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## Article

# An Analysis Safe Protocols Employed in Professional Male Soccer and the Impacts of the COVID-19 Pandemic on the 2020 Brazilian Championship

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**Abstract:** The COVID-19 pandemic directly reached and impacted upon elite sports and caused the postponement of sporting events globally. In order to enable the return of activities, protocols were created with recommendations to prevent the transmission of COVID-19. The objective of this work is to analyze and compare the safe return protocols of major football leagues and associations to those of the Brazilian Championship, as well as to survey the numbers of COVID-19 outbreaks in clubs that competed in the 2020 Brazilian Championship Series A. The documentary research was carried out through the analysis of articles published on open-source football league and federation websites. National and international return protocols were verified, as well as the documenting of isolated cases and outbreaks of COVID-19 in the Brazilian Championship. In the Brazilian Championship, the return to play occurred at a time when COVID-19 case numbers were rising, a fact that, together with the decentralization of the match cities, was likely linked to the number of positive cases. A total of 302 positive cases of COVID-19 were identified in 14 outbreaks during the competition. Therefore, this work identifies good practice and underscores the need to reassess and refine the protocols to minimize the impacts of COVID-19 going forward.

**Keywords:** COVID-19; soccer protocol; Brazilian Championship

## 1. Introduction

COVID-19 was first reported in December 2019 in Wuhan, China, spread rapidly around the world and was classified as a pandemic in March 2020 [1,2]. Severe acute respiratory syndrome caused by SARS-CoV-2 is the seventh disease of the Coronaviridae family to infect humans, being preceded by diseases caused by other variations of the virus, such as: HCoV-229E discovered in 1966; HCoV-OC43 in 1967; SARS-CoV in 2003, HCoV-NL63 in 2004; HCoV-HKU1 in 2005 and MERS-CoV in 2012 [3]. However, this coronavirus has caused disruption and death to the health, economy and freedom of the population worldwide that is unparalleled in modern times [4].

It is now understood that the transmission of SARS-CoV-2 generally comes through contact with airborne droplets and by transmission of aerosols released by infected individuals during speech, coughing and sneezing, and, less commonly, through indirect routes, such as contact with contaminated surfaces [5]. The risks of SARS-CoV-2 contagion are greater during direct contact at distances of less than 2 metres, although contaminated respiratory droplets are suspended in the air for seconds (droplets between 5 and 10  $\mu\text{m}$ ) or for minutes up to hours (droplets  $\leq 5 \mu\text{m}$ ), being classified as a great risk, even over larger distances [6]. These modes of transmission and the associated risks were not well known at the beginning of the outbreak.

The progress of the pandemic can be predicted by a measure of the viral transmissibility called  $R_0$ , which quantifies the number of new cases from each existing one, considering the infectivity rate of SARS-CoV-2 and human behavior [7]. It is believed that the restrictions imposed during the pandemic, including the closure of schools, the maintenance of social distancing, use of masks and hygiene and cleaning practices led to a decrease of 50–70% in the  $R_0$  [8,9].

In Brazil, the first recorded case of COVID-19 occurred on 26 February 2020, and the first death was recorded in São Paulo on 17 March, with the contagion spreading throughout all areas of the country [10]. However, only on 11 March did the Ministry of Health implement measures of isolation and social distancing directed at people with either suspected or confirmed cases of the virus [11].

The management of COVID-19 preventive measures was decentralized in Brazil, and the Federal District was the first body to impose non-pharmacological measures [12]. The restrictive measures that were adopted by the states varied but included the suspension of events and face-to-face teaching, the quarantine of the population and restrictions in transport. The cities most affected in the pandemic include the metropolises of the southeastern region and the state of Ceará in the northeastern region as these areas lead the infection curve and subsequently saw a higher number of deaths [13].

The restrictions imposed directly impacted the practice of physical activities, contributing to an increase in sedentary lifestyle and a decrease in the physical and mental health of the population [14]. In sports, the pandemic directly affected the sporting elite and led to the postponement of the Tokyo Olympic Games, Football Championships, NBA competitions, marathons and even Formula 1 races to safeguard the health of all those involved [15–17]. The interruption in competitions is unprecedented in modern times having last occurred on this scale during World War II [18].

The global sports industry estimates that its average annual turnover is at least US \$756 billion [19]. The direct costs of ticket sales for games and championships, image rights, payment of athletes and teams, sponsorships, marketing, as well as transportation and sale of inputs, among others, are involved in calculating this value [20]. The impact of COVID-19 on professional athletes began with the loss of physical fitness but was exacerbated by the imminence of reduced financial and sponsorship income and the absence of a prospect of return [21,22].

Soccer is the national sport of Brazil and, as elsewhere, was severely impacted by the pandemic. The State Championships were interrupted, and the beginning of the Brazilian Men's Championship was postponed for approximately 90 days [23]. During this period, it was necessary for athletes to conduct training in confined environments to maintain their physical fitness [21]. Considering that Brazil has an average of 360,000 registered athletes competing in more than 250 competitions, and that issuing guidance on such activities was not a priority for governmental bodies at the beginning of the pandemic, this created many health and logistical challenges which can be evaluated and learned from [24].

The return of football in Brazil in the COVID-19 era generated great deal of controversy domestically. In May 2020 the Football Federation of the State of Rio de Janeiro published the "Safe Return Protocol", which was the first such guide to be released [25]. This guide included individual, collective and managerial measures for the return of training and games with strict biosafety protocols for the conclusion of the Carioca Championship. This

publication coincided with what is now known as the first wave of COVID-19 in Brazil and the proposed return was considered premature and strongly contested by the clubs and federations of other states.

Additionally, in May 2020, the Fédération Internationale de Football Association (FIFA) announced a protocol for the safe return of football that includes biosafety measures for training, travel and matches [26]. Since this time other international associations, leagues and competitions around the world have also made their protocols for safe return of football available. The Brazilian Football Confederation (CBF) made available its return booklet, called the “Medical guide of protective suggestions for the return to the activities of Brazilian football”, on 15 June 2020 [27].

Team sports are considered to be high risk activities in relation to COVID-19 due to interpersonal contact within matches without the use of protective masks at distances of less than 2 m. As a result, specific protocols for systematic testing and biosafety measures needed to be implemented to enable the safe continuation and return of soccer. In this context, this study compares the safety protocol released by the CBF with international protocols, as well as the evaluation of the risks of SARS-CoV-2 transmission during the Brazilian Men’s Championship 2020 season between August 2020 and February of 2021.

## 2. Materials and Methods

An exploratory qualitative study was conducted between June 2020 and February 2021 using 15 protocols from the main world championships and international federations. These were gathered through searches on official websites of the competitions and federations [26–40]. Protocols belonging to the European leagues were used [28,32,38] as well as those from Asia [29], Africa [36], the Americas [27,33,39] and Oceania [30,31]. Additionally included is protocol issued by the International Football Federation (FIFA) [26] and 6 which were issued by national and international federations [27,31,34–37]. These protocols were issued by soccer leagues in Germany (Bundesliga) [37], Portugal (Portuguese League) [32], Spanish League (La Liga) [35], English League (Premier League) [28], Italian League (Serie A TIM) [34], Brazil (Brasileirão ASSAÍ) [27], South America in general (American and South American Libertadores) [33], Asia (Asian Champions League and Chinese League) [29,40], Australian League at the Australian Institute of Sports [30,31], African League [36] and United States League (MLS) [39]. Protocols were chosen according to release date and the success of the protect COVID-19 in sport. The criteria for the analysis of the protocols of the CBF and other international federations and competitions were related to the guidelines for biosafety and hygiene, testing protocols, recommendations on removal and conduct guidelines during the games.

The documental research was carried out through the analysis of articles published on websites of national and international newspapers with open-source access. The keywords and phrases COVID-19 X Football, SARS-CoV-2 Contamination X Football Players, COVID-19 test X Football were all used to gather relevant data. The number of infected players and outbreaks of COVID-19 were monitored in all rounds of the Brazilian Championship through open-source sports articles from national and international newspapers.

Data regarding the spread of COVID-19 in Brazil was collected from the same consortium of open-source press and from the website of the Institute of Scientific Information and Communication and Health Technology. The calculation of the number of infected individuals in the round was performed using the arithmetic mean of the number of cases in the federative units representing the clubs that dispute the series A of the Brazilian championship. For the analysis of cases by federative unit, the arithmetic mean was performed by the sum of cases reported on the match days of their teams divided by the number of teams in this state. The repetition of the same state in the average number of cases in a round was considered. Values are calculated for every 100,000 inhabitants of its corresponding population. Obtaining the values for the number of deaths per round follows the same methodology as for the number of infected per round. The difference in the number of infected per round is the subtraction of the number of infected in the state

whose number is the highest in that round by the number of infected in the state with the lowest number. Likewise, the greatest difference in the number of deaths per round was also calculated.

### 3. Results

#### 3.1. *The Brazilian Championship*

The Brazilian Championship is the largest competition coordinated by the CBF, and is divided into series A, B, C and D where the 128 clubs participate. Since 2003, this competition has adopted a unified system of organization in awarding points and the winner being the team that obtains the highest score after 38 rounds of with the matches [41]. The geographical distribution of the teams in the Brazilian A series changes according to the promotion and relegation of 4 teams each season. In 2020, there was a predominance of teams from the Southeast region (50%), followed by 20% from both the South and Northeast regions and the remaining 10% coming from the Midwest region. The continental size of the Brazilian territory means that Brazilian Championship games usually involve travel by air and/or land for one of the teams involved.

The schedule of the Brazilian Championship was set pre-pandemic in October 2019 by the CBF, which anticipated the season beginning on 2 May 2020. However, due to COVID-19, and rapidly rising cases and deaths in Brazil, the competition was postponed for an indefinite period. The return of Brazilian Championship matches took place on 8 August, at a time when Brazil was reported as having the second highest numbers of COVID-19 cases and related deaths in the world [42]. The return to activities in the clubs took place prior to the games, with 25% returning to training in May, while the majority (50%) returned in June. Due to state rules the teams in São Paulo were only able to return on 1 July.

The return to competitive matches was preceded by the release on 9 July of the CBF protocol, which describes specific rules and recommendations for training and games. The guiding document, applicable to all clubs, presented specific rules of individual, collective and managerial conduct for training, commuting to and from stadiums, use of locker rooms, prohibition of supporters, in addition to providing guidance on the frequency of testing and isolation protocols for suspected and confirmed COVID-19 cases.

#### 3.2. *The Comparative COVID-19 Protocols*

The comparative analysis of the CBF protocol in was performed by evaluating 15 international protocols that presented specific recommendations on safety in training and professional football matches around the world during the COVID-19 pandemic. A similar pattern of recommendations and requirements was observed in the protocols analyzed for the return of football to COVID-19 (Table 1). In the CBF protocol is described a RT-PCR as a standard diagnosis before the training return and the matches, measures of isolation for 10 days individuals who tested positive for COVID-19, social distancing of 1 m however, the guidance no showed restrict of stadium for matches in cities according to SARS-CoV-2 transmission.

All protocols were unanimous in the obligation for players and staff to be tested prior to matches and that the general public be prohibited from stadiums. RT-PCR is the diagnostic test required by most of the associations, with the exception of the protocols of the African Federation, Australia and the United States Soccer Federation, which did not specify the testing methodologies. According to the protocols, the testing periodicity should occur 2 weeks before the beginning of training in the protocols of the Bundesliga (Germany), England, Italian Football Federation and FIFA. In the Spanish guide, however, there is a requirement for testing 1 week before the start of training and in the Chinese, only 72 h before the start of training. The protocol of the Royal Spanish Federation and the Bundesliga (Germany) showed retesting during training, once a day during the entire training stage and twice a week, respectively. Regarding the tests during the games, most protocols require RT-PCR testing 48 h before the matches. The Asian Champions League

(AFC) determined that the tests should be performed 72 h and that the Chinese protocol requires weekly tests (Table 1). This variation between different associations is strongly suggestive that there are best practices to be adopted and lessons to be learned.

Keeping players segregated into small groups (or bubbles) was recommended at various times in most protocols, including during training and during warm-up in matches, though, again, we see different patterns and recommendations amongst associations within this. Individualized training, followed by pairs, and finally the formation of groups lasting 35 to 50 min was recommended in 7 analyzed protocols. The protocol published by the Australian Sports Institute did not refer to duration but indicated the same pattern in training (individual/double/small groups). The protocol United States Soccer Federation standardized the training in up to 9 people with 1 coach, while the CBF and Libertadores da America imposed only training in small groups. Only the African Confederation registered sessions of 2 people with a coach.

Most of the protocols analyzed determined an optimal minimum contact distance of 2 m; however, the Bundesliga, as well as the Australian Federation, used 1.5 m in their protocols. The CBF, China and the Asian Champions League maintained 1 m as the measure of distance (Table 1). Most protocols advocate distancing during celebrations; however, and only in the protocol of the Libertadores da America are celebrations prohibited.

The use of masks and constant hand-related hygiene were recorded in almost all protocols analyzed. Only the Portuguese League, the Royal Spanish Federation, the Italian Federation, FIFA and the African Confederation also required the use of gloves. In all of the protocols, it was recommended that medical grade hand sanitizer be made available to players, officials and staff. This was one of the few unanimously agreed recommendations.

Specific regulation on media coverage was also one of the points present in many of the protocols and these included the positioning of TV cameras, commentators, reporters and photographers. Only the guides from England, the Australian Federation, Australia (Australian Institute of Sports) and the United States Soccer Federation did not specify conduct for the media services.

The guides of the Portugal League and the Asian Champions League determined the stadiums that would be used for the matches, while the vast majority chose to play in stadiums according to the home club. Only the African Confederation confirmed that the games would be held in the stadiums of a single city. The protocols of Australia (Australian Institute of Sports), CBF and the United States Soccer Federation did not specify any restriction on the usage of stadiums.

Almost all protocols included measures of isolation for those who had tested positive for COVID-19. In the case of the Italian Federation the required period was 2 weeks, while the protocol of the United States Soccer Federation required a medical report after isolation. The CBF and the Libertadores da America imposed 10 days of isolation for the infected, and the FIFA deemed it necessary to isolate between 7 and 10 days. Return testing for positive cases was recommended in the CBF protocol. The diagnosis by antibody, used to validate the return of the players, was only identified in the guides of the Royal Spanish Federation, Bundesliga, Italian Federation, CBF and Libertadores da America. Here, clearly, there was a great deal of variation between what was recommended by the different associations and federations.

With regards to the transportation of players, staff and officials to training and non-matchday events, most protocols required that this should take place in isolation, preferably by private car. For games, however, buses were the preferred method with all on board following biosafety protocols and the vehicle being thoroughly cleaned. The rules for boarding included the use of masks and face protection, maintenance of social distancing when inside of the vehicle, and only the use of seats near the windows. Only the protocol of the African Confederation required the request of overnight accommodation for the teams and provisions for arbitration related to this were clearly laid out.

**Table 1.** Soccer return protocols around the world.

Countries and Federations	Protocol Release Date	COVID-19 Testing	Social Distancing	Hygiene Measures	Action to Be Taken in Case of Positive Results	Match Stadium	Return Testing After Isolation for Infection	Antibody Diagnosis	Soccer Player Transportation	Club/Stadium Hygiene Procedures
<b>Brazilian Football Confederation (Brazil)</b>	June 15, 2020	rRT-PCR, 48h before the game	Minimum contact, distance of 1m	Hand washing, mask use	Isolation 10 days	No restrictions	Present	Present	Individual car	Present
<b>Asian Football Confederation (AFC)</b>	June 1, 2020	rRT-PCR, 72h before the game	Minimum contact, distance of 1m	Hand washing, mask use	Isolation until cure	No restrictions	Present	Ausent	Training: personal car; Match: bus club	Present
<b>Australia</b>	March 16, 2020	Ausent	Minimum contact, distance of 1,5m	Hand washing, mask use	Isolation until cure	No restrictions	Ausent	Ausent	Ausent	Present
<b>Australian Institute of Sport</b>	May 2020	Ausent	Ausent	Hand washing, mask use	Isolation until cure	Ausent	Present	Ausent	Ausent	Ausent
<b>China</b>	July 19, 2020	rRT-PCR, once a week	Minimum contact, distance of 1m	Hand washing, mask use	Isolation until cure	Chosen by Chinese Government	Present	Ausent	Training: personal car; Match: bus club	Present
<b>Confédération Africaine de Football (CAF)</b>	June 22, 2020	rRT-PCR, 48h before and after the game	Minimum contact, distance of 2m	Hand washing, glove and mask use	Isolation until cure	Only in one city	Present	Ausent	The Confederation would be responsible for providing (permanent) the hotel and transportation for the teams and referees	Present
<b>England</b>	June 11, 2020	rRT-PCR, 48h before the game	Minimum contact, distance of 2m	Hand washing, mask use	Isolation until cure	No restrictions	Ausent	Ausent	Training: personal car; Match: bus club	Present
<b>Fédération Internationale de Football Association (FIFA)</b>	October 1, 2020	rRT-PCR, 48h before the game	Minimum contact, distance of 2m	Hand washing, glove and mask use	Isolation between 7 to 10 days	No restrictions	Present	Ausent	Training: personal car; Match: bus club	Present
<b>Federazione Italiana Giuoco Calcio (FIGC)</b>	May 21, 2020	rRT-PCR, 48h before the game	Minimum contact, distance of 2m	Hand washing, glove and mask use	2 weeks isolation	No restrictions	Present	Present	Training: personal car; Match: bus club	Present
<b>Germany</b>	May 1, 2020	rRT-PCR, 48h before the game	Minimum contact, distance of 1,5m	Hand washing, mask use	Isolation until cure	No restrictions	Present	Present	Training: personal car; Match: bus club	Present
<b>Libertadores e Sulamericana (CONMEBOL)</b>	September 2020	rRT-PCR, 72h before the game	Minimum contact, distance between 2m to 2,5m	Hand washing, mask use	Isolation 10 dias; Symptomatic cases 13 days	No restrictions	Present	Present	Individual or Collective sanitized vehicle	Present

Table 1. Cont.

Countries and Federations	Protocol Release Date	COVID-19 Testing	Social Distancing	Hygiene Measures	Action to Be Taken in Case of Positive Results	Match Stadium	Return Testing After Isolation for Infection	Antibody Diagnosis	Soccer Player Transportation	Club/Stadium Hygiene Procedures
Portugal	September 07, 2020	rRT-PCR, 48h before the game	Minimum contact, distance of 2m	Hand washing, glove and mask use	Isolation until cure	Chosen by FPF	Present	Ausent	Training: personal car; Match: bus club	Present
Real Federación Española de Fútbol (RFEF)	March 28, 2020	rRT-PCR, 48h before the game	Minimum contact, distance of 2m	Hand washing, glove and mask use	Isolation until cure	No restrictions	Ausent	Present	Training: personal car; Match: bus club	Present
Union of European Football (UEFA)	August 5, 2020	rRT-PCR, 48h before the game	Minimum contact, distance of 2m	Hand washing, mask use	Isolation until cure	No restrictions	Ausent	Ausent	Private bus	Present
United States of America	June 10, 2020	Ausent	Minimum contact, distance of 2m	Hand washing, mask use	Isolation 14 days and a medical report confirming the return	Ausent	Ausent	Ausent	Individual car	Present



### 3.3. COVID-19 Infections during the 2020 Brazilian Championship

Though the effectiveness of sporting protocols and their implementation must be viewed in wider, national and international contexts related to the pandemic, it is appropriate to pay regard to COVID-19 outbreaks and cases amongst players during this period. During the 2020 Brazilian Championship, the professionals registered in the competition that showed positive results for infection by COVID-19 were monitored, as well as the outbreaks in the clubs involved. In this research the outbreaks were characterized when more than 07 individuals (symptomatic or asymptomatic) had tested positive for COVID-19 in period of 10 days. The monitoring of the presence of SARS-CoV-2 infections in the players and the technical committee during the matches of the Brazilian Championship was performed through an active search in open-source media and the data released by the participating clubs. Data obtained from the media and the CBF website indicate that the 2020 Brazilian Championship had 625 registered players, of which 302 were infected during this period, and that there were 14 distinct outbreaks identified.

All teams presented cases of players infected by SARS-CoV-2 throughout the championship, showing a championship infection rate of 48.32%, of which 97 positive cases (32%) occurred in the first round of the championship and 205 cases (68%) occurred in the second round. The Southeast region had the highest percentage of infected players, corresponding to 53% of the total (159 players). The teams with the highest number of infected individuals were the Club of Regattas Vasco da Gama and the Fluminense Football Club, with 26 players testing positive in each, and the Sport Club of Recife had the lowest score, with only 3 players testing positive (Figure 1). It was observed that the infection rate of the clubs in the second round was comparatively higher than that in the first round, where an increase in outbreaks was identified mainly in the Southeast region in the states of São Paulo and Minas Gerais; in the South region, in the states of Paraná; and in the Northeast region of Ceará and Bahia. At the end of the championship, out of 10 teams from the Southeast region in the competition, outbreaks were recorded in 7 participants, and the last case was recorded in the Sport Club 9 days after the end of the competition.

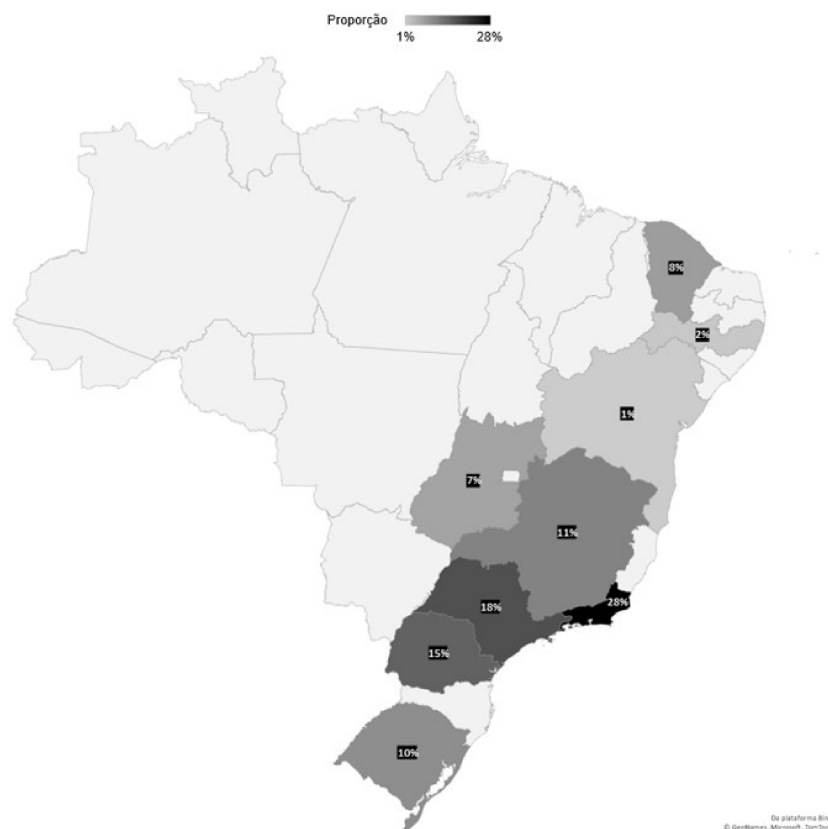


Figure 1. Distribution of COVID-19 cases in the 2020 Brazilian Championship series A.

Cases of reinfection by SARS-CoV-2, although rare, were identified throughout the tournament in the players/coaches that had an initial infection, totaling 0.16% among the players and 2% among the coaches. All cases were identified in the state of São Paulo, with the first reported in November in an athlete from the Palmeiras Sport Society and the other confirmed in December in a coach who at the time of his second SARS-CoV-2 infection was without a club.

There were 14 outbreaks in 12 clubs throughout the competition, representing 60% of clubs with a high number of positive cases in a given period (Figure 2A). Two clubs located in Rio de Janeiro recorded 2 outbreaks each in their squads, in August and November in Club of Regattas Vasco da Gama and between September and November in Fluminense [43]. It was observed that 50% of the outbreaks throughout the championship occurred in clubs in the Southeast Region of Brazil. Altogether, 167 athletes tested positive for COVID-19 while their team was experiencing an outbreak. The highest number of players infected during an outbreak was in the Palmeiras Sport Society with 22 players, and the lowest number was recorded in the Sports Club Bahia and in the Club of Regattas Vasco da Gama in its first outbreak (August 2020) with 7 players. The only team that tested positive and found an outbreak of the disease after the end of the championship (9 days after the end of the championship) was the SP Sport Club Corinthians. Here 14 players tested positive for infection.

The chronological distribution of the outbreaks was not even throughout the duration of the Brazilian Championship, with a predominance of positive cases in the same club coming in the second round of the championship. During the first phase, 4 outbreaks were recorded between the months of August and early November, where 2 occurred in August and 2 in September. In the second round of the Championship there were 10 outbreaks from November 2020 to February, where 7 outbreaks occurred in November, a further 2 in January 2021 and 1 more in February 2021. November was the month with the highest number of cases, accounting for 50% of outbreaks in clubs. It was identified that 55% of the outbreaks occurred only once in a club, 9% occurred more than once in a club, and 36% of the clubs never had an outbreak recorded.

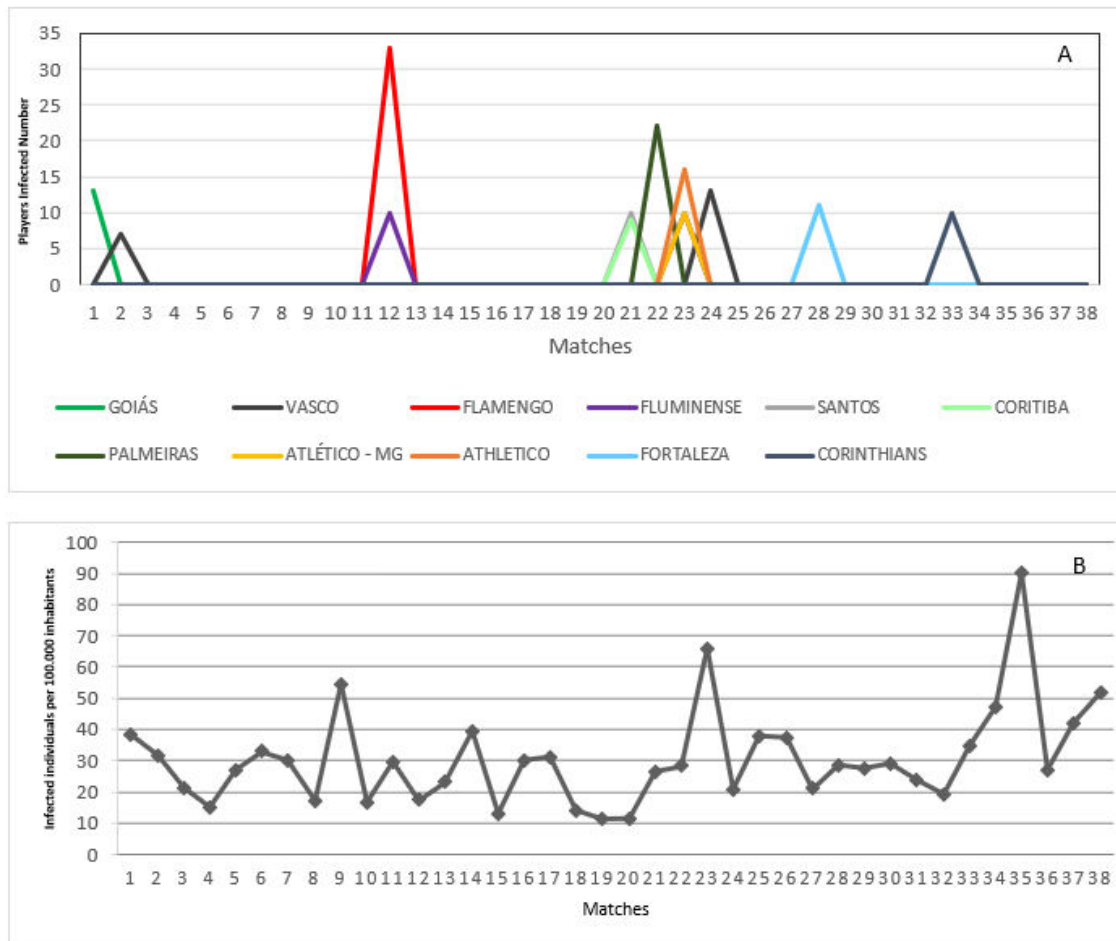
Using the isolation measures of the World Health Organization (WHO) protocols related to the time period of incubation and transmission of the disease, the 10 days before and after the outbreak were analyzed in all clubs to identify a possible relationship between them. It was recorded that one of the clubs that had an outbreak in its squad (Paranaense Athletic) previously faced a club that had just come out of an outbreak (Santos Football Club). The match occurred at the SARS-CoV-2 transmission limit of 10 days (21 November), with the first outbreak identified on November 11 and the second on 27 November. This is suggestive of in-game transmission taking place.

One of the impacts analyzed during the pandemic was the change in days and times of departures according to outbreaks or regional restrictive measures. The first round of the Brazilian Championship had 19 rounds that were played between August and November 2020, and only one round was postponed due to COVID-19 outbreaks in the clubs. This postponement occurred in the first round between Goiás and São Paulo, where the Goiás Sport Club showed a positive result for COVID-19 in 9 players.

The Brazilian Football Confederation set a defined criterion for the postponement of matches which specified that clubs with more than 13 fit and healthy players were to play. Indeed, a game took place (Palmeiras vs. Flamengo) in the 12th round of the first phase, in which one of the clubs was just able to meet the requirement. In this case, due to the insistence that the game go ahead by the CBF, a legal imbroglio took place between the Regional Labor Court of Rio de Janeiro (Regional Court of Labor of Rio de Janeiro-TRT-RJ), the Superior Labor Court (TST) and the CBF. It is clear from this that the criteria of the CBF were not felt by some authorities to be robust enough or well enforced so as to ensure player and public health.

In order to understand and show the epidemiological situation of the states throughout the Brazilian Championship a monitoring of the infected and death rates was carried out

on the days of the matches. Here it is shown that the Southeast region led the ranking of the number of infected and dead throughout the championship, with the peak occurring between rounds 12 and 13 in the first round of the championship, when outbreaks in Flamengo and Fluminense were identified. The study allowed us to identify a correlation between the onset of outbreaks and the transmission rates of SARS-CoV-2 in the states (Figure 2B).



**Figure 2.** (A): COVID-19 outbreaks in soccer players during the Brazilian Championship matches; (B): Infected Individuals per 100,000 inhabitants in Brazil each matches.

#### 4. Discussion

It is clear that the risks of community-based transmission of SARS-CoV-2 in sports should be evaluated when considering the suspension and resumption of sporting activity [44]. Contact sports, by their very nature, lead to greater interpersonal contact with a distance of less than 2 m and make the use of masks very challenging, if not impossible. Sporting activities which take place indoors or in enclosed environments, also carry a higher risk of transmission [44,45]. It is noteworthy that environments with reduced air renewal are considered very high risk and here SARS-CoV-2 transmission has been observed at a rate 19 times higher than in ventilated environments [46].

When observing the dynamics of professional soccer, a high-contact team sport, it can be considered that the risk of transmission for SARS-CoV-2 and other respiratory diseases can be high, but there is on-going debate around this. DiFiori and co [47] describe soccer as a sport with a high risk of disease transmission; in countermeasures, the Brazilian Olympic Committee classified it as a sport with medium risk of SARS-CoV-2 transmission [48]. Sparrow et al. [43] also characterized soccer as a medium-risk sport

because it is practiced in open places. However, the high presence of hand-to-hand contact and the non-use of a mask during soccer practice increase the risk of transmissibility [45].

Studies have shown that the proximity of contact between players and opponents favors the transmission of respiratory diseases [49,50]. Gonçalves et al. [51] monitored the respiratory exposure of soccer players and found that the duration of situations of risk of infection ranged from 2 min for each player, reaching the 14-min and 10-s mark when the contacts between certain players were isolated. The moments of risk of infection highlighted in the study were moments of proximity of 1.5 m and when a player was in the same location as a previous player was positioned as this increases the possibility of aspiration of exhaled particles.

Moments during a game such as attempts on goal, tackles, free kicks and corners are considered situations with a high possibility of interpersonal contact. Analyses identified that in 90 min of play, each of the players presented 52 situations of risk of infection, with the highest average contact time in the midfield (35.5 min) [45]. However, although soccer requires a large amount of interpersonal contact, the contacts occur mainly between the arms, hands on the shirt, hand on the ball and heading, which may explain the absence of contagion in three matches which each had an average of 6 infected players involved in them [52].

The duration of the highest-risk interpersonal contact, which involves frontal contact, varies between 30 s in German league matches and 1 min and 28 s in Danish league matches [53].

Despite the risks in football, the German Bundesliga 2020 Championship was able to conclude its competition with a relatively low number of SARS-CoV-2 infections [54]. Studies emphasize that safe participations for athletes, along the lines of the German Championship, demands strict compliance with the public health measures implemented. In the Brazilian championship, the contamination rate was high, reaching 48.32% among athletes [55], with greater transmissibility in the 2nd phase. The high number of infected individuals and the presence of outbreaks in the teams show weaknesses of the CBF protocol. This protocol does not recommend the assessment of risk with regard to the transmission rate of the city of departure and the epidemiological situation of the local population for the games. A consideration of these factors is important for the minimization of risk [56].

In another study, Schumacher et al. [57] point out that most infections which occurred in their study came from contact with family members and that there were no documented infections on the field or in training. Schumacher et al. [57] also detail a case of infection in three staff members and an athlete who went to a dinner and then received negative test results 4 days later. However, following testing 7 days after the dinner, all results were positive. This underlines what is already known about the range of virus incubation times and the challenges that these bring to containment and tracing.

Gualano et al. [58] in their study found that athletes are more susceptible to infection than staff members are. However, there is a higher risk of complications for staff due to age demographics. The different social behaviors of youth and professional athletes can also influence the dynamic around virus spread and risk, as younger players tend to stay in the club's quarters and thus are subjected to closer controls around external contacts while older players are able to interact socially in a freer manner.

A strategy to attempt to control the infection rate and to promote the safety of all involved in football would be the implementation of the 3Ts policy: Test, Trace and Treatment [59]. This strategy seeks to control the chain of infection through the identification of the COVID-19 virus in laboratory tests, a screening of close recent contacts of the infected person and then the identification of symptomatic and asymptomatic cases through further laboratory testing. This strategy also requires the isolation of infected people to avoid new infections and new outbreaks. Both Schumacher and Gualano suggest this approach to managing COVID-19 in football.

Another important measure identified by Meyer et al. [54] in the German Bundesliga 2020 was the battery of tests that the players who tested positive or borderline to the coronavirus were required to undertake afterwards. This provides greater safety to those involved and better control of the infection rate. The analyzed protocols determined the performance of tests 48 h before departure, but this measurement may not coincide with the minimum ideal days for detection. Failures can occur as occurred in the Brazilian Championship, where an athlete had to be substituted midway through match as his test had presented a positive result [60]. This means opponents and teammates had potentially been exposed to the virus. Considering that the ideal sample collection time for asymptomatic patients varies from 3–5 days post-exposure, it is therefore suggested that the incorporation of antigen tests for the detection of SARS-CoV-2 on the day of departure to increase safety is not only at the time of departure but also during transport [61].

Approximately 65% of the protocols analyzed in this article define isolation until the disease has passed as essential for return, and 71% show the need to retest the infected athletes. The recommendation of the California Department of Public Health [62] indicates that the athlete can return only if he or she has completed the 10 days of isolation, does not present episodes of fever during the previous 24 h or has any other symptoms detected, thus being released after a test to return to the sport. The incorporation of retesting for the release of infected individuals, even after the quarantine period, is an essential measure added to the protocols to expand the control of the risks of transmission of the COVID-19 virus.

Within the scope of national and international competitions, travel by bus and by air is common in soccer. This is particularly relevant to Brazilian domestic soccer. When analyzing air travel, Freedman and Wilder-Smith [63] observed that the highest transmission rate occurs after travel due to the 10-day incubation period of the virus. In this study, cases of transmission were observed during the trips, 3 of them with a high transmission rate and one in which 58 passengers with the disease were being extradited and there was no new infection. The reason for the absence of contamination lies in the effectiveness of the proper use of masks. The 3 flights without masks required had an outbreak of COVID-19, but in the other flights analyzed where it was mandatory to wear a mask and comply with the other sanitary measures, the transmission rate was very low.

Applying these findings in contexts such as soccer, the research indicates that the need to travel to competitions and contact with competitors from other locations imposes an increased risk for infection [64]. The high frequency of entry and exit of players and members of teams and clubs from airports, bus stations and hotels can contribute to the spread of the virus amongst the teams and the wider population. Most teams (60%) decided to use charter flights during the 2020 Brazilian Championship [65], avoiding contact with external people, which is a strategy to minimize contacts. However, the travel necessary to fulfil fixtures required lodging in hotels, which increases the risk of contact with asymptomatic infected people, as staff and other patrons in these are not subjected to systematic testing protocols, as occurs in sports. The presence of an outbreak with employees of a hotel that received the French national team in the European qualifiers for the Qatar World Cup is an example of this reality [66], making fundamental the concern with the incorporation of measures away from the field of play in the protocols.

In the Chinese Super league, as well as in the UEFA Champions League and the Europa League, specific regions were selected for the matches. Thus, the players and members of the commissions remained in a single region until the end of the competition, following the health and safety protocols. The measure was effective in the Chinese Championship, which did not show athletes infected in the first round [67] and could be a potential best practice measure to be used elsewhere, including in the Brazilian Championship.

## 5. Conclusions

The comparative analysis of the protocols highlighted some weaknesses of the protocol implemented by the CBF regarding the risks of COVID-19 transmission. The high rate of

infections amongst players in the Brazilian Championship is highly suggestive of protocols which were either not robust enough, not well enforced or both. The study presents some individual, collective and managerial measures from other countries and organizations which were more effective in curbing the chain of transmission of COVID-19 which could easily be applied to the Brazilian Championship. Paramount here is the incorporation the policy of the three Ts: Test, Trace and Treatment, which in addition to amplifying the dynamics of tests, ensures the monitoring of contacts and the isolation and retest after the quarantine period. Additional to this policy are measures that suggest the creation of competition bubbles that reduce the amount of trips and flights taken, the incorporation of analysis of local and national epidemiological data to identify the transmission rate and the resonance of collection of individual measures of social distancing and use of masks in all environments. Though not covered by the timeline of this study, an emergent suggestion is to encourage the adherence of vaccination regularly against COVID-19 among athletes.

It is noteworthy that the present study is not intended to criticize football for wishing to continue during the pandemic, or to bar it from doing so. This analysis only seeks to compare the protocols, identify strengths and weaknesses and find new ways for the sport industry to continue in a safer manner for all involved. This work emphasizes the need to comply with health and safety measures in the protocols as their effectiveness helps to ensure a safer and more well-run championship. Even after vaccination of all, it is essential that all those involved in the sport follow the rules present in the protocols with commitment and seriousness.

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## References

1. World Health Organization. WHO Director-General's Opening Remarks at the Media Briefing on COVID-19-11 March 2020; c2020. Available online: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-COVID-19> (accessed on 17 June 2021).
2. World Health Organization. Coronavirus. Available online: [https://www.who.int/health-topics/coronavirus#tab=tab\\_1](https://www.who.int/health-topics/coronavirus#tab=tab_1) (accessed on 17 June 2021).
3. Liu, Y.C.; Kuo, R.L.; Shih, S.R. COVID-19: The first documented coronavirus pandemic in history. *Biomed. J.* **2020**, *43*, 328–333. [[CrossRef](#)] [[PubMed](#)]
4. Aquino, E.M.L.; Silveira, I.H.; Pescarini, J.M.; Aquino, R.; Souza-Filho, J.A.; Rocha, A.S.; Ferreira, A.; Victor, A.; Teixeira, C.; Machado, D.B.; et al. Medidas de distanciamento social no controle da pandemia de COVID-19: Potenciais impactos e desafios no Brasil. *Cien. Saude Colet.* **2020**, *25*, 2423–2446. [[CrossRef](#)] [[PubMed](#)]
5. World Health Organization. Modes of Transmission of Virus Causing COVID-19: Implications for IPC Precaution Recommendations; c2020. Available online: <https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-COVID-19-implications-for-ipc-precaution-recommendations> (accessed on 17 June 2021).
6. Centers for Disease Control and Prevention (CDC). Descrição Geral sobre a COVID-19 e Prevenção de Infecções e Prioridades de Controle em Estabelecimentos de Saúde Fora dos EUA; c2021. Available online: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/non-us-settings/overview/index-Portuguese.html> (accessed on 17 June 2021).

7. Valcarcel, B.; Avilez, J.L.; Torres-Roman, J.S.; Poterico, J.A.; Bazalar-Palacios, J.; Vecchia, C. The effect of early-stage public health policies in the transmission of COVID-19 for South American countries. *Rev. Panam. Salud. Publica.* **2020**, *44*, e148. [[CrossRef](#)] [[PubMed](#)]
8. Chang, S.L.; Harding, N.; Zachreson, C.; Cliff, O.M.; Prokopenko, M. Modelling transmission and control of the COVID-19 pandemic in Australia. *Nat. Commun.* **2020**, *11*, 5710. [[CrossRef](#)]
9. Wackerhage, H.; Everett, R.; Krüger, K.; Murgia, M.; Simon, P.; Gehlert, S.; Neuberger, E.; Baumert, P.; Schönfelder, M. Sport, exercise and COVID-19, the disease caused by the SARS-CoV-2 coronavirus. *Dtsch Z Sportmed* **2020**, *71*, E1–E12. [[CrossRef](#)]
10. Cavalcante, J.R.; Cardoso-dos-Santos, A.C.; Bremm, J.M.; Lobo, A.P.; Macário, E.M.; Oliveira Wanderson, K.; de França, G.V.A. COVID-19 no Brasil: Evolução da Epidemia Até a Semana Epidemiológica 20 de 2020. *Epidemiol. Serv. Saúde.* **2020**, *29*, e2020376. [[CrossRef](#)]
11. Governo Federal. Portaria N°356, 11 de Março de 2020; c2020. Available online: <https://www.in.gov.br/web/dou/-/portaria-n-356-de-11-de-marco-de-2020-247538346> (accessed on 17 June 2021).
12. Da Silva, L.L.S.; Lima, A.F.R.; Polli, D.A.; Razia, P.F.S.; Pavão, L.F.A.; Cavalcanti, M.A.F.H.; Toscano, C.M. Medidas de distanciamento social para o enfrentamento da COVID-19 no Brasil: Caracterização e análise epidemiológica por estado. *Cad. Saúde Pública* **2020**, *36*, e00185020, ISSN 1678-4464. [[CrossRef](#)]
13. Ministério da Saúde. Coronavírus Brasil; c2020. Available online: <https://COVID.saude.gov.br/> (accessed on 17 June 2021).
14. King, A.J.; Burke, L.M.; Halson, S.L.; Hawley, J.A. The Challenge of Maintaining Metabolic Health During a Global Pandemic. *Sports Med.* **2020**, *50*, 1233–1241. [[CrossRef](#)]
15. TOKYO 2020. Olympic Games Postponed to 2021; c2020. Available online: <https://tokyo2020.org/en/news/joint-statement-from-international-olympic-committee-and-tokyo2020> (accessed on 18 June 2021).
16. National Basketball Association (NBA). Coronavirus Pandemic Causes NBA to Suspend Season after Player Tests Positive; c2020. Available online: <https://www.nba.com/news/coronavirus-pandemic-causes-nba-suspend-season> (accessed on 26 June 2021).
17. Fédération Internationale de l'Automobile (FIA). Chinese Grand Prix Postponed Due to Coronavirus Outbreak; c2020. Available online: <https://www.formula1.com/en/latest/article.chinese-grand-prix-postponed-due-to-coronavirus-outbreak.3g2y5Ngyrk1MbNxQB9hj4s.html> (accessed on 26 June 2021).
18. Tovar, J. Soccer, World War II and coronavirus: A comparative analysis of how the sport shut down. *Soccer Soc.* **2021**, *22*, 66–74. [[CrossRef](#)]
19. Sports Value [Internet]. COVID-19 Economic Impact on Sports Industry; c2020. Available online: <https://www.sportsvalue.com.br/en/estudos/COVID-19-economic-impact-on-sports-industry/> (accessed on 26 June 2021).
20. Azêvedo, P.H. O esporte como negócio: Uma visão sobre a gestão do esporte nos dias atuais. *Estudos* **2009**, *36*, 929–939.
21. Corso, J.S.; Wornath, F.; Rodrigues, R.R.S.; da Silva, F.D.K. Realidade de atletas de alto rendimento durante a epidemia de COVID-19. In *Seminário de Iniciação Científica, 28, 2020, Ijuí*; Universidade Regional do Noroeste do Estado do Rio Grande do Sul, Salão do Conhecimento: Rio Grande do Sul, Brazil, 2020; Volume 6, pp. 1–5.
22. Mehrsafari, A.H.; Gazerani, P.; Moghadam Zadeh, A.; Jaenes Sánchez, J.C. Addressing potential impact of COVID-19 pandemic on physical and mental health of elite athletes. *Brain Behav. Immun.* **2020**, *87*, 147–148. [[CrossRef](#)]
23. Confederação Brasileira de Futebol (CBF). CBF Suspende Competições de Âmbito Nacional por Tempo Indeterminado; c2020. Available online: <https://www.cbf.com.br/a-cbf/informes/index/cbf-suspende-competicoes-de-ambito-nacional-por-tempo-indeterminado> (accessed on 18 June 2021).
24. Guterman, M. *O Futebol Explica Brasil: Uma História da Maior Expressão Popular do País*, 1st ed.; Contexto: São Paulo, Brazil, 2009.
25. Federação de Futebol do Estado do Rio de Janeiro (FFERJ). COVID-19: FERJ Elabora Protocolo de Segurança; c2020. Available online: <http://www.fferj.com.br/Noticias/View/17986#:~:text=A%20Federa%C3%A7%C3%A3o%20de%20Futebol%20do,%C3%B3rg%C3%A3os%20governamentais%20de%20Sa%C3%BAde%20permitirem> (accessed on 18 June 2021).
26. Fédération Internationale de Football Association (FIFA). COVID-19: FIFA's Return to Football; c2020. Available online: <https://resources.fifa.com/image/upload/1735-COVID-19-fifa-s-return-to-football.pdf?cloudid=iepkvqns9kek6fltlx8k> (accessed on 18 June 2021).
27. Confederação Brasileira de Futebol (CBF). CBF Publica Guia Médico para Retorno das Atividades do Futebol; c2020. Available online: <https://www.cbf.com.br/a-cbf/informes/index/cbf-publica-guia-medico-para-retorno-das-atividades-do-futebol> (accessed on 18 June 2021).
28. Premier League. #WeAreOneTeam; c2020. Available online: <https://www.premierleague.com/coronavirus> (accessed on 20 June 2021).
29. Asian Football Confederation (AFC). AFC Match Operations Protocol During COVID-19 Pandemic. *The AFC*; c2020. Available online: <https://www.the-afc.com/documents/afc-match-operations-protocol-during-COVID-19-pandemic-edition-2021> (accessed on 20 June 2021).
30. Australian institute of Sport (AIS). COVID-19 and Sporting Activity. AIS; c2020. Available online: <https://www.ais.gov.au/health-wellbeing/COVID-19> (accessed on 20 June 2021).
31. Football Federation Australia (FFA). FFA's COVID-19 Guidelines for Football; c2020. Available online: <https://www.nationalpremierleagues.com.au/news/ffa-COVID-19-guidelines-football> (accessed on 20 June 2021).
32. Liga Portugal. Plano de Retoma do Futebol Profissional; c2020. Available online: <https://www.ligaportugal.pt/pt/epocas/2020/2021/noticias/institucional/liga-divulga-plano-de-retoma-para-2020-21/> (accessed on 20 June 2021).

33. Confederación Sudamericana de Fútbol (CONMEBOL). Protocolo de Operações Atualizado para a CONMEBOL Libertadores E Sul-Americana 2020; c2020. Available online: <https://www.conmebol.com/pt-br/protocolo-de-operacoes-atualizado-para-conmebol-libertadores-e-sul-americana-2020> (accessed on 20 June 2021).
34. Federazione Italiana Giuoco Calcio (FIGC). Pubblicate le Linee Guida Governative per Gli Allenamenti Italiana Giuoco Calcio, Degli Sport di Squadra e di Base; c2020. Available online: <https://www.figc.it/it/giovani/news/pubblicate-le-linee-guida-governative-per-gli-allenamenti-degli-sport-di-squadra-e-di-base/> (accessed on 20 June 2021).
35. Real Federación Española de Fútbol (RFEF). Recomendaciones para Evitar los Riesgos sobre la Salud en la Vuelta a la Competición en el Fútbol; c2020. Available online: <https://www.rfef.es/recomendaciones-evitar-riesgos-salud-vuelta-competicion-futbol> (accessed on 20 June 2021).
36. Confédération Africaine de Football (CAF). Recommendations for the Development of Football Activity Recovery Plan; c2020. Available online: <https://images.cafonline.com/image/upload/caf-prd/uh1shk6fbnckbkelinj.pdf> (accessed on 20 June 2021).
37. Deutscher Fussball-Bund (DFB). Task Force Sportmedizin; c2020. Available online: [https://www.dfb.de/fileadmin/\\_dfbdam/226090-Task\\_Force\\_Sportmedizin\\_Sonderspielbetrieb\\_Version\\_3.0.pdf](https://www.dfb.de/fileadmin/_dfbdam/226090-Task_Force_Sportmedizin_Sonderspielbetrieb_Version_3.0.pdf) (accessed on 20 June 2021).
38. Union of European Football Associations (UEFA). UEFA Return to Play Protocol; c2020. Available online: <https://www.uefa.com/insideuefa/about-uefa/news/0260-100e86100861-0f897cbeff8f-1000--uefa-return-to-play-protocol/> (accessed on 20 June 2021).
39. United States Soccer Federation (US Soccer). US Soccer Play On; c2020. Available online: <https://www.ussoccer.com/playon> (accessed on 20 June 2021).
40. The Chinese Football Association (CFA); c2021. Available online: <http://www.thecfa.cn/index.html> (accessed on 20 June 2021).
41. Globo Esporte. Brasileirão 2020: Conheça Todos os 128 Times que Vão Disputar as Séries A, B, C e D no Próximo Ano. *GLOBO ESPORTE*; c2020. Available online: <https://globoesporte.globo.com/pb/futebol/noticia/brasileirao-2020-times-serie-a-serie-b-serie-c-serie-d.ghtml> (accessed on 20 June 2021).
42. Globo. Com Mais de 100 Mil Mortes, Brasil Supera 3 Milhões de Casos de COVID-19; c2020. Available online: <https://g1.globo.com/jornal-nacional/noticia/2020/08/08/com-mais-de-100-mil-mortes-brasil-supera-3-milhoes-de-casos-de-COVID-19.ghtml> (accessed on 30 June 2021).
43. Globo Esporte. Brasileirão Tem 320 Casos de COVID-19 Entre Atletas e Técnicos; Veja os Times Mais Afetados; c2021. Available online: <https://globoesporte.globo.com/programas/esporte-espetacular/noticia/brasileirao-tem-320-casos-de-COVID-19-entre-atletas-e-tecnicos-veja-os-times-mais-afetados.ghtml> (accessed on 22 June 2021).
44. Sparrow, A.K.; Brosseau, L.M.; Harrison, R.J.; Osterholm, M.T. Protecting Olympic Participants from COVID-19—The Urgent Need for a Risk-Management Approach. *N. Engl. J. Med.* **2021**, *385*, e2, 1–4. [CrossRef]
45. Wong, A.Y.; Ling, S.K.; Louie, L.H.; Law, G.Y.; So, R.C.; Lee, D.C.; Yau, F.C.; Yung, P.S. Impact of the COVID-19 pandemic on sports and exercise. *Asia Pac. J. Sports Med. Arthrosc. Rehabil. Technol.* **2020**, *22*, 39–44. [CrossRef]
46. Nishiura, H.; Oshitani, H.; Kobayashi, T.; Saito, T.; Sunagawa, T.; Matsui, T.; Wakita, T.; Suzuki, M. Closed environments facilitate secondary transmission of coronavirus disease 2019. *medRxiv* **2020**. 02.28.20029272v1 [PrePrint]. [cited on 2 December 2021]: [p. 6]. Available online: <https://www.medrxiv.org/content/10.1101/2020.02.28.20029272v1?versioned=true> (accessed on 9 September 2021). [CrossRef]
47. DiFiori, J.P.; Green, G.; Meeuwisse, W.; Putukian, M.; Solomon, G.S.; Sills, A. Return to sport for North American professional sport leagues in the context of COVID-19. *Br. J. Sports Med.* **2021**, *55*, 417–421. [CrossRef]
48. Comitê Olímpico Brasileiro (COB). Guia para a Prática de Esportes Olímpicos no Cenário da COVID-19; c2020. Available online: <https://www.cob.org.br/pt/documentos/download/d31e79368058e> (accessed on 22 June 2021).
49. Mast, E.E.; Goodman, R.A. Prevention of infectious disease transmission in sports. *Sports Med.* **1997**, *24*, 1–7. [CrossRef]
50. Daly, P.; Gustafson, R. Public health recommendations for athletes attending sporting events. *Clin. J. Sport Med.* **2011**, *21*, 67–70. [CrossRef]
51. Gonçalves, B.; Mendes, R.; Folgado, H.; Figueiredo, P.; Travassos, B.; Barros, H.; Campos-Fernandes, A.; Beckert, P.; Brito, J. Can Tracking Data Help in Assessing Interpersonal Contact Exposure in Team Sports during the COVID-19 Pandemic? *Sensors (Basel)* **2020**, *20*, 6163. [CrossRef]
52. Egger, F.; Faude, O.; Schreiber, S.; Gartner, B.C.; Meyer, T. Does playing (soccer) lead to SARS-CoV-2 transmission?—A case study of 3 matches with 18 infected football players. *Sci. Med. Footb.* **2021**, 1–6. [CrossRef]
53. Knudsen, N.S.; Thomasen, M.M.; Andersen, T.B. Spread of virus during soccer matches. *medRxiv* **2020**. 2020.04.26.20080614v1 [PrePrint] [cited on 2 December 2021]: [p. 4]. Available online: <https://www.medrxiv.org/content/10.1101/2020.04.26.20080614v1> (accessed on 9 September 2021). [CrossRef]
54. Meyer, T.; Mack, D.; Donde, K.; Harzer, O.; Krutsch, W.; Rossler, A.; Kimpel, J.; von Laer, D.; Gartner, B.C. Successful return to professional men’s football (soccer) competition after the COVID-19 shutdown: A cohort study in the German Bundesliga. *Br. J. Sports Med.* **2021**, *55*, 62–66. [CrossRef]
55. Moreno, M.; Coelho, M.L.R.A.; Câmara, F.P. COVID-19 em atletas no Campeonato Brasileiro de Futebol (Brasileirão) de 2020. *Braz. J. Dev.* **2021**, *7*, 35867–35874. [CrossRef]
56. Kemp, S.; Cowie, C.M.; Gillett, M.; Higgins, R.; Hill, J.; Iqbal, Z.; Jackson, P.; Jaques, R.; Larkin, J.; Phillips, G.; et al. Sports medicine leaders working with government and public health to plan a ‘return-to-sport’ during the COVID-19 pandemic: The UK’s collaborative five-stage model for elite sport. *Br. J. Sports Med.* **2021**, *55*, 4–5. [CrossRef] [PubMed]



57. Schumacher, Y.O.; Tabben, M.; Hassoun, K.; Al Marwani, A.; Al Hussein, I.; Coyle, P.; Abbassi, A.K.; Ballan, H.T.; Al-Kuwari, A.; Chamari, K.; et al. Resuming professional football (soccer) during the COVID-19 pandemic in a country with high infection rates: A prospective cohort study. *Br. J. Sports Med.* **2021**, *55*, 1092–1098. [[CrossRef](#)] [[PubMed](#)]
58. Gualano, B.; Brito, G.M.; Pinto, A.J.; Lemes, I.R.; Matos, L.D.N.J.; Pinto, A.L.S.; Loturco, I. High SARS-CoV-2 infection rate after resuming professional football in São Paulo, Brazil. *Br. J. Sports Med.* **2021**, 1–4. [[CrossRef](#)] [[PubMed](#)]
59. United Nations News. Testing, Tracing, and When to Lift Restrictions: WHO's Latest Advice; c2020. Available online: <https://news.un.org/en/story/2020/04/1061642> (accessed on 10 November 2021).
60. Globo Esporte. Valdívia, do Avaí, Deixa Partida no Intervalo ao Ser Comunicado que Testou Positivo para COVID-19; c2021. Available online: <https://globoesporte.globo.com/sc/futebol/times/avai/noticia/valdivia-do-avai-deixa-partida-no-intervalo-ao-ser-comunicado-que-testou-positivo-para-COVID-19.ghtml> (accessed on 23 June 2021).
61. Hellewell, J.; Russell, T.W. Estimating the effectiveness of routine asymptomatic PCR testing at different frequencies for the detection of SARS-CoV-2 infections. *BMC Med.* **2021**, *19*, 106. [[CrossRef](#)]
62. California Department of Public Health (CDPH). Outdoor and Indoor Youth and Recreational Adult Sports; c2021. Available online: <https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/outdoor-indoor-recreational-sports.aspx> (accessed on 24 June 2021).
63. Freedman, D.O.; Wilder-Smith, A. In-flight transmission of SARS-CoV-2: A review of the attack rates and available data on the efficacy of face masks. *J. Travel Med.* **2020**, *27*, taaa178. [[CrossRef](#)]
64. Gärtner, B.C.; Meyer, T. Vaccination in elite athletes. *Sports Med.* **2014**, *44*, 1361–1376. [[CrossRef](#)]
65. Globo Esporte. Voos Solos: Clubes Aproveitam Crise Aérea e Evitam Aviões Comerciais por Pacotes Fretados na Série A; c2020. Available online: <https://globoesporte.globo.com/futebol/noticia/voos-solos-clubes-aproveitam-cri-se-aerea-e-evitam-avioes-comerciais-por-pacotes-fretados-na-serie-a.ghtml> (accessed on 24 June 2021).
66. Globo Esporte. Hotel de Concentração da França Registra Surto de COVID-19; c2021. Available online: <https://globoesporte.globo.com/futebol/copa-do-mundo/eliminotorias-europa/noticia/hotel-de-concentracao-da-franca-tem-surto-de-COVID-19.ghtml> (accessed on 24 June 2021).
67. CNN Brasil. Sem Nenhum Caso de COVID-19, Campeonato Chinês quer Aumentar Públicos em Jogos; c2020. Available online: <https://www.cnnbrasil.com.br/esporte/2020/09/30/sem-nenhum-caso-de-COVID-19-campeonato-chines-quer-aumentar-publicos-em-jogos> (accessed on 23 June 2021).