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## Large-scale international volleyball competition in “bubble” under the COVID-19 pandemic



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### ABSTRACT

**Objective:** To verify whether a large-scale international volleyball competition could be conducted safely using the bubble method, both for our participating team and as a whole.

**Methods:** All 32 men's and women's teams were gathered in one place and a large-scale international volleyball competition was held for over a month without spectators using the bubble method. More than 1,000 people participated in the event, and 572 volleyball players played a total of 248 matches during the competition. There were 54 participants from Japan, including 27 male and female staff and players each. There was one team doctor for both men and women. A total of 2,250 PCR tests and 7,920 antigen tests were performed over 38 days. We investigated the incidence of infection in our team and in all participating teams.

**Results:** There were 9 fever cases from our men's team, but all of them tested negative for COVID-19. Overall, a total of 10,170 tests were performed and only one was positive.

**Conclusion:** In order to ensure the health and well-being of all participants, the indoor competition was concluded safely without the occurrence of COVID-19 clusters in the bubble system with strict adherence to various strict protocols of COVID-19.

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## 1. Introduction

Coronavirus disease 2019 (COVID-19) was first identified in China in December 2019, causing a cluster of respiratory diseases.<sup>1</sup> This new virus rapidly spread around the world, and the World Health Organization declared a pandemic in March 2020.<sup>2</sup> The global crisis affected all life aspects, including sports. Major national and international sporting events were affected, including the Tokyo Olympic Games, which were postponed until the summer of 2021. The “bubble” method of cutting off contact between the athletes and the outside world is one solution to stop the spread

of COVID-19.<sup>3</sup> We report herein our experience with a large-scale international volleyball competition using the bubble method.

## 2. Methods

### 2.1. Competition outline

In 2018, the Volleyball Nations League (VNL) was inaugurated by the International Volleyball Federation (The Fédération Internationale de Volleyball [FIVB], Lausanne, Switzerland). Sixteen teams of both men and women played a single round-robin system over five weeks, and the top six teams then competed in a five-day final round to determine the final ranking. In 2020, VNL was canceled owing to the COVID-19 pandemic. In 2021, the VNL was held in Rimini, Italy, where all teams, officials, and staff were enclosed in a bubble without spectators. A total of 572 volleyball

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players played 248 matches. More than 1000 people, including players, teams, and competition management staff, participated. The women's and men's competitions were held from May 25 to June 25, and from May 28 to June 27, respectively. The men's and women's teams alternated games and practices for three days each at the same venue, but basically there was no contact between them. In addition, more than 100 television production teams were included in the bubble.

## 2.2. Hygiene management system

### 2.2.1. Sanitation practices were governed by guidelines issued by the competition task force

(VNL 2021-COVID-19 VOLLEYBALL SAFETY GUIDELINES; <https://www.fivb.com/-/media/volleyball/regulations%20and%20forms/vnl%202021%20-%20covid-19%20volleyball%20safety%20guidelines.pdf?la=en&hash=FBDEA253CC1BA3F84AD2774423E688A4>). Basic hygiene management included wearing masks, maintaining social distancing, frequent hand washing and disinfection, and air purification through ventilation, as shown in Fig. 1. Only non-woven masks were allowed, not including cloth or urethane masks. Masks were required to be worn at all times, even during games, except for players and head coaches. No one was allowed to leave the bubble, except for transport to the hotel and activity venues, which was allowed only by designated means of transportation (mainly buses), and going out for other reasons was not allowed. In the designated hotel, only trips to the private beach for relaxation were allowed. Each team was assigned a specific time to take their meals. Although buffet style, all meals were served by the restaurant staff. In the hotel, we tried to avoid contact with other teams as much as possible, including in the elevators. The person-in-charge was required to send a daily health report of the entire team to the task force platform.

### 2.2.2. Inspection system

As shown in Table 1, all participants were required to take a PCR test and a negative result before leaving the respective countries. Upon arrival, the participants were taken directly to the hotel where they were staying and were not allowed to enter the bubble until another PCR test was conducted at the hotel, with a negative result. During the competition, antigen qualitative tests were

conducted at the venue every four days. Participants had to wait in the waiting area for about 10 minutes, and were allowed to enter the venue once the negative results were confirmed. If the test result was positive or uncertain, the PCR test would be conducted immediately in another room. After the competition, PCR tests were also conducted at the venue before leaving for home, and if the results were negative, a certificate was issued and we left for home. In addition to the regular tests, if there were any symptoms related to COVID-19, it was agreed that the task force would conduct tests as needed.

### 2.2.3. Composition of our team

The Japanese team consisted of 27 men and 27 women (17 players each), including one team doctor. Except for the team doctor, the 53 team members were unvaccinated. Three male players and one female player had a previous COVID-19 infection.

We investigated the infection status of the Japanese team in the bubble and the results of the overall examination to verify the effectiveness of the bubble method.

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## 3. Results

In the Japanese team, there were a few fever cases among the male members (Table 2). In the women's team, there were no cases of fever or symptoms suggestive of COVID-19. In the men's team, three staff members had temperatures of  $\geq 37.5^\circ$ . All of them were additionally tested for antigens or PCR by the task force, and diagnosed as acute gastroenteritis, pyogenic tonsillitis, and acute upper respiratory infection, respectively. One staff member diagnosed with pyogenic tonsillitis had tonsillitis with white moss, and was treated with 5 days of antimicrobial treatment for suspected streptococcal infection. Six players had fever. The fever broke within a day except for the first one. All of them had a sore throat, without no evidence of tonsillitis. The first patient had a fever that broke within two days, and a sore throat that persisted for several days. In both cases, additional antigen or PCR tests were performed using the task force, and all were negative. An acute upper respiratory tract infection caused by a non-coronavirus was diagnosed due to sequential morbidity.

## General Hygiene Measures – Safe Harbour

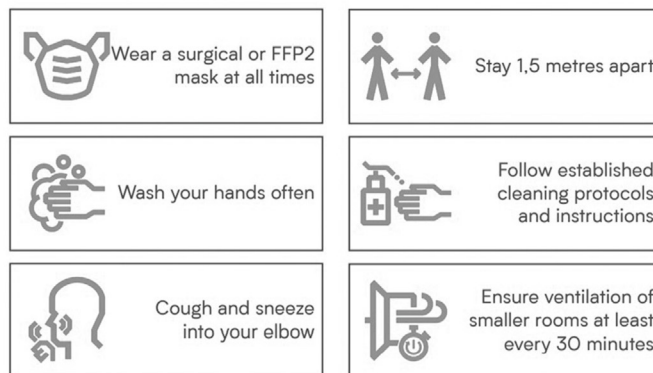


Fig. 1. General hygiene precautions by Fédération Internationale de Volleyball.

**Table 1**  
Timing and types of tests.

Before departure
PCR test for COVID-19 within 48 hours of departure
Negative certificate issued in English
Upload all team members' test certificates to the FIVB platform
After arrival
PCR test on arrival at the accommodation hotel
During competition
Antigen qualitative test at the venue every four days
If results are questionable or positive, adding immediate PCR tests
Before returning home
PCR test at the venue
Negative certificate issued in English

**Table 2**  
Cases with fever.

Days after arrival	Roles	Duration of fever (day)	Associated symptoms	Final diagnosis
Day 2	staff	1	stomach ache, lower back pain	acute gastroenteritis
Day 3	staff	2	sore throat	pyogenic tonsillitis
Day 7	player	2	sore throat	acute upper respiratory tract infections
Day 7	player	1	sore throat	acute upper respiratory tract infections
Day 8	player	1	sore throat	acute upper respiratory tract infections
Day 8	player	1	sore throat	acute upper respiratory tract infections
Day 10	player	1	sore throat	acute upper respiratory tract infections
Day 11	staff	2	sore throat	acute upper respiratory tract infections
Day 17	player	1	sore throat	acute upper respiratory tract infections

In the competition, 2250 PCR tests and 7920 antigen tests were performed in 38 days. The only positive case was that of a bus driver who drove a team from the hotel to the training site and back. Immediately after the test results returned, the bus driver was released from the bubble and quarantined, and the players and staff of the team underwent additional tests, all of which returned negative results. Since it was before the competition, there was no direct impact on the team's ability to compete or hold the competition.

#### 4. Discussion

##### 4.1. Bubble in sports event

COVID-19 is a novel disease, and as new information is gathered by the scientific community, countermeasures and practices must change accordingly. Events that attract large numbers of people, including cultural activities, such as sporting events, indoor gatherings, plays, and concerts, have been identified to be high-risk for COVID-19 transmission (Guidance for Organizing Large Events and Gatherings; <https://www.cdc.gov/coronavirus/2019-ncov/community/large-events/considerations-for-events-gatherings.html>, Updated May 20, 2021).<sup>4,5</sup> The word “bubble” has been used to refer to the area where competing sports teams are quarantined and reside to safely play their games during the COVID-19 pandemic. The players and their officials must follow the established safety regulations around the clock, whether during games, practices, or off-hours. The NBA professional basketball team in the United States has achieved success through a strict and comprehensive strategy, setting a great precedent for future sports bubbles.<sup>3</sup> The bubble method has also been adopted in the World Cup in football, and was effective in controlling infection.<sup>6</sup> For this competition, the FIVB worked with local public health authorities to conduct a risk assessment in line with the WHO best practices. As a result, stringent measures were taken to minimize the health risks to athletes and staff. These data provide a direct benefit in that COVID-19 transmission can be minimized or reduced to zero if large

international competitions are held safely and appropriate risk mitigation factors are implemented. In addition, the number of personnel within the bubble group is minimized and operational integrity is maintained. This study is one of the rare reports of COVID-19 transmission among convention staff in the field using the bubble concept, which combines regular testing, hygiene measures, physical distancing, and daily symptom reporting. All participants in the competition were tested negative by PCR prior to travel to the host country and again upon arrival. One local staff member tested positive, and the source was determined to be non-external. Therefore, we were able to limit the risk of transmission within an individual bubble, which is a significant phenomenon for an indoor competition.

##### 4.2. Description of our team's fever

The symptoms of one player and six other players were similar, except for two staff members who developed fever on days 2 and 3. There were no cases of persistent high fever or specific symptoms, such as ageusia, and from the infectiousness of the cases, we thought it was very likely that the upper respiratory tract infection was caused by a non-coronavirus. Although general hygiene precautions were followed, it proved to be very difficult to avoid droplet infection, especially among players who played and practiced without masks.

##### 4.3. Limitation

A limitation of this study is that the final diagnosis was made based on a single test and the subsequent course of symptoms, not always at the same time as the outbreak of fever in the team concerned. In our case, there was no suspicion of COVID-19 infection based on the clinical course, but a more reliable protocol for detecting COVID-19 is needed in such cases, and future improvements are required. Furthermore, although there was only one case of COVID-19 infection, it is important to note that not all positive cases could be identified. Detailed information on the patients,

including the route of infection, has not been made public due to privacy concerns, and this information is not available. The details of the testing method, i.e., what kind of test kit was used and how accurate it was, were known only to the convention headquarters and not to us.

## 5. Conclusion

A large-scale international volleyball competition was concluded safely without the occurrence of COVID-19 clusters within the bubble system, after adherence to various strict COVID-19-related protocols. These experiences will be useful for future large-scale sporting events.

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Conception and design of study: T. Nishino, K. Obara.

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### Declaration of competing interest

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### References

- Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395(10223):497–506.
- Escher Jr AR. An ounce of prevention: coronavirus (COVID-19) and mass gatherings. *Cureus*. 2020;12(3), e7345.
- McHill AW, Chinoy ED. Utilizing the National Basketball Association's COVID-19 restart "bubble" to uncover the impact of travel and circadian disruption on athletic performance. *Sci Rep*. 2020;10(1):21827.
- Althouse BM, Wenger EA, Miller JC, et al. Superspreading events in the transmission dynamics of SARS-CoV-2: opportunities for interventions and control. *PLoS Biol*. 2020;18(11), e3000897.
- Adam DC, Wu P, Wong JY, et al. Clustering and superspreading potential of SARS-CoV-2 infections in Hong Kong. *Nat Med*. 2020;26(11):1714–1719.
- Massey A, Lindsay S, Seow D, Gordon J, Lowe DJ. Bubble concept for sporting tournaments during the COVID-19 pandemic: football club world Cup. *BMJ Open Sport Exerc Med*. 2021;7(2), e001126.