


# Bio-secure bubble during the COVID-19 pandemic to host the Asian Football Confederation (AFC) Champions League: A retrospective observational study

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## Abstract

**Background and Aims:** To describe the COVID-19 positivity rate among football players, team staff, and local organizing committee members participated in the Asian Football Confederation (AFC) Champions League (West) tournament organized with the *Bio-secure bubble* protocol in place.

**Methods:** A retrospective observational study was carried out to include a total of 2184 participants during the AFC-West tournament in Qatar, which was a 3-week event (September 14–October 3, 2020). This event was undertaken under the Bio-secure bubble protocol, which was developed and implemented for sports events in Qatar during the pandemic. Within 72 h of departure and upon arrival in Qatar, all participants underwent reverse-transcriptase polymerase chain reaction testing (RT-PCR) to diagnose COVID-19. The test was considered positive based on the cycle threshold (cT) value which was <30, whereas, reactive if cT value was ≥30 and <40, and negative (cT > 40).

**Results:** Of the 2184 participants (528 players, 388 team staff, and 1268 local staff), 916 international participants were tested for COVID-19 PCR upon arrival at the Hamad International Airport, whereas the local staff ( $n = 1268$ ) were tested 2 days before entering the bubble. The mean age of the players was  $27.5 \pm 9.8$ . Fifteen teams participated and as many as 60 matches were played over 3 weeks. Most participants tested negative (95.3%) and 3.9% tests were inconclusive. During the entire tournament, the positivity rate was 2.7% among all participants. Of the total positive cases, 0.8% were positive before entering the bubble system. The remaining (1.9%) tested positive during the tournament phase (19 players, 16 team officials, and 8 organizing committee staff).

**Conclusion:** *Bio-secure bubble* protocol operated in a controlled environment presents a minimal risk of COVID-19 infection for hosting international football

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events. This framework could be benchmarked to resume professional football competitions under unprecedented pandemic situations.

#### KEYWORDS

AFC Champions League, Bio-secure bubble, COVID-19, football, SARS-CoV-2 infection, sports

## 1 | INTRODUCTION

With a potential risk of infection, the COVID-19 pandemic presents unprecedented public health threat, particularly for travelers and mass gathering.<sup>1</sup> Implementing preventive measures, such as lockdown and social distancing, adversely impacted professional sports worldwide, as many events were canceled. Notably, it is not unique that sporting events are being disrupted due to epidemic diseases. For instance, during the 2014 FIFA World Cup in Brazil, there was a threat of dengue and Zika viruses; despite that, the competition continued with precautionary measures.<sup>2,3</sup> Similarly, there are considerations for resumption of professional football events amidst the COVID-19 pandemic worldwide.<sup>4,5</sup> Fortunately, after the ease of lockdown, training and competition for football events were gradually resumed in many countries.<sup>6</sup> However, risk mitigation for disease transmission among participants remains the primary challenge for ensuring the integrity of competition and sportsmanship.<sup>7</sup>

Several unique challenges are associated with the resumption of international sporting events during the pandemic, such as safe travel arrangements for the team, risk-free accommodation, delivering training, and hosting sporting events safely.<sup>8,9</sup> The most apparent issues are enforcing social distancing and controlling the behavior of mass-gathering events, which may entail close physical contact between players, team staff, and local organizing committee (LOC) members during travel, accommodation, and interactions with the media. To achieve this, a new concept of bio-secure bubble has been introduced for sportspersons and their support staff in some countries for recommencement of major sports events during COVID-19. A bio-secure bubble is a sanitized area that operates in a strictly controlled environment involving the interaction between a specific set of people, all of whom need to test negative for COVID-19 by the reverse-transcriptase polymerase chain reaction (RT-PCR) testing. It includes all the elements of return-to-competition protocol in addition to isolated space (safe zone) which remains closed to outsiders. The mainstay of this protocol is regular COVID-19 testing, dedicated hotels, safe transportation methods to stadiums and training facilities, and regular disinfection of tournament venues, including training and media facilities. This basically entails adhering to strict protocols while in a hotel, traveling to venues, training sessions, actual sporting events, and visiting recreational areas. Isolation of players, staff, LOC members, and other related personnel is required in a bio-secure bubble to ensure “no” or “limited” contact with people outside the bubble.<sup>10-12</sup> Additionally, it also included regular COVID-19 testing, secure transportation, and routine disinfection of the tournament venues, including the media and training facilities.

Therefore, all stakeholders should be considered when planning safe event operations in a controlled environment.<sup>13</sup> Notably, the ongoing COVID-19 pandemic necessitates new dimensions and benchmarks for the safety, health, and well-being of all participants.<sup>13</sup>

By the end of 2020, sporting events were resumed in some countries in Europe, the United States, and Asia without spectators or with a limited capacity after safety precautions were taken to ensure spectator safety and the reduction of the risk of infection among athletes (Table 1). In the Middle Eastern region, Qatar has the opportunity to lead the way by benchmarking the best practices to gradually optimize the return of sports events through the implementation of robust precautionary measures, and will host the FIFA World Cup 2022. To test the readiness of the venues, operations of tournaments, and real-life experiences, Qatar hosted several local and international football events during the pandemic (Table 2).<sup>10,14-16</sup> Qatar's resumption of football events initiated with the Qatar Stars League (QSL), which was discontinued on March 16, 2020, due to the COVID outbreak and later on, which was resumed and completed successfully (June 8 to September 2, 2020) through the implementation of a robust return-to-competition protocol. Similarly, the Asian Football Confederation (AFC) Champions League was discontinued on March 4, 2020. Subsequently, with the control of SARS-CoV-2 transmission in August 2020, Qatar offered to host the AFC (West) Championship League. At that time, the international football activities gradually resumed in Qatar. The present study describes the COVID-19 positivity rate among participants in the AFC (West) tournament with the bio-secure bubble protocol in place.

## 2 | METHODS

We conducted a retrospective observational study to examine the results of the COVID-19 test among all AFC (West) participants to determine the efficiency of the bio-secure bubble in reducing the risk of COVID-19 transmission during an international sports event. This 3-week event (September 14 to October 3, 2020) was hosted without spectators. The West Asian Football Federation (WAFF), Central Asian Football Association (CAFA), and South Asian Football Federation (SAFF) associations are represented in the AFC West region. For this competition, 15 teams participated, and as many as 60 matches were played, including quarterfinals, semi-finals, and finals, and were hosted within bio-secure venues. All four stadiums (Al Janoub, Khalifa International, Education City Stadiums, and Jassim Bin Hamad Stadium) that hosted the AFC (West) tournament were FIFA World Cup 2022 stadiums, which provided an opportunity to

**TABLE 1** Implementation of safety measure benchmarks for hosting global sporting events during the COVID-19 pandemic era

Country	Events	Month	Precautionary measures
Germany	Restart 19 experiment	August 2020	<ul style="list-style-type: none"> <li>• 4000 spectators</li> <li>• Contact tracing</li> <li>• Social distancing</li> <li>• Air movement study</li> </ul>
	Eifel Grand Prix Formula 1	October 2020	<ul style="list-style-type: none"> <li>• 20,000 capping</li> <li>• Masks</li> <li>• Social distancing</li> </ul>
	Bundesliga football	May 2020	<ul style="list-style-type: none"> <li>• 20% capping</li> <li>• Social distancing</li> <li>• Home fans</li> <li>• No standing/spaced seating</li> </ul>
USA	NBA/Auburn University (AU)	July 2020	<ul style="list-style-type: none"> <li>• Bubble concept</li> <li>• Proximity alarms to avoid close contact</li> <li>• No spectator (NBA)</li> <li>• 20% capacity (AU)</li> <li>• Masks</li> </ul>
UK	Premier League and English Football League	August to September 2020	<ul style="list-style-type: none"> <li>• Masks</li> <li>• Social distancing</li> </ul>
Japan	Pro Baseball & J-League	July to September 2020	<ul style="list-style-type: none"> <li>• 50% capping permitted of venue's capacity for spectators</li> <li>• Yokohama Stadium (22% of venue's capacity)</li> <li>• Tokyo Dome (34% of venue's capacity)</li> <li>• Social distancing</li> <li>• Face masks</li> </ul>
	Tokyo Olympic and Para-Olympic games	October 31/November 1, 2020	<ul style="list-style-type: none"> <li>• Face mask and fan movement</li> <li>• Monitored using sensors</li> <li>• Spectators (80%)</li> <li>• All players and officials tested</li> <li>• Air movement study</li> </ul>

demonstrate Qatar's preparedness and readiness for the upcoming mega event. The AFC (West) tournament concluded with Iran's Persepolis FC overcoming the Al Nassr FC of Saudi Arabia to qualify for the AFC Champions League final.

In addition, we also assessed the monthly national incidence of RT-PCR-confirmed COVID-19 cases per 100,000 population (Qatar population: 2.8 million) from the beginning of the pandemic (March 2020) till end of the tournament (October 2020). We also estimated the daily incidence of RT-PCR-confirmed cases per 100,000 people during the AFC (West) Championship League (September 14 to October 3, 2020). The portal, Qatar Open Data ([data.gov.qa](http://data.gov.qa)) was used to retrieve information on the incidence of COVID-19 in Qatar. This is a part of the Qatar Digital Government strategy to share official statistical information available to the general public.<sup>17</sup> Data are presented as proportions and percentages.

For this study, fully anonymized data were collected from the electronic medical records of Hamad Medical Corporation and the study was approved with a waiver of informed consent by the Institutional Review Board of the Medical Research Center at Hamad medical corporation, Doha, Qatar (IRB #MRC-01-21-431).

### 3 | RT-PCR ANALYSES FOR COVID-19

All participants provided nasopharyngeal and oropharyngeal swabs (Huachenyang Technology). All RT-PCR assays required prevalidation before use. Samples for RT-PCR was collected in small tubes containing aliquots in proper transport medium. QIA Symphony platform (QIAGEN) was used to extract the aliquots and run for the reverse-transcription RT-qPCR using the TaqPath combo kit for COVID-19 on an ABI 7500 FAST (Thermo Fisher), using a custom protocol loaded to a Roche Cobas<sup>®</sup> 6800 system and analyzed by the Cobas<sup>®</sup> SARS-CoV-2 Test (Roche).

On the basis of the relevant cycle threshold (cT) of the amplified gene target, the results were interpreted in accordance with the manufacturer's instructions. Results were interpreted and reported on the basis of cT value. A cT value <30 was considered as positive, cT ≥ 30 and <40 was considered as reactive, and cT > 40 was regarded as negative test. Reactive samples were defined as those in which the risk of infection transmission was minimal. Following standardized procedures, all RT-PCR analyses were completed at the Communicable Disease Centre Laboratory at Hamad Medical Corporation, Qatar. The average time required for the validation and reporting of the test results was around 06 h.

TABLE 2 Overview of football events hosted in Qatar during pandemic (2020–2021)

Tournaments	Duration	Number of participants	COVID-19 positivity rate (%)	Event	Spectators <sup>a</sup>	Sports resumption protocol	Precautionary measures
Qatar Stars League <sup>14</sup>	9-week event (June 8, 2020–September 2, 2020)	1337	6.4	Local	No	Return-to-competition	<ul style="list-style-type: none"> <li>• Repeated PCR testing</li> <li>• Temperature check</li> <li>• Social distancing</li> <li>• Face mask (outside training and matches)</li> <li>• Hand hygiene</li> </ul>
AFC Champions League (West region) Current study	3-week event (September 14–October 3, 2020)	2184	2.7	Intercontinental	No	Bio-secure bubble	<ul style="list-style-type: none"> <li>• Secure isolated zone for all the participants</li> <li>• Protocolized PCR testing for all Bubble participants</li> <li>• Social distancing</li> <li>• Bubble venue, transportation, and hotels</li> <li>• Face mask (outside training and matches)</li> <li>• Protocolized results management</li> </ul>
AFC Champions League (East region) including final <sup>10</sup>	4-week event (November 18–December 19, 2020)	3158	0.15	Intercontinental	Yes <sup>b</sup>	Bio-secure bubble	<ul style="list-style-type: none"> <li>• Same as above</li> <li>• Pretesting all spectators</li> <li>• Spaced seating in stadium</li> <li>• Social distancing, mask-wearing</li> <li>• Managed spectator entry process</li> </ul>
Amiri Cup <sup>15</sup>	1-day event (December 18, 2020)	2893	0.42	Local	Yes <sup>c</sup>	Bio-secure bubble	<ul style="list-style-type: none"> <li>• Same as AFC (East) including final</li> </ul>
FIFA Club World Cup <sup>16</sup>	2-week event (February 1–11, 2021)	8192	0.015	International	Yes <sup>b</sup>	Bio-secure bubble	<ul style="list-style-type: none"> <li>• Same as AFC (East) including final</li> </ul>

<sup>a</sup>20%–30% seating capacity.

<sup>b</sup>Spectators undergone rapid antigen testing.

<sup>c</sup>Spectators were not under bubble but had undergone antigen testing within 48 h of the event and also included individuals recovered from COVID-19 and underwent antibody testing as spectators.

### 3.1 | “Bio-secure bubble” protocol for AFC (West) Championship

The AFC, the Qatar Football Association (QFA), and the Supreme Committee for Delivery & Legacy (SC) created the Bio-secure bubble protocol during the COVID-19 pandemic to ensure the safe return of practice and football competitions in the state of Qatar.<sup>18–21</sup> Briefly, the *Bio-secure bubble* protocol for the AFC (West) tournament without spectators followed protocolized PCR testing, clinical assessment, ready availability of healthcare support, and strict measures to control movement and physical interactions with individuals outside the Bio-secure bubble. Apart from players, coaches, and other team officials, family members were allowed to join the Bio-secure bubble under strict adherence to the protocol. This protocol is frequently reviewed and updated based on the Ministry of Public Health's (MoPH) recommendations. Figure 1 shows the infographics of COVID-19 measures under *Bio-secure bubble protocol* from the arrival of international participants to the final departure. Table 2 briefly shows the difference between the Bio-secure bubble protocol and other protocols such as return-to-competition protocol.

### 3.2 | Testing and management of COVID-19

All international participants (sports personnel, team staff, and match officials) were required to undergo COVID-19 testing within 72 h before travel using the RT-PCR test in their countries and should have negative test for COVID-19 to be allowed to travel to Qatar. All participants and match officials underwent a COVID-19 PCR test and were placed in a “Bio-secure bubble” environment upon arrival at Hamad International Airport. For local participants (organizing committee staff, sports personnel, and team staff or officials), PCR testing was done 1–2 days before entering the bubble system. Subsequent swabbing was performed for all participants every 3–6 days until the end of the tournament for COVID-19. A negative PCR test result was mandatory for participation in sporting events.

The LOCs staff constituted the Supreme Committee and QFA members. All were strictly confined to the bubble during the entire tournament. However, if there was a genuine reason, they were allowed to leave, but could not join the bubble again. They were replaced by individuals who tested negative for RT-PCR before joining the bubble. All bubble-related hotels had medical clinics with dedicated physicians and nurses available for the participants. The bubble hotels have additional capacity to isolate suspected COVID-19 cases, and a robust “response management plan” was in place for the *positive/reactive* cases diagnosed at the hotel or the venue (stadium) (Figure 2). Team players found *positive* or *reactive* while in the hotel, were immediately placed in isolation rooms. Similarly, *positive* or *reactive* cases detected in the stadium, en route to the stadium, or at the training site were removed from the venue and moved to the isolation rooms. The *positive* cases

were transported to an isolation facility, while *reactive* cases were self-isolated in their rooms for 7 days and retested on Day 6.

Figure 3 shows the infographics for the surveillance of COVID-19 infections using RT-PCR testing and further management plans for positive, reactive, and negative/inconclusive test results. All COVID-19-positive cases diagnosed before or during the event were transferred to an isolation facility and were retested on Day 9. If the test result was negative or reactive, it was released on Day 10. If the test results were nonetheless positive, they were kept in an isolation facility for an additional 14 days. Refusal of RT-PCR testing resulted in discontinuation of participation in the event.

### 3.3 | Management of close contacts of COVID-19-positive cases

A close contact was defined as a person involved in providing direct care for a suspected or confirmed COVID-19 case without proper personal protective equipment (PPE) within 2 m and for more than 15 min, or a healthcare worker handling specimens from a COVID-19 case without PPE, unprotected direct contact with infectious secretions of COVID-19, staying within 2 m of a COVID-19 patient for a period of time greater than 15 min, traveling together in close proximity (2 m) with a COVID-19-positive patient.<sup>22</sup> Contact tracing was applied to detect close contacts (primary as well as secondary; those who had an interaction with positive cases for >15 min from less than 2 m away in the previous 48 h) of the infected players and RT-PCR testing was performed at baseline and after 3 days. The frequency of testing for close contacts varied according to the case location and nature of work. Those with negative RT-PCR were allowed to participate in the training and matches but had to follow isolation during the stay and had to be retested after 3 days. If the subsequent test was negative, the player was allowed to resume normal participation. All close contacts were closely monitored for COVID-19 symptoms and were offered medical care if symptoms developed. Cleaning and disinfection of the areas with COVID-19-positive and close contacts during the AFC Champions League was performed effectively as per the standard international infection prevention and control guidelines. The high-touch surfaces were considered for priority disinfection. A comprehensive safety net of expert planning, vigorous testing, and medical protocols were put in place to ensure the health protection of all stakeholders, including players, and match officials. All high-touch surfaces inside the stadiums were disinfected daily, and multiple mobile handwash stations and automated hand sanitizer dispensers were placed to designated areas of the stadiums. Moreover, there was a separate ingress route for different teams to the stadium. A limited number of players and staff were allowed for training by implementing a staggered timetable for the AFC Champions League. Furthermore, symptom reporting and frequent testing were done for players, staff, and match officials.



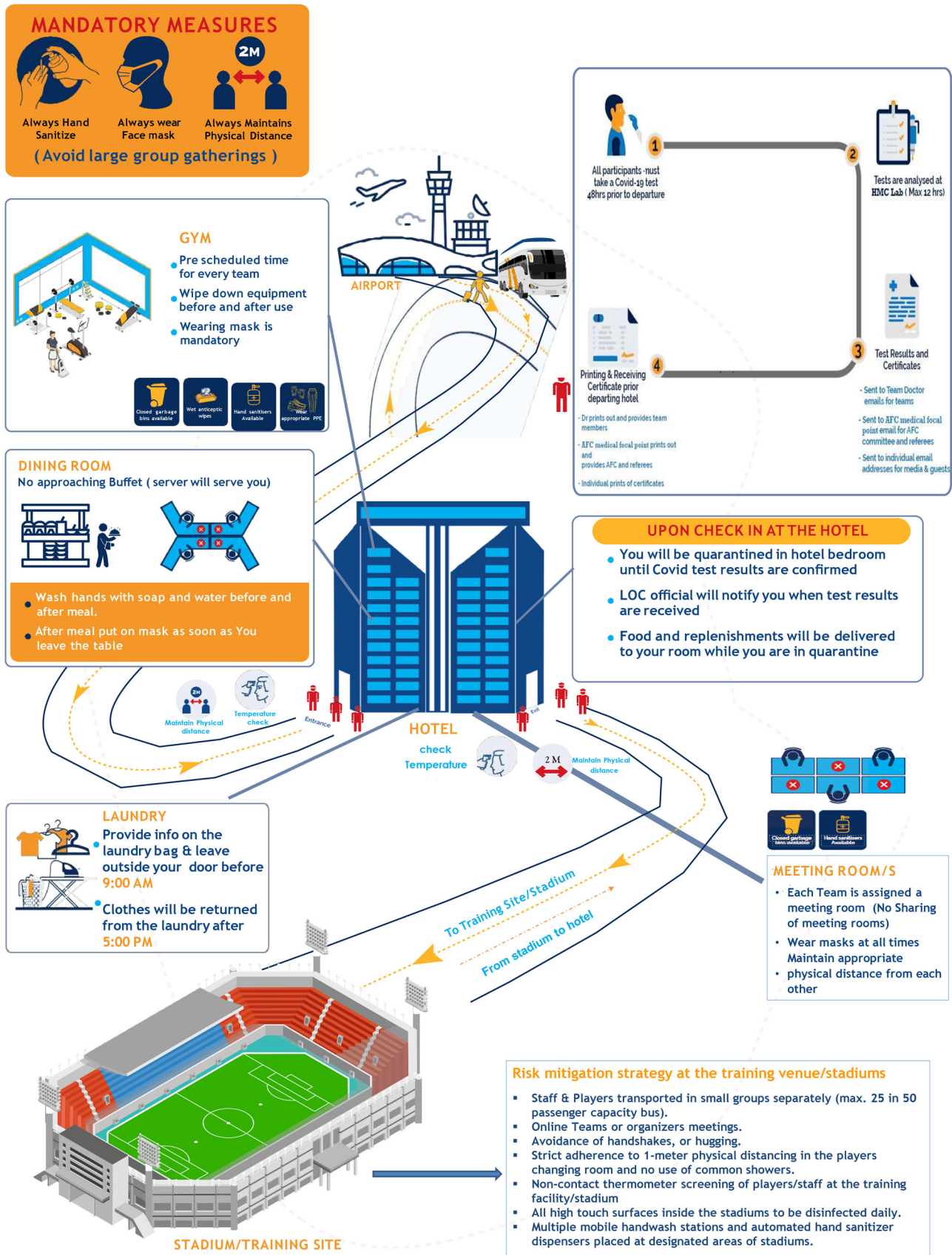
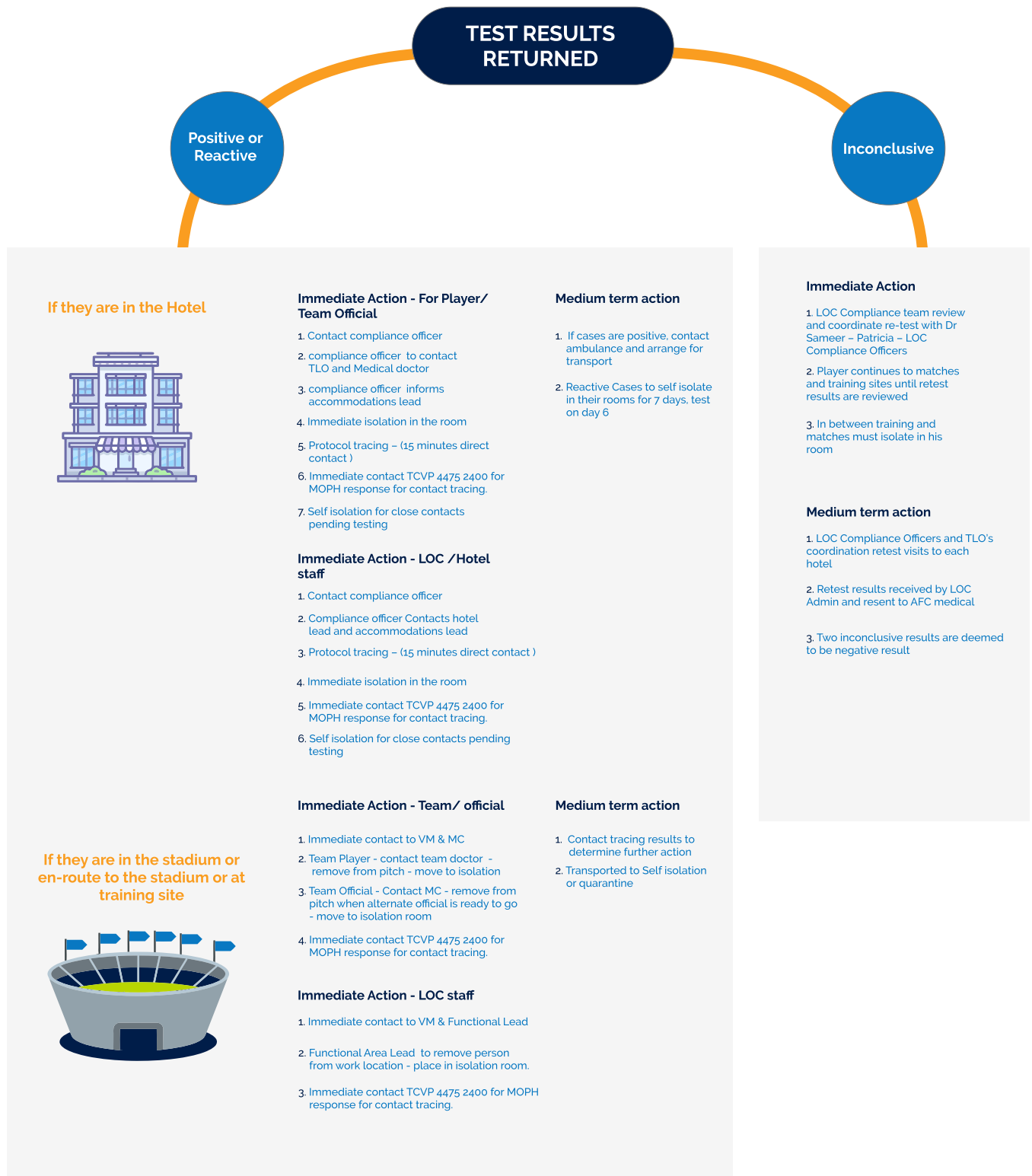


FIGURE 1 Infographics of the COVID-19 measures under Bio-secure bubble bio framework.

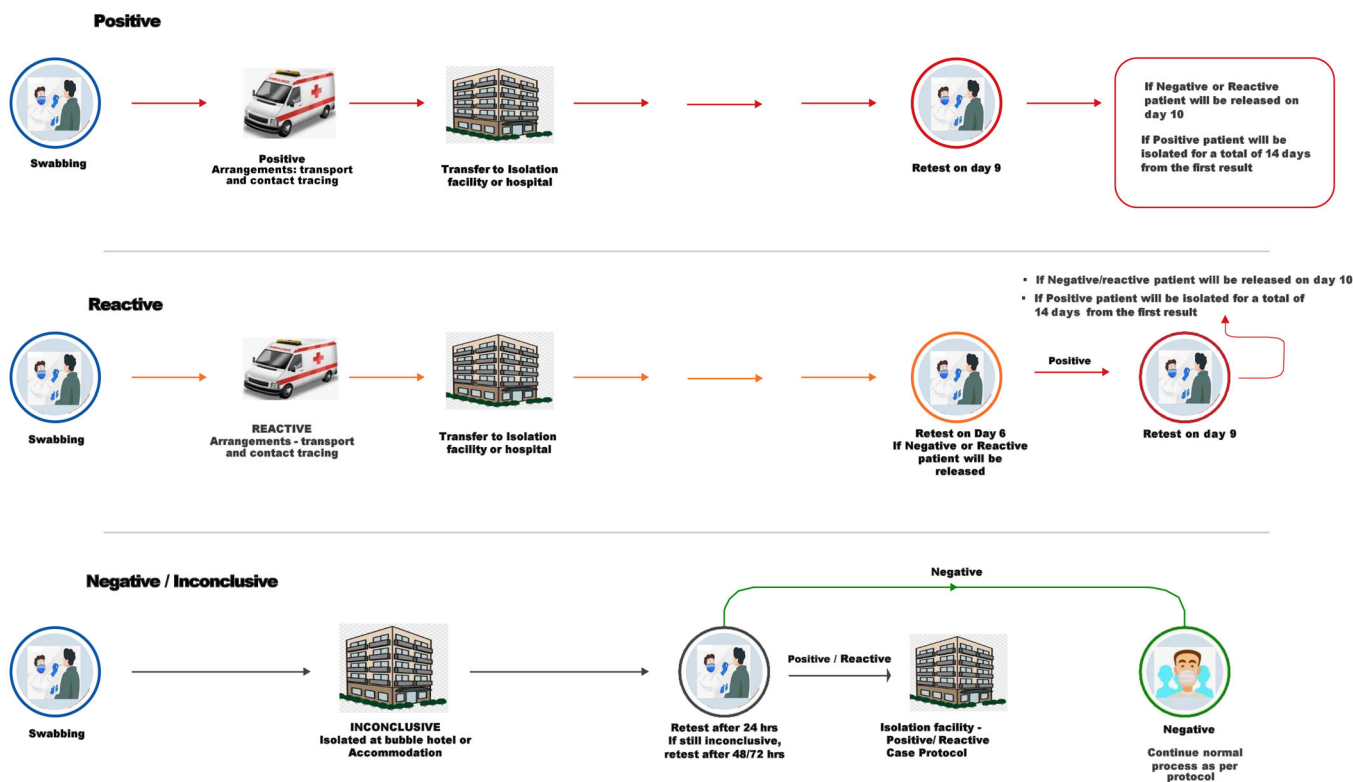


**FIGURE 2** Response plan for COVID-19 detection during the event.

### 3.4 | Transportation, accommodation, dining, and recreational facilities at the bubble hotels

Participants were transported to the venue in small groups to maintain social distancing (1.5 m front, side, and behind) with a

maximum seating capacity of 50% in the buses. All vehicles were equipped with covered bins to dispose of used tissues or other items. The participants and organizers were exclusively accommodated at the designated bubble hotels. On arrival at the accommodation, the participants were scanned for body temperature (<37.8°C) using



**FIGURE 3** Infographics for COVID-19 PCR result management protocol. PCR, polymerase chain reaction.

thermal scanners, ensure face masks, and were examined for signs and symptoms of COVID-19. The participants were only allowed to leave the accommodation for personal or group training sessions and the actual sporting event as per the official schedule with a *Bio-secure bubble*. For dining services in the bubble hotel, only four people were allowed to sit at the same table with a minimum distance of 1 m. Takeaway food, groceries, and other shopping items were allowed at bubble hotels, and the safety measure protocol set by the LOCs for delivery items was strictly followed. The participants were allowed to avail gyms and other recreational facilities at the accommodation/hotels with adherence to precautionary measures of sanitization and appropriate hygiene practices. Moreover, common showers, saunas, and steam rooms were prohibited at hotels.

### 3.5 | Training, interactions, and meetings at the stadium

The training venues had state-of-the-art infrastructure facilities such as FIFA-compliant floodlit, natural grass pitches, media facilities, and a gym. All participants wore a face mask while traveling, except during the training and competition. During training or matches, social distancing, designated changing rooms, transportation, and personal training equipment were implemented. Online meetings were conducted with the team members and organizers. However, if a physical meeting was necessary, it was preferably performed

outdoors by maintaining a safe distance (1 m) and masks during the entire meeting.

### 3.6 | Protocol for return to sports activities post-COVID-19 infection

All players or delegates who had COVID-19, developed symptoms, or were identified as having “close contact” with COVID-19 were evaluated before their return to the event. The decision to discontinue isolation precautions for COVID-19-positive players and other support staff was undertaken by the LOC Chief Medical Officer on a case-by-case basis, in consultation with other healthcare providers, if required. However, typically isolation can be discontinued after 10 days from the onset of symptoms and at least 5 days since the disappearance of symptoms, with PCR test reactive (Ct value more than 30) or negative on Day 8 or 9 from the date of the positive test.

In case of close contacts (including health care workers) who may have been exposed to individuals with suspected COVID-19 infection were isolated, monitored for their health for 14 days from the last day of possible contact and were provided immediate medical attention if they develop any symptoms (fever or coughing, shortness of breath and body ache, etc.). If they do not report to have any of the above symptoms, they were allowed to continue in the bio-secure bubble.



Furthermore, based on the history of COVID-19 and clinical presentation, participants were investigated for cardiac parameters (electrocardiography, echocardiography, and troponin test) and renal function tests. Once a decision to resume sports activity was made, a careful, gradual process of exercise adaptation was undertaken that included the establishment of a gradual increase in the duration and strength of exercise to achieve full adaptation.

### 3.7 | Departure and breach of bubble protocol

All participants of the tournament underwent COVID-19 testing 48 h before the departure. Compliance with the event-specific bubble protocol was mandatory, and hotel security reserved the right to disciplinary action against violators. As per the policy, anyone violating the bio-bubble protocol was barred from returning to the hotel and was transferred to another facility, not allowed event participation, and finally departed back to their home country. A contingency plan was also in place for bio-secure bubble burst, which included removal of all the positive participants from the bubble and subsequently isolating and testing all the close and casual contacts immediately. Furthermore, the frequency of repeat testing will be increased for all the participants within the bio-

secure bubble depending upon the nature and magnitude of the spread of COVID-19 infection.

## 4 | RESULTS

### 4.1 | COVID-19 PCR testing among participants

In total, 8563 COVID-19 PCR tests were performed on 2184 participants (528 players, 388 officials/team staff, and 1268 LOC staff) during the tournament. Of these, 916 international participants were tested for COVID-19 by PCR upon arrival at the airport, whereas the LOCs ( $n = 1268$ ) were tested 1–2 days before entering the bubble. The mean age of the 528 athletes was  $27.5 \pm 9.8$  years and players from 69 nationalities participated in the tournament. Table 3 shows the COVID-19 PCR test results among the participants upon entry into the *Bio-secure bubble* system and during the match phase. The majority of the participants tested negative (95.3%,  $n = 2081$ ), and 86 (3.9%) test results were inconclusive. The PCR tests were repeated every 6–9 days, according to the protocol for the early detection of infection and appropriate management. Table 4 summarizes the COVID-19 test results among players and team staff/officials stratified by age. The majority of players were in the age

**TABLE 3** COVID-19 PCR test result among participants of AFC Champions League (West) tournament

	Grand total ( $n = 2184$ )	Local organizing committee staff ( $n = 1268$ )	Sports person ( $n = 528$ )	Team staff/officials ( $n = 388$ )
PCR results upon entry into Bio-secure bubble system				
Negative	2081 (95.3%)	1205 (95.0%)	505 (95.7%)	371 (95.6%)
Inconclusive	86 (3.9%)	54 (4.3%)	17 (3.2%)	15 (3.9%)
Positive/reactive	17 (0.8%) <sup>a</sup>	9 (0.7%)	6 (1.1%)	2 (0.5%)
PCR results during the match-phase				
Positive	43 (1.9%) <sup>a</sup>	8 (0.6%)	19 (3.6%)	16 (4.1%)

Note: COVID-19-positive:  $cT < 30$ ; reactive:  $cT \geq 30$ .

Abbreviations: AFC, Asian Football Confederation;  $cT$ , cycle threshold; PCR, polymerase chain reaction.

<sup>a</sup>Overall COVID-19-positive rate = 2.7% (60/2184); COVID-19-positive rate among players = 4.7% (25/528).

**TABLE 4** Summary of the COVID-19 test results stratified by age

	18–30 years	31–40 years	>40 years
Players ( $n = 528$ )	381 (72.2%)	81 (15.3%)	66 (12.5%)
Positive	6 (1.6%)	0 (0.0%)	0 (0.0%)
Negative	362 (95.0%)	78 (96.3%)	65 (98.5%)
Inconclusive	13 (3.4%)	3 (3.7%)	1 (1.5%)
Team staff/officials ( $n = 388$ )	195 (50.3%)	75 (19.3%)	118 (30.4%)
Positive	2 (1.02%)	0 (0.0%)	0 (0.0%)
Negative	182 (93.3%)	74 (98.6%)	115 (97.5%)
Inconclusive	11 (5.6%)	1 (1.4%)	3 (2.5%)

group 18–30 years with 1.6% positivity rate. Similarly, half of the team staff/officials were in the age range 18–30 years with 1.02% positivity rate. Notably, none of the players or team officials were tested positive for COVID-19 in the age groups above 30 years old.

## 4.2 | COVID-19-positive/reactive cases

The overall positivity rate of COVID-19 infection among all participants was 2.7% (60/2184) during the AFC (West) Zone tournament. Of the total COVID-19-positive cases, 17 (0.8%) were found to be positive/reactive before entering the bubble system (6 players, 2 team officials, and 9 LOCs), and the remaining 43 (1.9%) participants tested positive/reactive during the tournament (Table 3).

During the match phase, a total of 35 sports persons including team staff/officials were tested positive for COVID-19 (19 players and 16 team staff/officials). Eight ( $n = 08$ ) members of LOC were reported positive for COVID-19 during the match phase (Table 3).

The overall positivity rate among players was 4.7% (25/528) for the entire event, of which 6 (1.1%) were positive on initial PCR testing and 19 (3.6%) were positive during the tournament.

At the time of testing, all players who tested positive for COVID-19 were asymptomatic. They were closely monitored and treated at the isolation facility. The majority of positive cases mainly came from seven clubs (25 players).

Among the 388 international team staff/officials, 2 (0.5%) tested positive on initial PCR testing at the airport, and 16 (4.1%) tested positive during the tournament, with an overall positivity rate of 4.6% (18/388). Among 1268 LOCs, 9 (0.7%) tested positive upon entry into the bubble, and during the tournament, 8 (0.6%) were found to be positive for SARS-CoV-2 (Table 3).

Appropriate medical care and support were provided to all participants who tested positive (14 days quarantine) or reactive (7 days quarantine) and who were under continuous medical supervision in an isolation facility, as per the bubble protocol. All the participants (players, team staff, and LOC staff) who tested positive or reactive during the entire tournament remained asymptomatic or had developed mild symptoms and did not require hospitalization, except for one of the team staff who was hospitalized for further management.

## 4.3 | Estimation of the national incidence of COVID-19 in Qatar (March–October 2020)

In Qatar, the monthly national incidence of COVID-19-positive cases gradually stabilized until the beginning of the AFC (West) tournament (Figure 4A). The incidence of COVID-19 cases peaked in May 2020 (494 positive cases per 100,000 individuals) and markedly declined by September 2020 (79 positive cases per 100,000 individuals). The same was true for the proportion of COVID-19 related-deaths per month, which was higher in June ( $n = 75$ ) and gradually decreased ( $n = 16$ ) in September 2020 (Figure 4B). During the study period, the

COVID-19 statistics in Qatar (population reference data) showed an overall lower risk of the disease burden in the general population. The frequency of COVID-19 cases on the first day of the tournament (September 14, 2020) was 7 cases per 100,000 individuals in Qatar. At the conclusion of the competition (October 3, 2020), the positivity rate per day further decreased to 6 cases per 100,000 people (Figure 4C). The overall COVID-19-related death ( $n = 10$ ) remained low during the study period among the general population. The safety of hosting professional international football events in Qatar was associated with the lower positive cases of COVID-19 in the whole country as shown in Figure 4A–C. This has reinforced the efficacy of the bio-secure bubble protocol that resulted in low positivity rate during the tournament.

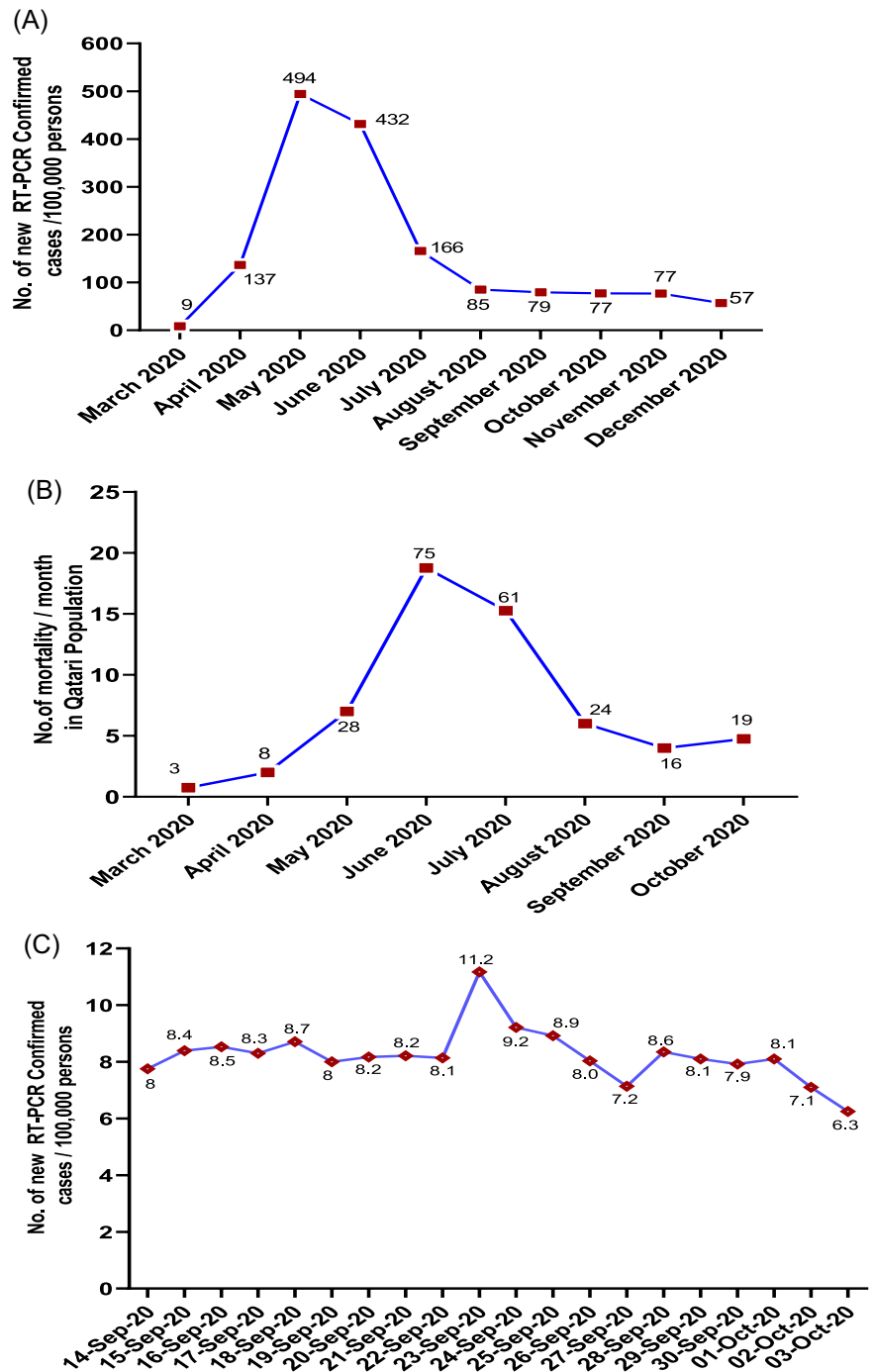
## 5 | DISCUSSION

The ability to safely resume sporting events in this unprecedented situation depends on putting safety measures in place for risk mitigation against the spread of COVID-19, particularly when there are higher chances of subsequent waves of COVID-19. At present, innovation in professional sports is key to offering robust protocols and procedures that can support athletes' return to play with appropriate preventive strategies involving social distancing, hand hygiene, and the use of face mask.<sup>23</sup> However, social distancing is a challenge in organizing mega sporting events such as football (soccer).<sup>9</sup> International football events require athletes to travel to the host country, which may increase the risk of disease transmission unless appropriate precautionary measures are in place.<sup>4</sup> Furthermore, there is an additional risk of airborne infection transmission through spectators attending the event. The WHO proposed recommendations to reduce the risk of transmission during mass gatherings in 2020 after consulting with international partners regarding safety measures involving those events.<sup>24</sup> In addition, the COVID-19 risk assessment tool for mass gathering sports events was developed by the WHO, which is a cyclic process based on the evaluation, mitigation, and explanation of the risk to the public, participants, and event staff.<sup>25</sup>

DiFiori et al.<sup>26</sup> proposed important contemplations and compendium to restore sports for American professional sports leagues, which describe the phased operations of competitions and training considering athletes' health and safety, teams, and other staff involved in the events.

This sports resumption protocol provides an in-depth guidance for the phased-in-play measures, such as directions for pre-event screening, during a sporting event, and a post-sporting event. These planning considerations can be implemented to resume safer elite sporting events worldwide in a controlled environment. In March 2020, the Royal Spanish Football Federation established a task force to develop guidelines for resuming football activities during the pandemic.<sup>27</sup> The guideline framework encompasses three components: clinical assessment and monitoring of the health status of athletes, training considerations, and suggestions of the possibility of

**FIGURE 4** (A) Incidence of RT-PCR confirmed COVID-19-positive cases per 100,000 population (2.8 million residents) by month since beginning of pandemic till end of tournament (B) number of deaths per month in Qatar since beginning of pandemic till end of tournament (C) incidence of RT-PCR confirmed cases per 100,000 population during the AFC (West) championship league (September 14–October 3, 2020). Data were retrieved from the Qatar Open Data Portal. AFC, Asian Football Confederation; RT-PCR, reverse-transcriptase polymerase chain reaction testing.



changing regulations during the event. At a professional level, there is a greater need to host these elite events in controlled settings to mitigate the risk of infection, leading to the introduction of a “biologically safe environment” or “bio bubble.”<sup>9,28,29</sup> It includes medical checkups before the competition, ready availability of medical care and protocolized PCR testing, and strict protective measures for players, ensuring their safety and other team members throughout the event.<sup>30</sup>

Qatar was a pioneer in marking the return of professional football events in the Middle Eastern region. This was started with the resumption of the QSL, which was initially discontinued in March

2020 and later restarted on June 8, 2020, with the implementation of a return-to-competition protocol.<sup>14</sup> This cohort study involving 1337 participants showed 6.4% positivity ( $n = 85$ ) among all participants, of which 36 were players (2.7%). Notably, this event was hosted during the high incidence period of COVID-19 in Qatar, with a reported incidence of 191 cases per 100,000 residents per week. This article offers practical insight into the application of evidence-based strategies for the successful restart of the international football league during the pandemic. The MoPH in Qatar created a “Bio-secure bubble” protocol for the secure resumption of professional sporting events during the COVID-19 pandemic after consulting with

international recommendations and best practices to allow participation of national and international football teams. According to this framework, a sporting event should involve a designated accommodation in which competing sports teams stay in isolation and safely play a series of games in a controlled environment to mitigate the risk of infection. This bio-secure bubble was utilized to host an international AFC Champions League (West) tournament in Qatar. The tournament had an overall lower risk of COVID-19 positivity (2.7%) among the participants. This could be attributed to the adequate risk mitigation procedures followed by the *bio-secure bubble* protocol and a lower community transmission rate during the tournament (7 positive cases per 100,000 individuals).

Therefore, the bio-secure bubble concept can be helpful and effective when combined with a risk assessment strategy based on scientific evidence that supports routine testing, hygiene precautions, social distancing, and daily symptom reporting to prevent COVID-19 infections among players. Furthermore, all participants in this report mostly worked in a safe and regulated outdoor environment. The predeparture tests seemed to guarantee that those entering the bubbles were already at low risk of transmitting COVID-19, despite the fact that all subjects had to undergo RT-PCR testing before embarking on international travel to reach the host country. The use of the Geolocation app (Ehtaraz) further enhanced the contact tracing efforts for the participants in the biosecure bubble and provided documentation.

Consistent with our observations, an earlier study from Denmark reported the successful implementation of a protocol for reopening football training and matching professional athletes.<sup>31</sup> This study demonstrated the resumption of a football league involving 26 teams and 748 athletes hosted during the spring season (May 19 to July 28, 2020). The authors reported a lower positivity rate of SARS-CoV-2 infection (0.06%) among the 6511 tests performed. Moreover, the positivity rate among the players was 0.53%.

Another observational study assessed the resumption of German football competition post-COVID-19 lockdown<sup>5</sup> with the implementation of the Bundesliga Hygiene Protocol. It follows the tracing of all COVID-19 cases, implementing strict hygiene, and protocolized COVID PCR testing among all participants, including athletes and staff with close contact. This study focuses on nine matches played between male German teams between May and July 2020 over a period of 9 weeks. Of the 1702 participants, 10 (0.6%) had positive results for the SARS-CoV-2 infection. Moreover, the positivity rate among the players was 0.74% (8/1079). The authors concluded that it was feasible to successfully host professional sporting events with a lower risk of infection by implementing stringent hygiene measures during the pandemic. Another subsequent study from Germany demonstrated a 2% (23/1157) seroprevalence of SARS-CoV-2 IgG among players and staff, which was determined at two-time points (and May/June 2020).<sup>32</sup> Table 5 shows a comparison of football events for SARS-CoV-2 infection following resumption of football with the current study.<sup>5,14,31,33–36</sup>

It is known that players and team staff travel together and may have a higher chance of interclub disease transmission.<sup>31</sup> In our

study, the overall positivity rates among the players and staff members were 4.7% and 4.6%, respectively. Notably, we observed a cluster of COVID-19 outbreaks in one team (53.3%), and the rest of the teams had sporadic cases of COVID-19. However, this did not lead to the transmission or spread of COVID-19 to other participants from different teams. The strict bio-secure protocol mandated the elimination of all participants with positive test results from the tournament. Previous football leagues also reported various mass outbreaks; however, these did not result in a chain of infections.<sup>5,14,31</sup>

Notably, over time, the infectivity rate of COVID-19 fluctuated substantially within a country. Therefore, the variability in the reported incidence of sporting events should be evaluated considering national and international events. Despite the strict testing protocol and precautionary measures during sporting events, there are chances of infection transmission during tournaments.<sup>37</sup> Under the current unique circumstances, a multidisciplinary approach should allow hosting sports competitions with acceptable medical risks to all participants.<sup>9</sup> In addition, detailed medical and hygienic-sanitary instructions should be followed.<sup>38</sup> The practical success of the stipulated sporting event guidelines may boost professional league organizers' confidence in allowing the reopening of competitions in other parts of the world.<sup>39</sup> Therefore, the robust bubble framework used in the AFC (West) tournament may prove to be a benchmark for regional and international clubs that ensures the safe hosting of elite professional sports with spectators during the pandemic. Qatar continues to host international football competitions despite the fact that professional sports without spectators appeared to be the norm for the near future (Table 2).<sup>10,14–16</sup> The positive rate of COVID-19 pandemic in each football events is given in Table 2. However, with gradual reopening of football events without spectators, Qatar moves ahead to host events with spectators. A recent study from our center have shown that football events involving mass gathering can be staged successfully with fully vaccinated participants.<sup>40</sup> In addition, other outdoor sports (Qatar motorcycle Grand Prix) with a limited number of spectators was hosted in Qatar.

## 5.1 | Study limitations

The inaccessibility of the athletes' and support staff's prior health data is one of the study's limitations, but as per the traveling regulations, we assumed them to be healthy otherwise, in a good state of health. All players, including those diagnosed with COVID-19, were asymptomatic before testing, as per the health checkup record. However, we lacked information about the clinical presentation of team officials and LOC staff diagnosed with COVID-19 during the tournament. Transmission of infection among players during training and football events appears unlikely owing to the lower risk of infection spread during outdoor football; however, this cannot be ruled out. Compliance with preventive measures relies on the willingness of participants to follow a strict protocol, which is not considered on an individual

**TABLE 5** Comparative outline of COVID-19 infection, mitigation measures, and protocol adopted for the resumption of football tournaments during the COVID-19 pandemic (2020-2021).

Event and country	Duration	Total population	Positivity rate	Mitigation measures
Italian Football Federation, Italy <sup>33</sup>	March 2020–February 2021	54 (25 players and 26 staff members)	11.1% RT-PCR positive (players and staff). 66% IgG positivity (67% players and 65% staff members).	Tournament-specific strict surveillance protocol for COVID-19: screening 72–96 h before the first training session by RT-PCR both SARS-CoV-2 RT-PCR and serological testing and repeated every 4 and 14 days. Mitigation strategies included physical distancing and wearing masks during meetings, medical treatments, and rehabilitation sessions.
German Bundesliga football (soccer), Germany <sup>5</sup>	May–July 2020	1702 (1079 players, 623 match officials)	N/A	Daily symptom monitoring, PCR testing for SARS-CoV-2 RNA twice weekly, and antibody tests.
Danish Football League, Denmark <sup>31</sup>	May 19–July 28, 2020	748 players	0.53% (4/748)	<i>Protocol for the resumption of training and match play across all professional football competitions in Denmark</i> , self-reported health checks for all on-pitch staff, and daily health questionnaire and testing by strand invasion-based amplification (SIBA <sup>®</sup> ).
Qatar Stars League, Qatar <sup>14</sup>	8 June–September 2, 2020	1337 football players, staff, and officials	6.4% (overall), 4.4% (players)	Return-to-competition protocol: strict hygiene measures and regular testing (SARS-CoV-2 PCR testing every 3–5 days) combined with serology testing for immunity (every 4 weeks), temperature checks, hand hygiene social distancing, wearing a mask outside training and matches.
São Paulo professional soccer Sao Paulo, Brazil <sup>34</sup>	4 July–December 21, 2020	4269 players and 2231 staff	11.7% (players), 7.2% (staff)	The Sao Paulo Football Federation (SPFF) protocol for reopening football involved repeated RT-PCR testing on weekly basis, regular temperature checks, social distancing, mandatory mask outside training and matches, and limited number of staff in the stadium.
The National Football League (NFL) and the NFL Players Association (NFLPA), USA <sup>35</sup>	August 9–November 21, 2020	11,400 players and staff members	2.9% (329/11,400)	Strict risk mitigation protocol involving, mandatory masking; physical distancing; frequent hand washing; facility disinfection; restricted facility access; and regular, frequent RT-PCT testing of players and staff members every 6 days, contact tracing.
Persian Gulf Football League, Iran <sup>36</sup>	September–October 2020	1243 players	Seropositivity (17.9%), RT-PCR positivity (2.3%)	Physical distancing, regular temperature checks, social distancing, mandatory mask outside training and matches symptom reporting, testing by RT-PCR, serological testing.
Asian Football Confederation Champions League (West) tournament, Qatar (present study)	September 14–October 3, 2020	2184 (528 players, 388 team staff, and 1268 local staff)	Overall, 2.7% (60/2184); (players: 4.7%; staff: 4.6% LOCs: 1.3%)	Bio-secure bubble protocol: All participants were put in a strict bubble zone with dedicated bubble hotels, training stadiums, and regular COVID-19 RT-PCR testing (every 6–9 days) of players and staff, other mitigation strategies included physical distancing and wearing masks outside training and matches.

Abbreviations: LOC, local organizing committee; RT-PCR, reverse-transcriptase polymerase chain reaction testing.



basis. Finally, this article does not consider the resuming of football events with spectators; however, the latter has been covered in a recent publication analyzing the experience of hosting football events with spectators utilizing the bio-secure bubble protocol in Qatar.<sup>10</sup> In the early phase of the pandemic, the bio-secure bubble was the only feasible option, but currently with the mass vaccination against SARS-CoV-2 is ongoing worldwide and the fact that more than 65% of the world population has been vaccinated, the risk of spectators and athletes getting infection has been reduced significantly. So, the bio-secure protocol which was effectively tested to mitigate the risk of COVID-19 infection can be implemented in case of future/similar outbreaks of disease in the form of pandemic until specific measures and vaccinations become in-place and effective.

## 6 | CONCLUSIONS

Our findings suggest that the *bio-secure bubble* protocol operated in a controlled environment is safe for hosting professional international football events. In light of the ongoing COVID-19 pandemic, this framework might serve as a benchmark for the safe return of professional football tournaments. Qatar is a pioneer in the region for meticulously implementing the *bio-secure bubble* protocol, which is efficient in the rapid diagnosis of infected individuals who can be immediately isolated to prevent viral transmission and followed up for further management. The successful hosting of the AFC (West) Championship League affirms Qatar's preparedness and readiness to host the FIFA World Cup 2022.

### AUTHOR CONTRIBUTIONS

**AbdulWahab Abubaker Al Musleh:** Conceptualization; methodology; supervision; writing – review & editing. **Mohammad Asim:** Conceptualization; data curation; formal analysis; methodology; writing – original draft. **Sameer Abdurahiman:** Data curation; methodology; resources; validation. **Ayman El-Menyar:** Conceptualization; validation; writing – review & editing. **Naushad Ahmad Khan:** Conceptualization; data curation; formal analysis; methodology. **Hassan Al-Thani:** Conceptualization; methodology; supervision. All authors have read and approved the final version of the manuscript (the authors AbdulWahab Abubaker Al Musleh, Naushad Ahmad Khan, Mohammad Asim, Sameer Abdurahiman) had full access to all of the data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

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### CONFLICT OF INTEREST

The authors declare no conflict of interest.

### DATA AVAILABILITY STATEMENT

The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

### TRANSPARENCY STATEMENT

The lead author Ayman El-Menyar affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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