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A Practical Approach to SARS-CoV-2 Prevention and Containment in a National Sporting Event in Italy: A Public Health Model Applicable Also to Other Respiratory Viruses?

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Abstract: The Italian sporting event 'XIV Convittiadi' involving students at boarding schools took place in Molise region, central Italy, in April 2022. The study describes the public health protocol with specific countermeasures developed for the event, including testing, isolation, and contact tracing during the COVID-19 pandemic, and reports the main related findings. There were 590 Italian white participants, with 514 athletes (mean age 13.6 ± 1.6 years) and 76 accompanying teachers/guardians (50 ± 8.7 years) of 21 boarding schools from different Italian regions. During the event, 1281 antigenic swabs were performed, and twelve COVID-19 cases were promptly identified due to active screening, involving ten (83.3%) athletes and two (16.7%) accompanying teachers. Among the infected athletes, 83.3% complained mild symptoms, either before or after the ascertained positivity, and 40% had received primary cycle vaccination and booster, or only completed the primary course. The enhanced surveillance and contact tracing activities allowed identifying 34 participants as close contacts who were subjected to a daily follow-up that revealed only four (11.8%) as infected. Since in mass gathering events public health risk is not clear and could not be available through the traditional surveillance systems, increased monitoring activities are necessary. The practical approach implemented for this event was valuable for SARS-CoV-2 control and case management either among participants, or the host country population, suggesting its application to other airborne communicable diseases.

Keywords: SARS-CoV-2 infections; mass gathering; national sporting event; surveillance; students; respiratory viruses; public health

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1. Introduction

A mass gathering is a spontaneous or planned event attended by many people, which could have an impact on the planning, responses, and resources of the hosting country [1]. In this context, there are several health threats, including transmission of communicable diseases, occurrence of water and hygiene-related disorders, accidents, and trauma [2]. Indeed, these events could pose a complex challenge for public health responses, as occurred during the COVID-19 pandemic [3]. The World Health Organization (WHO) has identified SARS-CoV-2 among the infectious diseases representing a global health hazard, due to the epidemic potential, and/or for unavailable or insufficient countermeasures at time of its first identification [4].

In mass gathering situations (sporting, religious or festival), the transmission of respiratory diseases, including COVID-19 [5], raises greater concerns compared with other diseases (i.e., gastrointestinal infections), because the principal infection route includes droplet transmission through direct exposure to the virus in the proximity of infected subjects [6]. For this reason, during the H1N1 influenza pandemic in 2009–2010, the concept of Mass Gathering Medicine emerged [2,7], and became more important when MERS-CoV emerged in September 2012, with the Hajj pilgrimage scheduled for November 2013 [8]. Sporting events, in which contact between athletes is essential, are impossible to practice without the risk of transmission of respiratory viruses, including SARS-CoV-2 spread. Therefore, the athletes represent a critical population subgroup for whom there is an important need for protection and the implementation of targeted preventive measures [9].

Due to the emergence of COVID-19, many international sport competitions were either canceled, postponed or organized without spectators [10] because of the risk of creating a superspreading event potentially overwhelming the health system of the host countries, as occurred for the Tokyo 2020 Olympic and Paralympic Games [11]. Subsequently, on the lessons learned from the Tokyo Games, Beijing hosted the 2022 Winter Olympic Games as scheduled [12], and a unique challenge was further represented by the 2022 FIFA World Cup in Qatar due to the potential for rapid SARS-CoV-2 transmission among millions of fans attending the event [13]. All these events highlighted that compliance with rigorous prevention protocols and regular testing procedures before, during, and at the end of competitions allowed protection of athletes and technical staff in safe conditions [9]. During 2022, in Italy, following the large-scale of the effective and safe anti-COVID vaccination [14], there was a gradual resumption of economic, commercial, and social activities, including the restart of sporting events [15]. Among these, a national event called "Convittiadi" took place on 3–10 April 2022, in Campobasso, the capital city of Molise region, central Italy. The one-week event involved students aged 11–16 years from 21 boarding schools, competing in individual and team sport disciplines, as well as accompanying teachers or guardians. All competitions were open to spectators. In the two preceding weeks, the COVID-19 incidence was estimated at 795 per 100,000 inhabitants in Italy, with a similar rate in the hosting Molise region of 810.5/100,000 [16,17].

Considering the participation of the boarding schools from different Italian regions, the young age group of the athletes, and the need to ensure the complete performance of sport competitions, a set of procedures was promptly identified aiming at the prevention and containment of SARS-CoV-2 spread during the sporting event and to provide an effective public health response. Therefore, the prevention countermeasures, the enhanced surveillance process through active screening and contact tracing activities, and the procedures for the management of COVID-19 cases during this national sporting event are described, as well as the resulting findings.

2. Materials and Methods

2.1. Development of a Protocol for an Effective Public Health Response

A protocol describing the operational guidelines on procedures and behaviors to adopt was developed and implemented, in order to provide a valuable tool for protecting all attendees from the risk of exposure to SARS-CoV-2, including students, accompanying teachers or guardians and spectators, and for safely allowing the competitions during the 'XIV Convittiadi'. A document reporting the public health plan was made available to athletes and parents, accompanying teachers or guardians, as well as to the personnel even temporarily involved, and was published on the official website of the event and on that of the hosting boarding school. The main activities of the planned methodology are explained and concisely illustrated in a step-by-step flow chart (Figure 1).

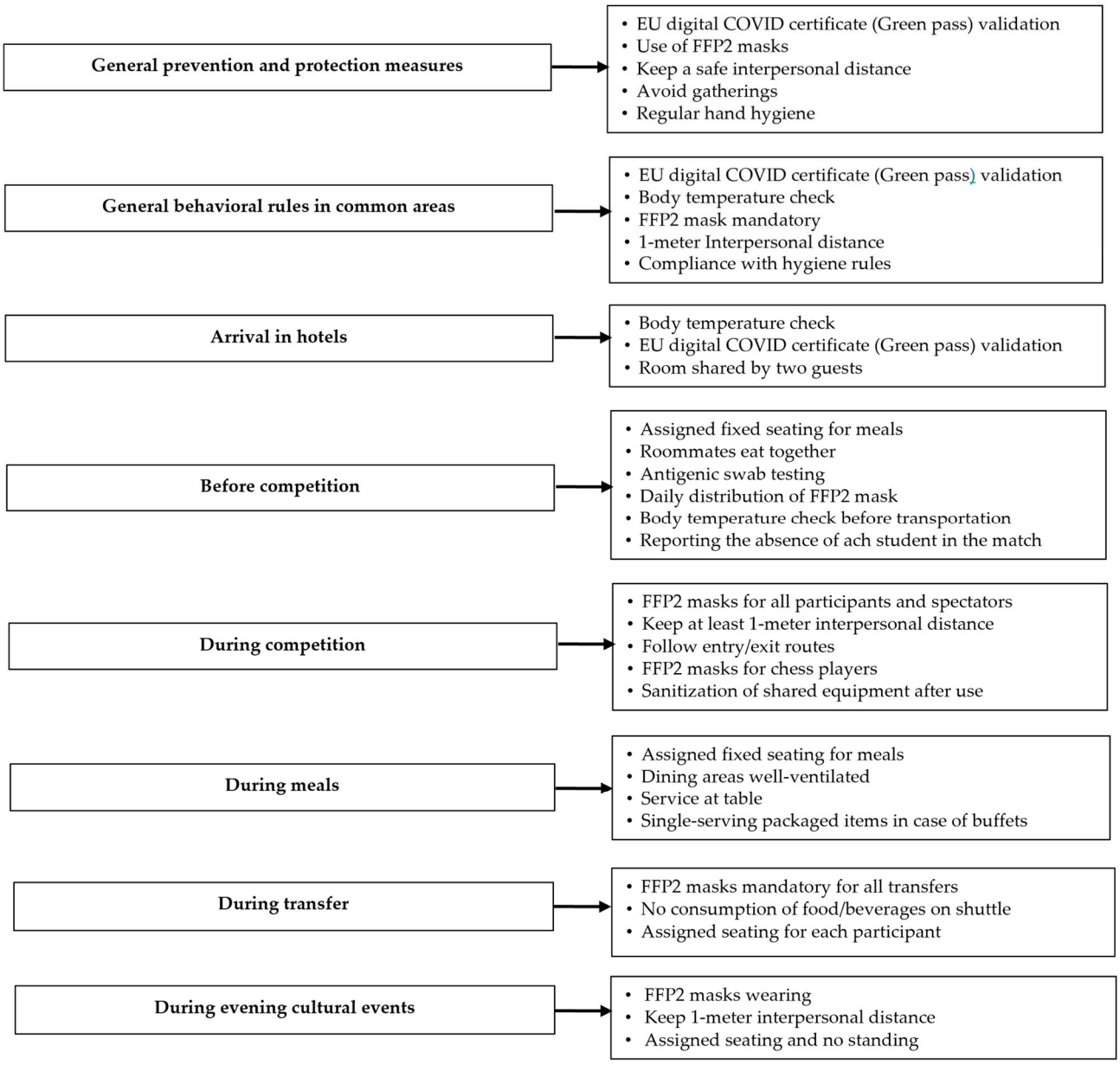

Figure 1. Schematic representation of all prevention measures predisposed during the event.

The protocol was drawn up taking into account the regulations defined by the Italian Department of Sport of the Presidency of Ministers and the national legislation, including "Guidelines for the organization of sporting events and competitions" [18], "Guidelines for basic sport activity and motor activity in general" [19], and Circular 750 "Indications to ensure the sport competitions" by the Ministry of Health [20]. Key reference people with specific tasks were also identified for an effective event organization, including referents for each boarding school, rector of the boarding school of the hosting city, medical doctor of the boarding school of the hosting city, and health team (Figure 2).

In each common environment, it was mandatory to adopt precautionary measures, such as maintaining a safe interpersonal distance, to respect the ban on gatherings, to observe the rules of hand hygiene, and to use adequate personal protective equipment (PPE; i.e., FFP2 masks).

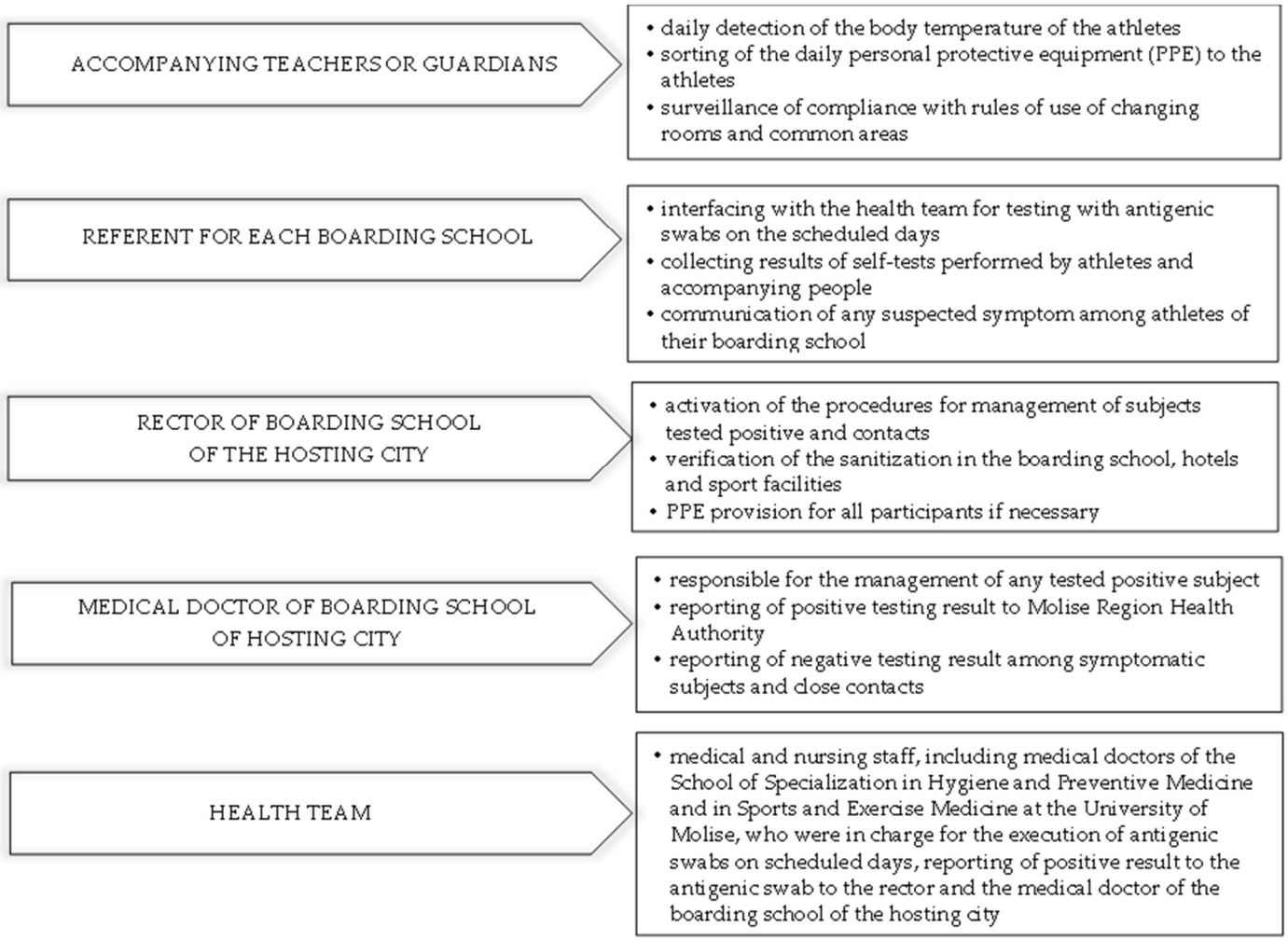

Figure 2. Key reference people with specific tasks during the sporting event.

2.2. General Anti-COVID-19 Procedures in Common Areas

Stringent anti-COVID-19 procedures were adopted to preserve a safe environment for all participants. Particularly, persons in charge of both accommodations and sporting facilities were responsible for the application of correct hygiene and preventive measures by all participants before and during each competition.

Indeed, access to sport facilities, hotels and common spaces was ensured only to EU digital COVID certificate (digital green certificate) holders, including participants and spectators, except for subjects under the age of twelve and those exempt from the vaccination campaign according to national legislation, and to subjects with a body temperature lower than 37.5 °C. The spectators did not interact with the athletes. The correct use of FFP2/N95 protective masks was also mandatory when not performing sporting competition. Consumption of food and drinks in areas not specifically dedicated was prohibited, and clothing worn for physical activity needed to be stored in backpacks or personal bags.

To improve compliance with these rules, posters and labels were available in each structure to ensure adherence to good hygiene practices, to identify entry and exit routes, and to make available hydroalcoholic gel dispensers. When a COVID-19 case was diagnosed, sanitization plans for common areas and hotel rooms were performed, including the use of nebulized hydrogen peroxide.

Being a mass event mainly including adolescents, the Molise Regional Health Authority was involved in the organization by alerting the local hospital, especially the Emergency, Pediatrics, Surgery and Orthopedics and traumatology wards.

At check-in in the hotel facilities, the body temperature of each subject was measured, and the validity of the EU digital COVID certification was checked. After accommodation, there was the opening ceremony of the event, attended by athletes and their companions who were in charge for checking that nobody violated the rules to limit contagion, as well as spectators.

2.3. Specific Anti-COVID-19 Measures for Students

The EU digital COVID certificate (digital green certificate), based on the recovery from an infection no longer of 120 days or on the completion of the primary vaccination cycle (two doses of mRNA COVID-19 vaccine, or one or two doses of viral vector COVID-19 vaccine according to national legislation) [15,21], was a prerequisite for attending the competitions. Moreover, for all athletes, a SARS-CoV-2 antigenic or molecular test certification performed within a maximum of 48 h before attending a competition was also required. Self-administered and certified tests were not accepted, being considered unreliable and not recognized as valid according to the national regulations.

To contain the virus spread and facilitate the contact tracing procedures, it was recommended to accommodate the athletes in a single room or with two beds, as well as assigning the same table and seat to roommates in the restaurant area for the whole period of the event.

Moreover, during bus transfers from hotels to sporting facilities, the accompanying teachers or relatives were asked to verify that the athletes wear the FFP2 mask and did not consume drinks and food to avoid mask removal [18,19]. The athletes had to wear the FFP2 mask until the beginning of the match/competition, except for the chess player, who had to use it even during the match. Hand disinfection was recommended before each match, as was the sanitation of any shared equipment at the end of each competition. The use of the FFP2 mask was required for the referees and the match staff (i.e., timekeepers, assistant referees) for the entire duration of the competition. In case of symptoms related to SARS-CoV-2 infection among athletes and/or companions, the person in charge of each school had to promptly notify a medical doctor, who was responsible for performing an antigenic test to confirm diagnosis together with a clinical evaluation.

2.4. Organization of SARS-CoV-2 Screening with Rapid Antigenic Tests

To identify any positive subject irrespectively from the presence of COVID-19 symptoms, the screening activities through the SARS-CoV-2 antigenic test were scheduled for all participants (athletes and guardians) in two days (5th and 7th April) during the event.

When a subject tested positive, a follow-up including a daily antigenic test to all close contacts was performed, starting from the day of the last contact until the end of the sporting event. According to the national legislation, close contacts were identified between roommates, tablemates, and teammates [22]. An informed consent for screening and follow-up was obtained in advance from the parents of the athletes and the accompanying individuals.

For an accurate organization of the screening activities, information about the number of participants, allocation among the hotel facilities, and schedules of competitions was collected. The selection of antigen test type was performed by considering detailed characteristics, such as safety, ease of use, compliance with the technical features of sensitivity and specificity [23], and ensuring the need for reporting the results on national digital platforms. Hence, based on sensitivity (97.06%; 95%CI 91.71~98.99%) and specificity (100%; 95%CI 99.12~100%), the Wellion VivaDiag Pro SARS-CoV-2 Ag Rapid Test (Guangzhou Wondfo Biotech Co., Guangzhou, China) was used, as reported in the documents "EU health preparedness: A common list of COVID-19 rapid antigen tests" by the European Commission Directorate-General for Health and Food Safety and "Outcome of the evaluation of rapid diagnostic assays for specific SARS-CoV-2 antigens (lateral flow devices)" by the UK Health Security Agency.

To avoid any potential issues or delays during screening, training was conducted for the healthcare operators assigned to perform the tests, manage positive cases, and carry out contact tracing.

Therefore, screening was conducted in the morning, prior to breakfast, in the hotel facility and completed at least 20 min before the scheduled start of the sporting competitions at 9:00 AM each day. A preliminary visit to each hosting hotel was necessary to identify the most suitable areas for conducting the screening activities. These areas included spacious and well-lit rooms with adequate air circulation, as well as easily accessible entry and exit routes. Workstations and chairs that were easy to disinfect were used, along with designated areas for regular and special waste disposal and storage spaces for PPE and sanitization products. Testing results were recorded and archived, and positive cases were reported in the healthcare information system and communicated to the Molise Regional Health Authority.

2.5. Management of SARS-CoV-2 Positive Cases and Close Contacts

The boarding school of the hosting city predisposed several accommodations for individuals who may have needed isolation. Indeed, tested-positive individuals were allocated to a facility different from the initial hosting hotel, and transportation with medical assistance was ensured.

When the antigenic swab resulted positive, the syndromic surveillance system was activated. The health team promptly reported the positivity of students/guardians to the referent person of the boarding school, and to the rector and medical doctor of the boarding school of the hosting city. The referent person of the boarding school was in charge for contacting the parents/legal guardians to communicate the positive result of the student, who also described a list of close contacts (roommates, table mates, etc.).

The rector of the boarding school of the hosting city was responsible for activating the procedure for any diagnosed COVID-19 case, including communication to the medical doctor and the activation of protected transportation.

The medical doctor of the boarding school of the hosting city was responsible for reporting positive and negative swabs. Any subject tested positive to a rapid antigenic test was subjected to a molecular swab for confirmation. For positive results to molecular swabs, other screening tests were further scheduled according to the timing by current legislation, while for negative ones, the subject was considered able to return to the hotel and continue the planned sporting activities.

For all tested positive individuals, separate meals and laundry services were provided, as well as equipment for monitoring clinical parameters (i.e., oxygen saturation, body temperature and heart rate), which were recorded daily and communicated to a designated medical doctor. A procedure for transferring the positive individuals to their residence was available according to national regulations [24].

Close contacts, identified among roommates, tablemates, and team members, were placed under strict surveillance. The sporting competitions continued with the obligation of using FFP2 masks, except during the activities and when consuming meals in a separate area. A daily follow-up was conducted using antigen tests for close contacts until the end of the event. Furthermore, it was recommended for all participants, especially for close contacts, to undergo a test for SARS-CoV-2 in the days following the conclusion of the event, once they had returned to the residence city.

If an athlete presented fever or other symptoms of SARS-CoV-2 infection, this was notified to the referent of the boarding school, who reported the clinical picture to the medical doctor of the boarding school of the hosting city. Each case was carefully evaluated, considering the need to eventually perform rapid antigenic swab testing.

3. Results

3.1. Characteristics of Students and Accompanying Teachers

In total, 590 Italian white participants took part in this event, including 514 athletes (mean age: 13.6 ± 1.6 years; range 11–16) and 76 accompanying teachers (mean age 50 ± 8.7; range 27–65) from 21 boarding schools from different Italian regions. The athletes played 8 sports, including three team sports (basketball, five-a-side football, women's volleyball) and five individual sports (cross-country running, 4 × 100 m relay, 100 m dash, chess, table tennis), for more than 400 matches for 6 days. The sports competitions took place in eight facilities, such as stadiums, arenas, schools and boarding school gyms, while participants were hosted in four different hotels.

3.2. SARS-CoV-2 Testing and Results

Between the 3rd and 10th of April 2022, a total of 1,281 rapid antigenic swabs were performed; of these, 92.3% (n = 1183) were completed in the two screening days, 7.6% (n = 97) for follow-up of close contacts, and 0.08% (n = 1) for one subject who developed COVID-19-related symptoms. Overall, 12 total tests were positive, with a 2% attack rate and a 0.9% swab positive rate. The first positive test was related to a symptomatic student with fever and asthenia on arrival in the hosting city, while 58.3% (n = 7) positive tests were performed during the two days of screening, and 33.3% (n = 4) during the daily follow-up of close contacts.

3.3. Description of COVID-19 Cases

The initial COVID-19 cases involved 83.3% (n = 10) athletes and 16.7% (n = 2) accompanying teachers. The positive athletes (n = 6 females, 60%) had a mean age of 14 years (range 12–16). A total of 40% (n = 4) had received primary cycle vaccination and booster, 40% (n = 4) had completed only the primary vaccination course, and 10% (n = 1) were unvaccinated, as they were previously diagnosed with COVID-19, while vaccination history was not available for one subject. Furthermore, 70% (n = 7) played in individual sport, while 30% (n = 3) in team sports.

A total of 34 participants were considered close contacts, and were subjected to surveillance and daily follow-up with antigen swab testing. The average surveillance time was 2.7 days (range 1–6). Among them, 11.8% (n = 4) resulted positive after an average of 1.2 days from the last contact with an infected individual.

COVID-19 cases were mostly (n = 10, 83.3%) detected among students who stayed in the same hotel, and 60% (n = 6) were roommates, while two male subjects (mean age 57 years) were tested positive among accompanying individuals, and had completed the full vaccination cycle.

83.3% (n = 10) of the infected athletes complained of mild symptoms either before or after the ascertained positivity, and mostly included rhinitis (n = 4, 33.3%), and sore throat (n = 2, 16.7%), followed by rhinitis and fever < 38 °C; rhinitis and sore throat; rhinitis, cough, arthralgia, and myalgia; and hoarseness, arthralgia, myalgia and headache, each observed in one subject (8.3%).

Following the diagnosis confirmation, the Prevention Department of the Molise Regional Health Authority was contacted for the activation and implementation of the procedures according to national guidelines [18] including the transportation of positive cases to their residence, which occurred for 91.6% (n = 11) of subjects with diagnosed COVID-19. Only one athlete decided to return to the residential city after obtaining a negative result.

4. Discussion

Mass gathering events play an important role in society, but since the onset of the COVID-19 pandemic, they have generally been restricted in order to mitigate SARS-CoV-2 transmission [25]. During these events, public health risk is not clear and could not be easily available from traditional surveillance systems; hence, recognition of the limits of surveillance organizations needs to be part of the planning [26]. Therefore, effective

public health responses with precise risk assessment are essential, including enhanced surveillance activities and efficient communication strategies [26], to protect the well-being of participants and the population of the hosting country, and to guarantee healthcare services [27].

Here, findings from the national sporting event "XIV Convittiadi" that took place in the Molise region (central Italy) in 2022 are described. Considering the nature of the event with an expected high number of participants and spectators, with high public and media attention and the ongoing COVID-19 pandemic, enhanced surveillance activities developed within the routine surveillance for infectious diseases were initiated, as reported for previous mass gathering events [28]. Due to planned screening activities among 590 participants, a limited number (12/590) of COVID-19 cases was diagnosed, who were promptly and effectively managed, and only four cases were detected throughout the contact tracing activities amongst close contacts, with a total 2.7% attack rate. This remarks that availability of rapid and reliable tests may play an important role, enabling detection of asymptomatic individuals, leading to immediate isolation and management, and limiting virus transmission. Nonetheless, it should be underlined that, at the time of the event, to reduce the likelihood of SARS-CoV-2 transmission [29], there was the availability of rapid diagnostic tests and COVID-19 vaccination or alternatively natural immunity, which were mandatory prerequisites for the participation. However, this study did not contemplate the number of infections likely occurred among spectators because no ticket was required to have access to the competitions. Therefore, the total impact of COVID-19 cases linked to this sporting event could not have been assessed. Certainly, in these events, to prevent the spread of infections, it is important to provide recommendations for mandatory and optional vaccines, as well as those for hygiene and prevention measures. Anyway, it could be hypothesized that awareness regarding infectious issues among participants was highly promoted before the event with proper training and information in the boarding schools [30].

The planning of preventive and screening activities established in the operative protocol, by minimizing the risk of SARS-CoV-2 contagion, ensured the entire course of the competitions. Furthermore, preliminary inspections for the identification of appropriate spaces and pathways, and training for involved healthcare professionals were advantageous for the screening activities. Hence, the operational protocol easily accessible to attendees was central, containing information on good hygiene practices, recommendations, and procedures to prevent the risk of infection throughout the various stages of the event. The mandatory use of masks and the presence of the staff enforcing anti-contagion measures among the athletes and participants may have played a crucial role. Previously, by a quantitative microbial risk assessment, it has been estimated that the implementation of measures according to the transmission route, such as physical distancing and wearing of face masks for droplet transmission, ventilation for airborne transmission and decontamination and hand washing for contact transmission, is useful for controlling the risk of infection in mass gathering events [31]. Protecting the population's health through extensive testing and enhancing contact tracing and surveillance represents a central stage, as well as developing containment and mitigation policies along with public cooperation [32].

Nevertheless, during the "XIV Convittiadi", more than half of the SARS-CoV-2 infections occurred among roommates, and the likelihood of transmission may have increased for non-compliance with COVID-19 mitigation measures, or when more than two guests were allocated in the hotel room for the limited availability of hosting hotels, and/or for the unfeasibility to keep the same distribution during meals [33].

5. Conclusions

The study shows that a public health approach to COVID-19 risk mitigation does work and can reduce transmission to low amounts, and that hosting a sporting event safely during a pandemic is possible, although this requires several resources and accurate planning.

The approach used for the management of this event was significantly valuable for SARS-CoV-2 spread control and case management, especially because mass gathering events have the potential to facilitate the evolution and spread of novel viral variants and other analogous pathogens [34]. The model here described could be easily applied to other airborne communicable diseases, introducing risk-based infection control measures [35]. These are crucial especially in the context of sporting events in which many behavioral factors may enhance the likelihood of respiratory viral infections in the athletes, who are more exposed than the general population because of increased verbal interaction and close physical contact during travel, shared housing, indoor spaces, meal sharing in restaurants, high-contact-risk sports, and mass gathering [36]. Indeed, the study remarks that in case of the transmission of respiratory infections, like SARS-CoV-2, some measures are strictly necessary, including the use of masks by participants and spectators, especially during transportation and in crowded areas; the availability of an adequate number of hand sanitizer dispensers in common areas; the participation by individuals who have a regular vaccination status; and sufficient personnel to manage and enforce infection control rules among crowds.

Some study limitations should be recognized, including the absence of the total number of spectators during each match, which was not available for an accurate assessment of the incidence rate during the one-week event, as well as the unavailability of some data; for example, when participants had undergone COVID-19 vaccination, for a better understanding of the dynamics of COVID-19 transmission. Anyway, to the best of our knowledge, the studies on the topic of sports events during COVID-19 pandemic are only related to an international scale.

Therefore, the present work shows a valuable approach at a national level, remarking that in the context of an ongoing infectious disease pandemic, public health strategies, used independently or concurrently, could significantly reduce the risk of transmission of infectious diseases also after the event, such as during travel to and from the event, allowing the participants' safety and, consequently, the not obvious end of the sporting event.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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