 recommendations that were categorized in accordance with the National Institute for Occupational Safety and Health's hierarchy of controls framework for addressing occupational hazards: elimination/substitution, engineering controls, administrative controls, and personal protective equipment. **Conclusion:** The results provide recommendations for public health (i.e., mandatory vaccination), architects/engineers (i.e., ventilation), and sport and recreation facility managers (i.e., cleaning) that can be enacted progressively in the event of future public health crises. **Health & Fitness Journal of Canada 2022;15(1):31-53**. https://doi.org/10.14288/hfjc.v15i1.811

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Introduction

The COVID-19 pandemic has forced industries to integrate infection control practices into their regular business practices to safely operate while protecting against the spread of COVID-19 (Kumar, Priya, & Srivastava, 2021). Among the industries that have been most impacted is the sport and recreation industry. Many sport and recreation facilities were required to close or operate under strict COVID-19 guidelines (Vancini et al., 2021). Naturally, indoor sport and recreation contexts pose higher transmission risks than other indoor contexts due to their large and complex building designs, turbulent airflow patterns (Blocken et al., 2021), elevated respiratory activity among users and limited ability to physically distance (Bae et al., 2020). As a result, even under strict guidelines, epidemiologists have traced multiple COVID-19 outbreaks

to indoor sport and recreation contexts (e.g., Bae et al. 2020; Chu et al. 2021).

Restricted access to sport and recreation facilities due to the pandemic (Amini, Habibi, Islamoglu, Isanejad & Daniyari, 2021) has corresponded with a decline in population level physical activity, higher levels of sedentary behaviour (Bates et al., 2020; Moore et al., 2020), and a decline in mental health and wellbeing (Daly, Suttin & Robinson, 2020). Unhealthy lifestyles are also associated with greater risk of severe complications from the COVID-19 virus (Hamer, Kivimaki, Gale & Batty, 2020). Considering the relationship between physical inactivity and severe medical complications from COVID-19, it will be increasingly important for physical activity to be promoted prior to and throughout future pandemics. Moreover, some suggest that a state of herd immunity is unlikely, and we may need to learn to live with the virus (Madhi, 2021). Therefore, it is imperative that practitioners within the sport and recreation industry have an array of risk mitigation strategies in place to begin to safely conduct operations.

Reductions to operating budgets and workforces have placed increased demands on management, coaches, and support staffs, who have adapted to new workplace conditions, and been responsible for implementing COVID-19 protocols and temporarily redesigning the operational environment (Dolesh, 2020; Maditinos, Vassiliadis, Tzavlopoulos, & Vassiliadis, 2020). To alleviate this burden, it is of the utmost importance that a guide of universal risk-mitigating recommendations is available to sport and recreation operators, and further communicated to those who frequent these facilities. This will allow industry practitioners to focus their efforts on operational responsibilities and the delivery of health-promoting services, while ensuring that built environments are safe for the return of facility users.

The National Institute for Occupational Safety and Health's (NIOSH) hierarchy of controls framework for addressing occupational hazards to settings that pose safety risks has been recommended for identifying control mechanisms that reduce risk (Morris & Cannady, 2019). The framework suggests that occupational hazards can be reduced by eliminating or substituting the hazard, improving the built environment through engineering control systems, adjusting how people work through administrative controls and using personal protective equipment (National Institute for Occupational Safety and Health, 2015). These control mechanisms are considered to be progressive, with elimination offering the most protection and personal protective equipment the least. Thus, the purpose of this rapid review was to identify evidence- and expert opinion-informed recommendations that community sport and recreation facilities can implement to resume safe operation as we emerge from the COVID-19 pandemic. Through engaging this question, our review aims to situate these recommendations within the hierarchy of controls framework so that practitioners can take the appropriate steps to mitigate COVID-19 transmission risk in their respective facilities.

Methods

Design

This rapid review was conducted in line with the approaches outlined by the World Health Organization (Khangura, Konnyu, Cushma, Grimshaw, & Moher, 2012; Tricco et al., 2017). Rapid reviews function as a knowledge to action research methodology that follow similar – albeit abbreviated –

methodologies as a systematic review to address knowledge gaps surrounding policy and practical issues in an expedited manner (Tricco et al., 2017). Methodological concessions made when conducting rapid reviews can include restricting the scope of sources (e.g., only peer-reviewed literature, grey literature excluded), having fewer investigators screen records, and not assessing risk of bias in included studies (Khangura et al., 2012). Although following these procedures increases the chances of introducing bias, these shortcomings must be weighed against the timely knowledge that can be put into action by scientific and professional communities (Khangura et al., 2012; Tricco et al., 2017).

Research Question

The goal of this rapid review was to identify recommendations pertaining to the steps that indoor sport and recreation facilities can take to resume operation as we emerge from COVID-19 with the goal of reducing transmission risk.

Search Strategy

Electronic databases selected to identify relevant studies were chosen and search strategies were developed through consultation with an academic librarian. Searches were conducted in SPORTDiscus, SCOPUS, Web of Science, and the WHO COVID-19 Database. Community organized sport and recreation facilities were broadly defined as any facility (e.g., sport/fitness facilities, recreation/community centres, gymnasiums) that provides opportunities for people to engage in physical activity indoors. Park settings and outdoor sport/recreation facilities were not included given that the risk of transmission is considerably lower outdoors (Bulfone, Malekinejad, Rutherford, & Razani, 2021). The search strategy involved combinations of the following keywords and was translated appropriately for each database: 1) facility OR facilities OR centre OR center OR gym OR stadium OR infrastructure; AND 2) recreation OR sport OR fitness OR exercis* OR "physical activity" OR "physical activities"; AND 3) COVID-19 OR coronavirus OR SARS-COV-2; AND 4) return OR restart OR reboot OR reopen OR resume OR recommendation. The reference lists of all articles included at the full-text screening stage were also searched to identify any additional relevant articles. Studies published in English from January 1, 2020 – the day after the World Health Organization was informed about cases of pneumonia that were later identified as COVID-19 (World Health Organization Regional Office of Europe, 2020) – to May 13th, 2021 were included. This was later updated to August 3rd, 2021. Results from the searches of each electronic database were exported into the online review management system Covidence (Veritas Health Innovation, Melbourne, Australia), which removed duplicate records from the database.

Study Selection

Inclusion criteria are detailed in Table 1. As per the guidelines for conducting rapid reviews, the title and abstract for each record were screened by one reviewer. Next, the research team retrieved the full-text articles for all records that met inclusion and exclusion criteria. At the full-text stage, each article was screened by two reviewers to determine whether it should be included, and inconsistent decisions were resolved by a third reviewer. Reasons for exclusion were recorded at the full-text screening stage.

Table 1: Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Published since January 1, 2020	Focused on elite sport (i.e., recommendations not realistic for community recreation)
English language	Focused on transmission risk while engaging in recreational physical activities, without recommendations for mitigation
Peer-reviewed academic publications including empirical articles, opinions/commentaries and reviews	Focused on injury prevention during return to sport
Focused on community organized sport and recreation facilities	Focused strictly on park or outdoor settings
Provides solution-oriented implications or recommendations	

Data Extraction

Relevant data were extracted into a structured data charting form with attributes decided on by the research team. The form captured the following data: author, year of publication, country of origin, purpose, methods, source characteristics, applicable context, and practical implications. Three authors (ZE, JM, DB) independently extracted and charted the data from one third of the articles each and subsequently checked an equivalent number of articles (that were not included in their initial batch) for accuracy and completeness.

Data Synthesis and Analysis

The first author (KW) summarized and reported the key findings that emerged from the charting process. The first author then synthesized the key findings into potential recommendations using an inductive content analysis approach (Kyngäs, 2020). This approach involved applying codes to the key findings to reduce and group data into mutually exclusive categories (recommendations). Next, three authors (ZE, JM, DB) independently reviewed and revised the coding for the potential recommendations to further reduce and group the data. The research team then independently reviewed the recommendations prior to discussing as a team until consensus was achieved. Finally, the recommendations were deductively categorized into broader themes as per the NIOSH hierarchy of controls framework for addressing occupational hazards. This type of hybrid approach allowed for the sub-themes to emerge directly from the data being coded, while also allowing the data to be categorized and interpreted based on broader, overarching themes guided by an existing framework (Fereday & Muir-Cochrane, 2006; Graneheim Lindgrem, & Lundman, 2017).

Results

Selection of Sources

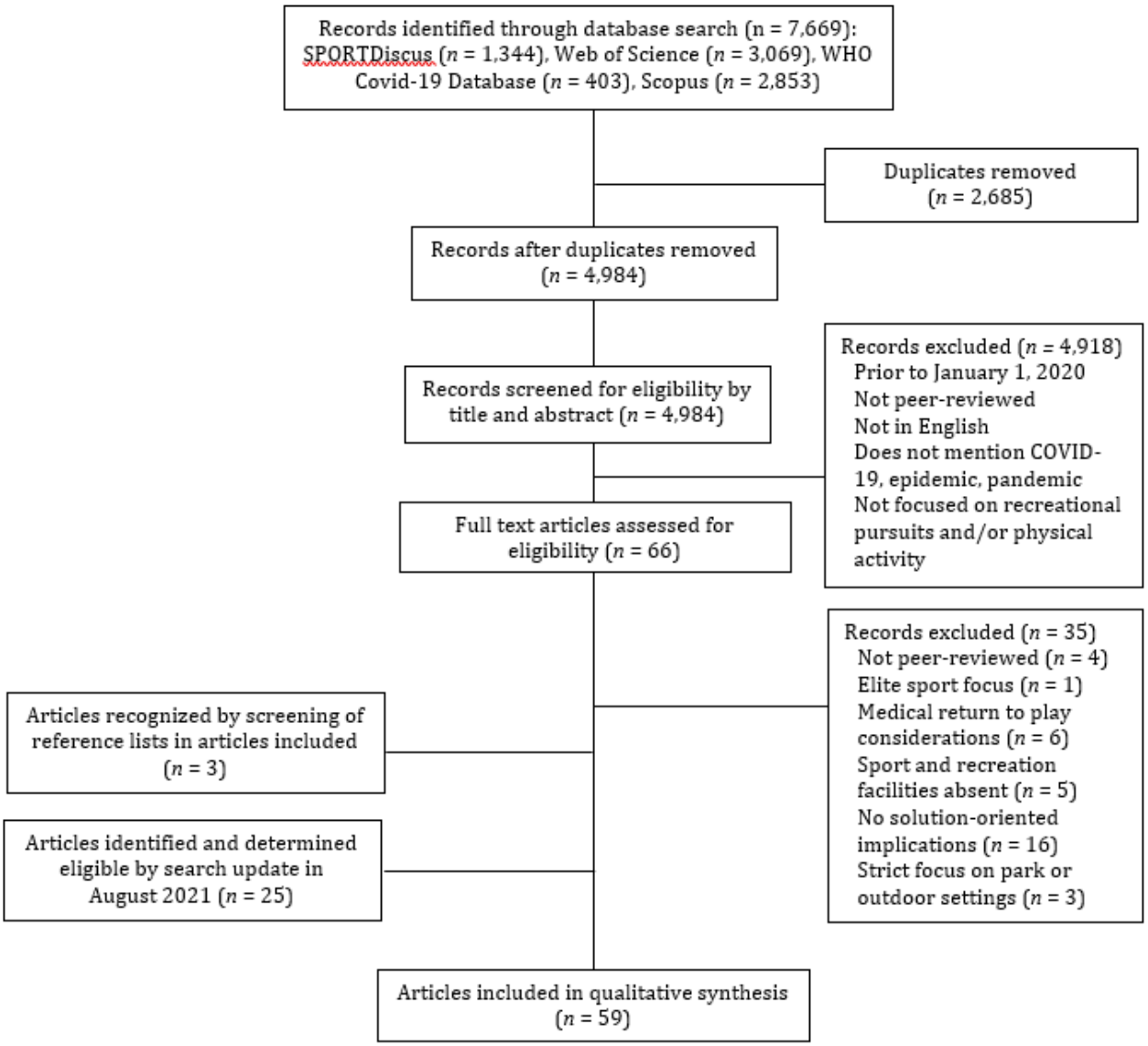
The initial search yielded 7,669 peer-reviewed sources from the databases that were uploaded to the Covidence platform. The platform removed duplicate sources,

after which 4,984 remained. The title and abstract were then screened using the inclusion/exclusion criteria and 66 articles remained for full-text screening. Full-text screening resulted in the removal of 35 articles and 31 remained in the selection. The reference lists of these articles were reviewed for additional sources which resulted in three more. The search was performed again in August 2021 and 25 additional sources were identified and included. In total, 59 articles were selected for full review (see Figure 1 for PRISMA flow chart).

Source Characteristics

The year of publication, country of origin, purpose, methods, source characteristics, applicable context and practical implications for each study were extracted for analysis (see Supplementary Table 1 for supplementary information). In total, 25 sources were published in 2020 and 34 in 2021. The country of origin of

Figure 1. PRISMA flow chart detailing the selection of sources



where the first author resided or research was conducted represented a wide variety of countries including the United States (*n* = 16), United Kingdom (*n* = 7), Brazil (*n* = 5), Italy (*n* = 4), South Korea (*n* = 3), Germany (*n* = 3), Australia (*n* = 2), Hong Kong (*n* = 2), Japan (*n* = 2), Netherlands (*n* = 2), and one (*n* = 1) from 13 other countries. Of the sources, 33 were commentaries or editorials, 18 included empirical evidence, and 8 were reviews (i.e., rapid or systematic reviews). The sources that conducted empirical research used a variety of samples including adults (n = 12), youth (n = 1), commonly touched surfaces (n = 1), sports clubs (n = 1), regions/counties (n = 1), children and adults (n = 1) and one study involved a simulation. The contexts in which the practical implications were applicable included indoor facilities (n = 40) and broader return to sport recommendations (n = 19).

Recommendations

The analysis resulted in 25 recommendations to help sport and recreation facilities mitigate the spread of infectious diseases between occupants. These recommendations were categorized according to the NIOSH hierarchy of controls for addressing occupational hazards: elimination/substitution, engineering controls, administrative controls, and personal protective equipment (National Institute for Occupational Safety and Health, 2015). Elimination and substitution were grouped together because the current vaccines do not eradicate the virus completely (i.e., elimination) and instead provide a less lethal alternative (i.e., substitution) (Spigarelli, 2020). A summary of findings for each control mechanism is provided below.

Elimination/Substitution: Immunization Policy

Elimination/substitution pertains to ensuring users who visit sport and recreation facilities that are of low risk for contracting, transmitting, or becoming hospitalized due to the virus. One recommendation, the implementation of immunization policies, was identified. Table 2 provides the recommendation and corresponding sources.

Facility users must show proof of vaccination(s) upon entry. Vaccination passports and/or immunization policies were identified by five sources (see Table 2). Multiple sources suggested that facilities and organizations should consider mandatory immunization policies to protect participants, staff and potential spectators (e.g., Chu et al., 2021; McElheny Little, Taylor & Manzi, 2021; McLarnon & Heron, 2021). DiFiori et al. (2021) also suggested mandating other vaccinations (i.e., influenza) to protect against other types of
illnesses. Despite the financial cost, given the nature of physical activity and elevated risk, vaccination could be as important as sport safety equipment (Francis & Francis, 2020).

Table 2: Summary of Recommendations for Elimination/Substitution

Recommendation	Supporting Literature
1. Facility users must show proof of vaccination upon entry	DiFiori et al. (2021); Chu et al. (2021); Francis & Francis (2020); McElheny et al. (2021); McLarnon & Heron (2021)

Engineering Controls: The Built Environment

Engineering controls represent strategies for the built environment of sport and recreation facilities that can be altered to mitigate transmission risk. Architects, engineers, and facility managers can consider these when designing new or retrofitting existing facilities. Four recommendations for the built environment were identified. Table 3 provides an overview of these recommendations.

Improve ventilation and air handling procedures. The importance of air quality was identified in 21 sources (see Table 3). Blocken et al. (2021) discussed how sport and recreation facilities generally have large and complex rooms that will require more powerful air handling systems than previous standards. The literature revealed that air quality in these rooms can be improved by incorporating high-intensity air displacement systems, portable air cleaners, high-efficiency particulate absorbing (HEPA) air filtration, ultraviolet-C radiation air disinfectors, and increasing the number of air zones within a facility (Blocken et al., 2021; Blocken et al., 2020; Dominski & Brandt, 2020; Fitzgerald, Rubin, Fitzgerald & Rubin, 2021). Moreover, real-time environmental monitoring technology can also help to identify contaminated air and reduce risk for occupants by automating ventilation

Table 3: Summary of Recommendations for Engineering Controls

	Recommendation	Supporting Literature
1.	Improve ventilation and air handling procedures	Amagasa et al. (2020); Asif et al. (2020); Blocken et al. (2020); Blocken et al. (2021); Cilhoroz & Deruisseau (2021); Chu et al. (2021); Cortez et al. (2020); DiFiori et al. (2021); Dominski & Brandt (2020); Donadu et al. (2020); Drury et al. (2021); Fitzgerald et al. (2021); Gentil et al. (2020); Hodgson et al. (2021b); Jones et al. (2021); McElheny et al. (2021); Mercurio et al. (2020); Murakami et al. (in-press); Parker et al. (2020); Piotrowski & Piotrowski (2021); Wackerhage et al. (2020)
2.	Design or reorganize rooms and corridors to allow for physical distancing	Altavilla, Macri & Esposito (2021); Amagasa et al. (2020); Blocken et al. (2020); Carmody et al. (2020); Castagna et al. (2020); Cilhoroz & DeRuisseau (2021); Chu et al. (2021); Cortez et al. (2020); D'Agostino et al. (2021); Denay et al. (2020); DiFiori et al. (2021); Dominski & Brandt (2020); Donadu et al. (2020); Drury et al. (2021); Fitzgerald et al. (2021); Gentil et al. (2020); Hughes et al. (2020); Kim & Yang (2021); Mercurio et al. (2020); Matos et al. (2021); McElheny et al. (2021); Mulcahey et al. (2021); Murakami et al. (in-press); Pena et al. (2021); Piotrowski & Piotrowski (2021); Romano-Bertrand et al. (2020); Suhs et al. (2021); Wackerhage et al. (2020); Watson et al. (2021); Wong et al. (2020)
3.	Reduce the number of high-touch surfaces	Cortez et al. (2020); DiFiori et al. (2021); Drury et al. (2021); Gentil et al. (2020); Matos et al. (2021); McElheny et al. (2021); Parker et al. (2020); Pena et al. (2021)
4.	Hand washing stations should be installed throughout facilities	Almasri et al. (2020); Amagasa et al. (2020); Asif et al. (2020); Blocken et al. (2020); Carmody et al. (2020); Cortez et al. (2020); DiFiori et al. (2021); Dominski & Brandt (2020); Drury et al. (2021); Gentil et al. (2020); Hughes et al. (2020); Matos et al. (2021); McElheny et al. (2021); Mulcahey et al. (2021); Murakami et al. (in-press); Parker et al. (2020); Pena et al. (2021); Ramos e Corte et al. (2020); Romano-Bertrand et al. (2020); Timpka (2020); Vancini et al. (2021); Watson et al. (2021); Wong et al. (2020)

practices (Blocken et al., 2020; Cortez et al., 2020).

*Design or reorganize rooms and corridors to allow for physical distancing***.** Physical distancing was highlighted in 30 sources (see Table 3) and the literature revealed that general facility spaces should be designed to allow for minimum distances to be maintained between users (1 to 1.5 meters) as they use facilities (e.g., Cortez et al., 2020; Denay et al., 2020; Gentil et al., 2020). The literature also identified that many of the spaces within these facilities were not designed with this intention, so future designs will need to consider strategies that provide enough space for attendees to physically distance and reduce crowding as they occupy and move throughout a facility (Amagasa, Machida & Ding, 2020; Kim & Yang, 2021). Existing facilities may also need to minimize social contacts (Blocken et al., 2020), and consider altering the layout of equipment (Blocken et al., 2020; Chu et al., 2021).

Reduce the number of high-touch surfaces. Eight sources indicated that altering how occupants interact with surfaces can reduce the risk of transmission (see Table 3). Sources suggested that integrating touch-free technology where possible can reduce this risk (e.g., McElheny et al., 2021; Matos, Antunes, & Rosa, 2021; Parker et al., 2020). For example, automatic sensors can be installed on doors, soap/sanitizer dispensers, lighting fixtures, concession areas, garbage bins, water fountains and wherever else possible (DiFiori et al., 2021; Matos et al., 2021; Parker et al., 2020). In addition, foot pedals or robots can play a role activating switches for doorways and amenities (Matos et al., 2021), or doors can be redesigned to reduce the need to touch with hands (Gentil et al., 2020).

Hand washing stations should be installed throughout facilities. With the increased need for occupants to maintain personal hygiene, 23 sources recommended that facilities install hand washing stations throughout (see Table 3). These hand washing stations should have 70% alcohol gel (Cortez et al., 2020) and should be located at the entrance of a facility, high traffic areas, and each activity space, in addition to being accessible to all (e.g., Amagasa et al., 2020; Dominski & Brandt, 2020; Gentil et al., 2020;). Occupants should also be encouraged to use them frequently, including before, after and if needed during an activity (e.g., Blocken et al., 2020; Carmody Murray, Borodina, Gouttenbarge, & Massey, 2020).

Administrative Controls: Policies and Procedures

Administrative controls refer to sport and recreation facility operations and standard practices that can reduce the risk of transmitting infectious diseases within a facility. These recommendations are intended to be progressive and can be enacted to varying degrees, depending on local health conditions. In total, 19 recommendations were identified, and Table 4 provides an overview.

Screen everyone who enters the facility for symptoms and general health. To prevent COVID-19 from entering the facility, 24 sources suggested that all occupants should be screened prior to entering the facility (see Table 4). The literature revealed that screening should occur every visit and include a health and symptom questionnaire, and temperature check (e.g., Amagasa et al., 2020; Cortez et al., 2020; Dominski & Brandt, 2020). Those experiencing symptoms, a high temperature, have tested positive, or have encountered someone who has had COVID-

19 recently should not be permitted to enter the facility (Blocken et al., 2020; Cortez et al., 2020; Sikka, Lincoln, Adamson, Epstein, & Krumholz, 2020). Four sources also identified COVID-19 testing as a potential component of screening (Chu et al., 2021; Denay et al., 2020; Fitzgerald et al., 2021).

COVID-19 management plans should be developed and integrated into standard operating procedures to manage suspected or confirmed cases, and train staff. There were 20 sources that suggested standard operating procedures should be updated to reflect the risk of COVID-19 transmission (see Table 4). Multiple sources pointed to case management that outline how the collection of information and contact tracing will commence in the event of a confirmed case within the facility (e.g., Bae et al., 2020; Carmody et al., 2020; Denay et al., 2020; Hughes et al., 2020). Moreover, in the event of a suspected or confirmed case, the case must be medically managed, isolated immediately and contact tracing must commence to reduce further community spread (Castagna et al., 2020; Hughes et al., 2020; Sikka et al., 2020). Facilities may want to enforce the mandatory usage of government contact tracing applications (Hughes et al., 2020; Wackerhage et al., 2020) or use quick response (QR) code mobile phone applications to assist with contact tracing

Table 4: Summary of Recommendations for Administrative Controls

	Recommendation	Supporting Literature
1.	Screen everyone who enters the facility for symptoms and general health	Amagasa et al. (2020); Blocken et al. (2020); Chu et al. (2021); Cilhoroz & DeRuisseau (2021); Cortez et al. (2020); Denay et al. (2020); DiFiori et al. (2021); Dominski & Brandt (2020); Donadu et al. (2020); Fitzgerald et al. (2021); Hodgson et al. (2021a); Hughes et al. (2020); Kim & Yang (2021); Mercurio et al. (2020); McElheny et al. (2021); Mulcahey et al. (2021); Parker et al. (2020); Pena et al. (2021); Ramos e Corte et al. (2020); Romano-Bertrand et al. (2020); Sikka et al. (2020); Wackerhage et al. (2020); Watson et al. (2021); Wong et al. (2020)
2.	COVID-19 management plans should be developed and integrated into standard operating procedures to manage suspected or confirmed cases, and train staff.	Bae et al. (2020); Blocken et al. (2020); Carmody et al. (2020); Castagna et al. (2020); Chu et al. (2021); Cilhoroz & DeRuisseau (2021); D'Agostino et al. (2021); Denay et al. (2020); Drury et al. (2021); Fitzgerald et al. (2021); Hodgson et al. (2021a); Hodgson et al. (2021b); Hughes et al. (2020); McLarnon & Heron (2021); Parker et al. (2020); Pena et al. (2021); Romano-Bertrand et al. (2020); Sikka et al. (2020); Wackerhage et al. (2020); Watson et al. (2021)
3.	Increase the frequency of cleaning rooms, surfaces and equipment	Amagasa et al. (2020); Asif et al. (2020); Blocken et al. (2020); Castagna et al. (2020); Cilhoroz & DeRuisseau (2021); Cortez et al. (2020); DiFiori et al. (2021); Dominski & Brandt (2020); Donadu et al. (2020); Drury et al. (2021); Fitzgerald et al. (2021); Gentil et al. (2020); Haddad et al. (2021); Hodgson et al. (2021a); Hodgson et al. (2021b); Hughes et al. (2020); Kim & Yang (2021); Matos et al. (2021); McElheny et al. (2021); Mercurio et al. (2020); Mulcahey et al. (2021); Murakami et al. (in-press); Pena et al. (2021); Piotrowski & Piotrowski (2021); Ramos e Corte et al. (2020); Romano-Bertrand et al. (2020); Schumacher et al. (2021); Timpka (2020); Tinaz & Emiroglu (2020); Suhs et al. (2021); Wackerhage et al. (2020); Watson et al. (2021); Wong et al. (2020)

(Fitzgerald et al., 2021). Emergency action and/or first aid procedures may also need to be altered to protect first responders in the event of an emergency (Hodgson et al., 2021a; Hodgson et al., 2021b; Pena et al., 2021).

Increase the frequency of cleaning rooms, surfaces, and equipment. The increased cleaning requirements were identified in 33 sources (see Table 4). Rooms, surfaces, and equipment should be evaluated to determine the frequency of cleaning required for each (Hughes et al., 2020; Matos et al., 2021). Many sources pointed to strict cleaning schedules and inspections conducted each day (e.g., Amagasa et al., 2020; Blocken et al., 2020; Mulcahey, Gianakos, Mercurio, Rodeo, & Sutton, 2021; Tinaz & Emiroglu, 2020; Wong et al., 2020). Spaces and equipment should be cleaned between each user group to help prevent cross contamination between users (Dominski & Brandt, 2020; Timpka, 2020; Wackerhage et al., 2020). Cleaning and disinfectant products should be readily available on tables, countertops and near equipment to encourage users to assist with cleaning after each use (Cortez et al., 2020; Gentil et al., 2020). In pools and aquatic spaces, the physicochemical indicators should be frequently monitored to ensure chlorine and chemicals are maintained at appropriate levels (Romano-Bertrand, Aho Glele, Grandbastien,

Table 4 Continued: Summary of Recommendations for Administrative Controls

4.	Educational communication strategies should be developed to influence safe user behaviour and reinforce personal hygienic practices	Almasri et al. (2020); Amagasa et al. (2020); Bae et al. (2020); Carmody et al. (2020); D'Agostino et al. (2021); DiFiori et al. (2021); Donadu et al. (2020); Drury et al. (2021); Fitzgerald et al. (2021); Francis & Francis (2020); Gentil et al. (2020); Hodgson et al. (2021a); Hodgson et al. (2021b); Hughes et al. (2020); Kim et al. (2020); Kim & Yang (2021); Martin, Champ, & Franklin (2021); McElheny et al. (2021); Mercurio et al. (2020); Mulcahey et al. (2021); Parker et al. (2020); Pena et al. (2021); Piotrowski & Piotrowski (2021); Romano-Bertrand et al. (2020); Suhs et al. (2021); Timpka (2020); Tinaz & Emiroglu (2020); Vancini et al. (2021); Wong et al. (2020)
5.	Food and concession services should be opened gradually with disposable and individually wrapped items	Donadu et al. (2020); Drury et al. (2021); Hughes et al. (2020); Parker et al. (2020); Ramos e Corte et al. (2020)
6.	Contaminated material should be disposed of in a clinical waste bin	Hodgson et al. (2021a); Hodgson et al. (2021b); Pena et al. (2021); Shurlock et al. (2020)
7.	Suppliers should schedule strict delivery times and minimize contact with facility staff	Blocken et al. (2020); Cortez et al. (2020); Donadu et al. (2020)
8.	Facility and room capacity should be reduced	Almasri et al. (2020); Blocken et al. (2020); Carmody et al. (2020); Cilhoroz & DeRuisseau (2021); Cortez et al. (2020); Dominski & Brandt (2020); Donadu et al. (2020); Drury et al. (2021); Fitzgerald et al. (2021); Hughes et al. (2020); Kemp et al. (2021); Kim & Yang (2021); McElheny et al. (2021); Piotrowski & Piotrowski (2021); Ramos e Corte et al. (2020); Suhs et al. (2021)

Lepelletier, 2020; Haddad, Abbes, Mujija & Chamari, 2021).

Educational communication strategies should be developed to influence safe user behaviour and reinforce personal hygienic practices. There were 29 sources that recommended facilities to develop educational communication plans to promote safe and hygienic user behaviour (see Table 4). The communication plan can provide users with information regarding health screening procedures, COVID-19 symptoms, facility safety protocols, physical distancing, proper use of personal protective equipment and personal hygiene practices (e.g., Almasri, Noor & Diri, 2020; Gentil et al., 2020; Mulcahey et al., 2021;). The plans should be communicated throughout a facility (Hughes et al., 2020) and on media platforms to promote safety and encourage users to return to the facility (Tinaz & Emiroglu, 2020). Communication should also be updated whenever new information is available (Parker et al., 2020). Educational communication will help promote safe behaviour and decrease

Table 4 Continued: Summary of Recommendations for Administrative Controls

9. User travel within a facility should be minimized	Blocken et al. (2020); Cortez et al. (2020); DiFiori et al. (2021); Donadu et al. (2020); Drury et al. (2021); Fitzgerald et al. (2021); Kim & Yang (2021); Parker et al. (2020)
10. The use of change rooms should be minimized or altered to allow for physical distancing	Asif et al. (2020); Blocken et al. (2020); Cilhoroz & DeRuisseau (2021); Hughes et al. (2020); Fitzgerald et al. (2021); Parker et al. (2020); Ramos e Corte et al. (2020); Romano-Bertrand et al. (2020); Timpka (2020); Wong et al. (2020)
11. Spectator areas may need to adhere to larger physical distancing radiuses and stricter measures than general facility spaces	Hughes et al., (2020); Mulcahey et al., (2021); Murakami et al. (in-press); Parker et al., (2020)
12. Adhere to public health guidelines and if possible, engage public health to help assess each activity and space to develop temporary frameworks that promote safety or justifiably cancel a particular activity altogether.	Altavilla et al., (2021); Amagasa et al., (2020); Asif et al., (2020); Bae et al., (2020); Blocken et al., (2020); Carmody et al., (2020); Cortez et al., (2020); D'Agostino et al., 2021); Denay et al., (2020); DiFiori et al., (2021); Dominski & Brandt (2020); Donadu et al. (2020); Gentil et al., (2020); Fitzgerald et al., (2021); Francis & Francis, (2020); Hodgson et al., (2021a); Hodgson et al., (2021b); Hughes et al., (2020); Kim & Yang (2021); Kemp et al., (2021); Matos et al., (2021); McElheny et al., (2021); McLarnon & Heron (2021); Mercurio et al., (2020); Ramos e Corte et al., (2020); Romano-Bertrand et al., 2020); Shurlock et al., (2020); Timpka (2020); Tinaz & Emiroglu (2020); Vancini et al., (2021); Wackerhage et al., (2020); Wong et al., (2020)
13. Activities should adhere to strict schedules and participants must minimize unnecessary use of facilities	Blocken et al., (2020); Cortez et al., (2020) Gentil et al., (2020); Hughes et al., (2020); McElheny et al., (2021); Ramos e Corte et al., (2020); Suhs et al., (2021); Watson et al., (2021)

the risk of transmission within facilities (Bae et al., 2020; Francis & Francis, 2020).

Food and concession services should be opened gradually with disposable and individually wrapped items. Five sources provided recommendations for concession services (see Table 4) that included not providing these services (Ramos e Corte et al., 2020), offering them in an individual, pre-packaged manner (Parker et al., 2020), or delivering them directly to seats (Drury et al., 2021). Facility operators will need to progressively consider how to offer food and beverage services in a safe and appropriate manner (Hughes et al., 2020).

Contaminated material should be disposed of in a clinical waste bin. Contaminated equipment was discussed by four sources (see Table 4). Personal protective equipment and materials used to clean should be considered hazardous material and disposed of in a clinical waste bin (Hodgson et al., 2021a; Hodgson et al., 2021b; Pena et al., 2021).

Suppliers should schedule strict delivery times and minimize contact with facility staff. To reduce the number of interactions

Table 4 Continued: Summary of Recommendations for Administrative Controls

14. Special accommodation must be considered for users who are vulnerable to COVID-19	Amagasa et al. (2020); Carmody et al. (2020); Hodgson et al. (2021b); Hughes et al. (2020)
15. Users should bring their own personal equipment and only be permitted to use their own	Asif et al. (2020); Blocken et al. (2020); Chu et al. (2021); Cortez et al. (2020); DiFiori et al. (2021); Dominski & Brandt (2020); Fitzgerald et al. (2021); Gentil et al. (2020); Hodgson et al. (2021b); Hughes et al. (2020); Matos et al. (2021); McElheny et al. (2021); Pena et al. (2021); Ramos e Corte et al. (2020)
16. Basic staff requirements will be heightened with new duties and ensuring absences can be managed if quarantine is necessary.	Blocken et al. (2020); DiFiori et al. (2021); Hodgson et al. (2021a); Hodgson et al. (2021b); Hughes et al. (2020); Matos et al. (2021); Parker et al. (2020); Tinaz & Emiroglu (2020)
17. Staff should be trained on facility-specific COVID-19 standard operating procedures	Carmody et al. (2020); D'Agostino et al. (2021); Hodgson et al. (2021a); Hodgson et al. (2021b); Parker et al. (2020); Vancini et al. (2021); Wackerhage et al. (2020)
18. Staff whose tasks can be completed at home should work from home to reduce the number of people inside the facility	Blocken et al. (2020); Cortez et al. (2020); Ramos e Corte et al. (2020); Wong et al. (2020)
19. Third party personnel and organizations should be considered when developing return to sport protocols	Castagna et al. (2020); DiFiori et al. (2021); Feiler et al. (2021); Francis & Francis (2020); Kemp et al. (2021); Mercurio et al. (2020); Ramos e Corte et al. (2020)

between facility staff and others, three sources made suggestions towards supplier/delivery scheduling (see Table 4). Deliveries can either take place when the facility is not open (Cortez et al., 2020) or adhere to a strict delivery schedule (Blocken et al., 2020). When accepting deliveries, personal protective equipment should be worn and there should be an immediate sterilization of goods (Blocken et al., 2020; Cortez et al., 2020).

Facility and room capacity should be reduced. During a pandemic, 16 sources suggested that facility operators should evaluate and reduce their room capacity limits (see Table 4). Piotrowski & Piotrowski (2021) recommended that sport facilities should adhere to a limit of 1 person per ten square meters up to a maximum of one hundred fifty people at a time, however other sources suggested that ventilation, the proposed activities (Cortez et al., 2020) and the ability to physically distance (Dominski & Brandt, 2020) can help determine capacity.

Travelling within a facility should be minimized. Eight sources discussed travel within facilities (see Table 4). Users should be encouraged to leave the facility immediately after they have finished their activity (Blocken et al., 2020; Cortez et al., 2020). Facility operators may want to consider one-way traffic flow (DiFiori et al., 2021; Drury et al., 2021) or allowing users to enter and exit through multiple locations to reduce travel within the facility (Parker et al., 2020).

The use of change rooms should be minimized or altered to allow for physical distancing. Due to the moist environment of locker rooms and prevalence of COVID-19 aerosol transmission, 10 sources recommended reducing the usage of locker and change rooms (see Table 4). The showers in change rooms are an issue because mist can be a possible medium for transmitting infections (Wong et al., 2020). Therefore, change rooms should be primarily used as storage (Romano-Bertrand et al., 2020) and participants should shower (Hughes et al., 2020) or change (Fitzgerald et al., 2021) at home. Change rooms should also have capacity restrictions that reduce the number of people using them at one time (Asif, Chang, Diamond, Raukar, & Zaremski 2020; Ramos e Corte et al., 2020; Timpka, 2020; Wong et al., 2020).

Spectator areas may need to adhere to larger physical distancing radiuses and stricter measures than general facility spaces. Four sources provided guidance for the management of fans and spectators (see Table 4). Patrons will need to be assigned seats that maintain physical distancing (Hughes et al., 2020) and it is possible that larger distancing radiuses will need to be established to accommodate aerosols travelling further due to shouting and boisterous activity (Parker et al., 2020). Facilities can also consider installing partitions between seats (Murakami et al., in press). While entering and exiting, the flow of traffic will need to be considered to ensure people maintain safe distances apart (Parker et al., 2020). In addition, facility operators may want to consider more targeted screening and rapid testing to reduce transmission risk in spectator areas (Mulcahey et al., 2021).

Adhere to public health guidelines and if possible, engage public health to help assess each activity and space to develop temporary frameworks that promote safety or justifiably cancel a particular activity altogether. The nature of each activity and space is different, a fact that was highlighted by 32 sources that provided recommendations for various activity

frameworks (see Table 4). Multiple sources pointed to the risks associated with group activities and suggested that group sizes will need to be reduced to help maintain distancing (e.g., Hughes et al., 2020; Shurlock et al., 2020; Timpka, 2020; Tinaz & Emiroglu, 2020). If possible, the composition of these groups should be maintained for each training session to reduce the chances of larger outbreaks (Ramos e Corte et al., 2020). There is also a lower risk of transmission if participants remain stationery and equipment manipulation is minimized to limit turbulent airflow (Cortez et al., 2020; Gentil et al., 2020). Activities should be assessed, temporarily altered (Asif et al., 2020; Denay et al., 2020; Timpka, 2020) and ranked based on risk to determine how and when certain aspects of activities can be permitted to resume safely (Hughes et al., 2020). If an activity cannot be safely altered, it should be temporarily suspended until local health conditions improve (Amagasa et al., 2020; Francis & Francis, 2020; Romano-Bertrand et al., 2020; Wackerhage et al., 2020). Traditional customs such as handshakes will need to be discouraged or restricted (Wong et al., 2020). Most importantly, these frameworks should be developed with collaboration between local public health experts, governing bodies, facility operators and other stakeholders involved in the delivery of these services and adjusted according to local health conditions (Blocken et al., 2020; Carmody et al., 2020; Cortez et al., 2020; Hughes et al., 2020; Romano-Bertrand et al., 2020; Vancini et al., 2021).

Activities should adhere to strict schedules and participants must minimize unnecessary use of facilities. Eight sources provided recommendations for scheduling (see Table 4). Facility operators should consider implementing a time-based reservation system to maintain capacity thresholds (Blocken et al., 2020; Cortez et al., 2020; Hughes et al., 2020). These reservations can be staggered to prevent social contacts (Watson et al. 2021) and allow for cleaning between each user group (Suhs et al. 2021). Users should be encouraged to leave the facility immediately after their activity to reduce contacts between people (Hughes et al., 2020).

Special accommodation must be considered for users who are vulnerable to COVID-19. People with underlying health conditions were identified as particularly vulnerable to COVID-19 by four sources and require additional consideration (see Table 4). Facility operators should consider either delaying the return to activities for vulnerable populations (Amagasa et al., 2020) and/or taking additional safety measures such as further reducing capacity while people who have conditions exercise (Hughes et al., 2020). In addition, enforcing mask policies for people with underlying medical conditions may not be a safe policy (Shurlock et al., 2020).

Users should bring their own personal equipment and only be permitted to use their own. There were 14 sources that recommended facility users should bring their own personal equipment such as water bottles, uniforms, towels, etc. and not be permitted to share (see Table 4). Each player should bring their own uniform kit and necessary equipment, cleaned, and washed between each use (Ramos e Corte et al., 2020). Any disposable items must be discarded or recycled immediately after use (Matos et al., 2021).

Basic staff requirements will be heightened with new duties and ensuring absences can be managed if quarantine is

necessary. Staff requirements were a concern in eight sources (see Table 4) that highlighted new duties and the ability to manage absences. Regular health and safety evaluations will be required before opening (Parker et al., 2020). Four articles suggested that a COVID-19 supervisor should be appointed for this new, recurring task (Blocken et al., 2020; DiFiori et al., 2021; Hodgson et al., 2021a; Hodgson et al., 2021b). Communication between team members will also be critical to proactively resolve health and safety concerns (Tinaz & Emiroglu, 2020) and ensure staff can quarantine if needed while maintaining operations (Hughes et al., 2020).

Staff should be trained on facility-specific COVID-19 standard operating procedures. The need for staff to be educated about COVID-19 policies was highlighted by seven sources (see Table 4). Since staff can play an integral role in mitigating the risk of infection, facility operators will need to develop a communication plan and continuously educate staff with the most up to date COVID-19 prevention information possible (Parker et al., 2020; Wackerhage et al., 2020).

Staff whose tasks can be completed at home should work from home to reduce the number of people inside the facility. Four sources suggested that staff who can complete their duties remotely should be encouraged to do so (see Table 4). Doing so will reduce the total number of facility occupants at one time (Cortez et al., 2020; Wong et al., 2020).

*Third party personnel and organizations should be considered when developing return to sport protocols***.** Seven sources suggested that third party personnel should be taken into consideration and help design, educate and enforce COVID-19 protocols (see Table 4). These personnel may include coaches (Francis & Francis, 2020), medical personnel (Mercurio, Gianakos, Mulcahey, & Sutton, 2020; Ramos e Corte et al., 2020) and officials (Castagna et al., 2020). For example, coaches and medical personnel should be aware of their athletes' vaccination status and assist with providing health status updates (Francis & Francis, 2020). Facilities should also consider regular tenants, such as sport clubs, that regularly rent facility time and may require financial support to continue operations (Feiler & Breuer, 2021).

Personal Protective Equipment

Personal protective equipment is considered the last line of defence to reduce the risk of transmitting infectious disease. These recommendations are primarily to be enacted when local public health officials deem necessary. One recommendation was identified (see Table 5.).

All facility occupants should be required to wear masks when not participating in physical activity and extra personal protective equipment should be available. The importance of wearing masks by facility occupants was demonstrated by 41 sources recommending that wearing masks should be mandatory (see Table 5). Multiple sources recommended wearing a mask in any high-risk situation (Mulcahey et al., 2021; Shurlock et al., 2020), particularly when physical distancing cannot be maintained, while users are on the sidelines of activities (Asif et al., 2020; Wong et al., 2020) or on the way to and from the dressing rooms (Romano-Bertrand et al., 2020). One source recommended creating an anonymous reporting system that allows users to report issues of non-compliance (Sikka et al., 2020). Moreover, practitioners, including facility staff, coaches and athletic

Table 5: Summary of Recommendations for Personal Protective Equipment

	Recommendation	Supporting Literature
1.	All facility occupants should be required to wear masks when not participating in physical activity and extra personal protective equipment should be available	Amagasa et al. (2020); Asif et al. (2020); Blocken et al. (2020); Castagna et al. (2020); Cilhoroz & DeRuisseau (2021); Chu et al. (2021); Cortez et al. (2020); Cunningham et al. (2021); D'Agostino et al. (2021); Denay et al. (2020); DiFiori et al. (2021); Doherty et al. (2021); Dominski & Brandt (2020); Donadu et al. (2020); Drury et al. (2021); Egger et al. (2021); Epstein et al. (2021); Fitzgerald et al. (2021); Gentil et al. (2020); Haraf, Faghy, Carlin, & Josephson (2021); Hodgson et al. (2021a); Hodgson et al. (2021b); Hopkins et al. (2020); Jones et al. (2021); Kim et al. (2020); Kim & Yang (2021); Lakicevic et al. (2021); McElheny et al. (2021); Mercurio et al. (2020); Mulcahey et al. (2021); Murakami et al. (in-press); Parker et al. (2020); Pena et al. (2021); Ramos e Corte et al. (2020); Romano-Bertrand et al. (2020); Suhs et al. (2021); Shurlock et al. (2020); Sikka et al. (2020); Watson et al. (2021); Wackerhage et al. (2020); Wong et al. (2020)

trainers should be provided additional personal protective equipment that suits their role, such as gloves and goggles (Blocken et al., 2020; Castagna et al., 2020; Cortez et al., 2020; Mercurio et al., 2020).

Discussion

The present rapid review systematically gathered and reviewed peer-reviewed literature to develop broad recommendations that will help inform the safe return to sport and recreation facilities. After the analysis of 59 articles, 25 recommendations emerged. The recommendations were categorized according to NIOSH's hierarchy of controls for addressing occupational hazards. With the recency of the COVID-19 pandemic, it is likely that additional literature will be produced that will further promote the safe return to these facilities and as a result, the proposed recommendations could be updated in an iterative process. Nevertheless, these 25 recommendations have important implications for the occupational health and safety of sport and recreation facility users as the industry emerges from the COVID-19 pandemic.

The recommendations identified in this review align with literature that has adopted the NIOSH hierarchy of controls framework to develop strategies for the safe return to non-clinical settings (e.g., Dehghani, Omidi, Yousefinejad & Taheri, 2020; Zisook et al., 2020). With the elevated risk of transmitting COVID-19 at sport and recreation facilities (Bae et al., 2020), the framework was appropriate to apply to a sport and recreation context and is a key contribution of this review. The recommendations in this review pertained to eliminating or substituting the virus (through the currently available vaccines), engineering controls, administrative controls, and personal protective equipment, acting as risk mitigation strategies. Due to the nature of sport and recreation and the new variants of concern that continue to arise, it is unlikely that risk will be completely eliminated.

The mandatory immunization policy recommendation is the most protective in the hierarchy of controls framework. However, the current available vaccines (as of August 2021) do not provide complete immunity and are less effective at reducing the spread of variants of concern (i.e. Delta)

(Harder et al., 2021). Fortunately, the vaccines are effective at reducing the risk of transmission and hospitalization (Harder et al., 2021). Therefore, the implementation of an immunization policy will reduce the chance of transmission within sport and recreation facilities, and if transmission occurs, the infected will be less likely to be hospitalized. This will create a safer environment for the return to sport and recreation facilities.

The engineering control recommendations identified in this review highlighted how the built environment can be redesigned to better separate people and pathogens. For example, the current review's recommendation to improve current air handling practices aligns with previous literature that has found that improvements to ventilation and air quality can minimize the risk of airborne transmission (Megahed & Ghoneim, 2021; Morawska et al., 2020). To enforce this, policymakers may consider mandating improvements to air handling system and developing a certification program that sport and recreation facilities must adhere to in order to operate (Blocken et al., 2020). Like previous epidemics, such as SARS-CoV-1, architects will need to continue improving the built environment (i.e. engineering controls) for occupational health and safety (Pinheiro & Luis, 2020). Together, these recommendations should be considered when designing new sport and recreation facilities or renovating existing facilities to mitigate the risk of transmitting viruses in these settings.

The administrative control recommendations involved altering standard operating procedures to minimize transmission risk. The recommendations in this section also aligned with previous scholarly literature. For example, the need to educate staff, implement reductions to space capacity and promote physical distancing have also been implemented in other workplace settings (Dehghani et al., 2020; Hou, Remoy, Iylha & Putte., 2021; Zisook et al., 2020). Facility operators will also need to collaborate with local public health officials to determine the best course of progressive action based on the local health conditions. More generally, there will need to be a greater emphasis on the promotion of occupational health and safety (Dennerlein et al., 2020) in sport and recreation facilities. Finally, as the last line of defense, facility operators will need to be willing to provide personal protective equipment to their staff and enforce the usage thereof among the general public who enter their facilities when local conditions warrant the most extreme safety measures.

While the present review makes an important contribution to the literature, it is not without limitations. For instance, we did not include literature published before COVID-19 was identified, nor studies that addressed reduction of viral transmission in non-sport and recreational settings. Nevertheless, there has been ample research published since the pandemic was declared, thus providing significant evidence on which to base our recommendations. Second, our search was restricted to studies published in English, and we therefore may have omitted studies published in other languages that may have had meaningful implications for our recommendations. Third, we adopted rapid review methodologies and in doing so, only included peer reviewed literature that has been published in academic journals. As a result, grey literature (e.g., policy documents, white papers, reports) that have also provided recommendations for returning to participation in sport and recreation at community facilities were

excluded. Given the heterogeneity amongst policies at municipal, provincial/state and federal levels, in addition to their constantly evolving nature as the pandemic has unfolded, we believe that drawing on only empirical evidence and key stakeholder opinions enabled us to provide clearer and concise recommendations. However, the number of commentaries identified by this review also presents a limitation. Fourth, due to the rapid nature of this review, we did not conduct a risk of bias assessment for the included literature, which may bias our findings. Finally, these recommendations are not exhaustive as more research with implications for reducing transmission in sport and recreational settings is published every day. Moving forward to address the limitations, researchers and practitioners are encouraged to update these recommendations in an iterative manner as new information emerges.

Conclusions

In sum, this rapid review has provided timely practical recommendations to support the safe reopening of the sport and recreation industry. The recommendations identified by this review will provide guidance for practitioners that help the sport and recreation industry return to a degree of normalcy that has not been experienced since the onset of the pandemic. Considering the notion that herd immunity may be unlikely (Madhi, 2021), the progressive return to normalcy for this industry is extremely important, as it will help address the adoption of unhealthy lifestyles and mental health issues that the pandemic has caused.

Authors' Qualifications

The authors' qualifications are as follows: Kevin E. S. Wilson, MHK; Zachary C. T. Evans, MHK; P. J. Miller, MHK; Denver, M. Y. Brown, PhD.

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