

Halting the pandemic outside ‘CORTINA2021’ alpine world ski championships: a challenge for sport and public health in times of COVID-19

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ABSTRACT

Background In February 2021 the “Cortina2021” Alpine World Ski Championships took place in the mountain town of Cortina d’Ampezzo (Italy), thus gaining the definition of “first sporting event of global significance in the time of covid-19 pandemic”. Though the event took place behind closed doors and in a context of national public health restrictive measures, it counted almost 6,000 participants.

Methods A rigorous “Covid-19 Prevention and Hygiene Protocol” was drawn up by the local and regional health authorities together with the organizing committee, in order to contain the risk of viral circulation within the venue.

Results Overall about 20,000 rapid antigen nasal swabs were performed to screen-detect sars-cov2 cases: only 22 of these were found positive, whereas 25 people were quarantined as close contacts.

Conclusions The experience of “Cortina2021” proves that mass gatherings can take place even in times of epidemic threats, if adequately planned and by providing public health recommendations tailored on the viral circulation foreseen by the time the event is due. If new epidemics should arise in the future, hopefully the public health management of “Cortina2021” may be a template for next mass gatherings to be held, as far as possible, despite the viral circulation.

Introduction

From 7th to 21st February 2021, the Alpine World Ski Championships took place in the mountain town of Cortina d’Ampezzo, on the Dolomites, in the North of Italy. Acclaimed as the first world sport event since the outbreak of covid-19 pandemic just one year before, it was held still in times of concerning viral circulation.

Indeed, after a second pandemic wave invested Europe since the end of summer 2020, throughout all the autumn months and December, new perspectives and challenges appeared with the turn of the new year: if, on the one hand, the massive vaccination campaign started on 27th December in all Europe has given a boost to the hopes of defeating the pandemic for good;¹ on the other hand, the spread of

viral variants of concern appears threatening in terms of enhancing the transmissibility of the new coronavirus and

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of hypothetically diminishing the efficacy of the available vaccines.^{2,3}

In this context, according to the weekly ‘Maps in support of the Council Recommendation on a coordinated approach to travel measures in the EU’ provided by the ECDC,⁴ Veneto, the Italian region where Cortina is, passed just between the end of January and the beginning of February 2021 from being a ‘dark red’ area, meaning that 14-day cumulative covid-19 case notification rate was ≥ 500 , to becoming a ‘green’ area, meaning that a 14-day notification rate lower than 25 cases per 100 000 and a test positivity rate below 4%. At the same time, also the restrictive measures adopted by the Italian government were loosened in Veneto, following the decrease in the number of covid-19 incident cases (from an ‘orange area’, or scenery n°3 ‘of sustained and widespread transmissibility with risks of the health system being maintained in the medium term’ to a ‘yellow area’ or scenery n°2 ‘of sustained and widespread transmissibility but manageable by the health system in the short to medium term’):^{5–7} the most relevant changes that occurred since 1st February have been the restoration of freedom of movement within the regional boundaries, 50% students attendance at school, the opening of bars and restaurants until 6 pm. Among the restrictions that remained, there was the curfew at 10 pm, the prohibition of unnecessary movements toward other regions and of any mass gathering.

Considering this situation, the event took place behind closed doors, but anyhow, it involved over 6000 people, among staff members, teams, media and guests. Thus, a strict preventive protocol was adopted, consisting mainly of an intensive schedule of covid-19 testing and of thorough separation between different categories of participants.

The following work aims to describe the abovementioned protocol and its implementation, demonstrating the feasibility of large-scale sporting events even in times of pandemics with satisfying outcomes in terms of epidemic containment.

Methods

Context

Cortina d’Ampezzo (Province of Belluno, Veneto, Italy) is a mountain municipality of 5736 inhabitants⁸ on the Dolomites (Alps). The competent Health Authority is the Local Health Unit ‘Aulss1 - Dolomiti’, in turn afferent to the National Health Service.

In February 2021, Veneto has figured among the Italian regions ‘of sustained and widespread transmissibility but manageable by the health system in the short to medium term’ by the Italian technical-scientific committee, due to

a decrease of incident covid-19 cases below 25 cases per 100 000 inhabitants since the last week of January.^{5–7}

According to the WHO specific recommendations and risk-assessment checklist,^{9,10} ‘Cortina2021’ was considered at moderate risk of covid-19 spread during the competition.

In this context, the Alpine World Ski Championships ‘Cortina2021’ were organized and funded by a Foundation (‘Fondazione Cortina2021’) supported by both private sponsors and institutional local, regional, national and international partners.

An agreement was signed between the Foundation and the Local Health Unit ‘Aulss1 - Dolomiti’ which defined the medical support provided by the Health Authority (doctors and other personnel and equipment specifically coming from the Emergency Department for injuries and other accidents on the slopes and from the Prevention Department for the covid-19 management), in exchange of a lump-sum economic compensation. A similar agreement was signed between the Foundation and the White Cross of Bolzano Onlus, for the nursing and rescue staff and equipment.

The ‘Covid-19 Prevention and Hygiene Protocol’

The Cortina2021 Foundation, with the Prevention Directorate of the Veneto Region and the Italian Sports Department of the Presidency of the Council of Ministers, drew up a rigorous ‘Covid-19 Prevention and Hygiene Protocol’. The national covid-19 technical-scientific committee validated the document on 12th January 2021.

The document contained the followings:

- programme of the event and venues description;
- number of expected participants;
- current normative requirements;
- general and specific covid-19 prevention guidelines.

General recommendations consisted in social distancing, hand hygiene, temperature control at the gates and correct use of face masks.

Specific guidelines consisted in the principle of ‘epidemiological bubbles’: each bubble was an ecosystem of homogeneous working teams, each one of whom in turn being as much separated as possible from the others, and each bubble had no risky contacts with other bubbles (different hotels, canteens, hospitality areas and separate working spaces and/or times within the venues). All venues and ski-lifts had separate spaces for each bubble. The bubbles were:

- Red bubble: teams (athletes, coaches, team doctors, physiotherapists, ski-men and other members of the team crew), International Ski Federation staff, jury members, timekeepers, suppliers of race equipment, anti-doping officers and rescuers.

- Specific rules were:
 - The stay in Cortina and in the venues should be as short as possible, just to allow participation in races and official training sessions.
 - Teams should be organized in small permanent sub-groups.
 - Team meetings only by video-call.
 - Athletes must always wear face masks except during the race.
 - In the canteen, each national team has a dedicated table, no self-service is allowed and food is served in prepackaged portions; a permanent cleaning service is guaranteed.
 - Teams should only train outdoors; the use of gyms or spas possibly provided by the hotels is strongly discouraged.
 - Interviews must occur outdoors, possibly only during awards ceremonies, interviewer and interviewee being at least 1.5-m distant and both wearing face masks.
 - Events with sponsors, press conferences or other unnecessary attendances should be avoided.
 - Medallists find the prize on the podium and raise it by themselves (no awarding by hostesses or authorities); they must wear face mask and possibly ski gloves; social distancing of 2 m is guaranteed.
- Yellow bubble: media (journalists, photographers, host and foreign broadcaster operators).
- Specific rules were:
 - Avoid unnecessary interviews.
 - During interviews, use long-rod microphones, frequently sanitizing the microphone fairing or changing the microphone coverage.
 - In the media centre, each accredited person must wear an electronic device that vibrates if social distancing is not respected.
 - Max 220 people are allowed in the media centre and every workstation is exclusively assigned to a single accredited; seats are 1.5-m distant.
 - Personal objects must be put in lockers and removed at the end of every day, to allow the general sanitization of surfaces.
 - Max 4 people are allowed in every 15-m² container-office at the broadcaster centre; vehicles and other equipment must be used only with at least 1 m social distancing and face masks; max 1 person is allowed inside TV cabins (2.00 x 1.80 m) and max 2 people inside double TV cabins (2.00 x 3.60 m) respecting a social distancing of 2 m; max 4 people are allowed inside announcer positions (4.00 x 4.00 m), with 2-m social distancing during interviews and face masks; in the mixed zone, max 3 people are allowed in each platform (2.00 x 2.00 m) and a 1-m corridor separates platforms.
- Blue bubble: volunteers, organizing committee, other staff and providers, police.
 - Specific rules were:
 - The staff recruitment follows geographical proximity (no volunteers from abroad; on the contrary, preferably living within the province of Belluno).
 - No people with chronic diseases, frail or over-65 are recruited.
 - An information campaign and a training course are destined to the staff, centred on correct behaviours to avoid the contagion; all volunteers and staff have to self-certificate their knowledge of covid-19 prevention.
 - All the staff works in small subgroups that must not change during the event.
 - Green bubble: guests and authorities.
 - Specific rules were:
 - Each guest has nominal access to the hospitality area and a dedicated seat.
 - A dedicated shuttle service takes guests to the venue.
 - Before entering, temperature is checked and a self-certification of good health and tested covid-19 negativity within the past 48 hours must be provided.
 - Guests wear an electronic device that vibrates if social distancing is not respected.
 - The hospitality area has checkpoints at the entrances and exits and pre-defined separate paths to minimize unnecessary contacts among guests.
 - Max 350 people are allowed daily in the guest area; there is at least a 4-m² space per person; face masks are compulsory both indoors and outdoors and meals can only be eaten at the pre-assigned table.
 - 430 guests are invited to the opening ceremony (7 February 2021): the venue is outdoors, with temperature check at the entrances, pre-defined path and pre-assigned seats with 1-m distance one from each other.

The testing and health plan for each bubble is summarized in [Table 1](#).

Protocol implementation

The World Championships organization provided covid-19 rapid tests every three days for all the accredited during all the event, starting from approximately a week before the event opening, until approximately a week after the closure (to ensure the testing also for providers and workers who were in Cortina to assemble and disassemble all the venues and equipments required).

Table 1 Testing and other covid-19 requirements for each bubble

Bubble	Required tests for covid-19	Other requirements
Red	Before the event: 1 RT-PCR nasopharyngeal swab 8–10 days before the accreditation and 1 RT-PCR nasopharyngeal swab within 72 hours before the accreditation.	Daily answering the health triage available on the personal page on the online accreditation portal.
Yellow	During the event: a rapid antigenic swab every 72 hours. Before the event: 1 RT-PCR nasopharyngeal swab 8–10 days before the accreditation and 1 RT-PCR nasopharyngeal swab within 72 hours before the accreditation.	Daily answering the health triage available on the personal page on the online accreditation portal.
Blue	During the event: a rapid antigenic swab every 72 hours, except for catering and hotel staff, who were required to undergo a rapid antigenic swab once a week.	Daily answering the health triage available on the personal page on the online accreditation portal.
Green	Self-declaration of having undergone a rapid antigen test within 48 hours before entering the dedicated hospitality area.	Self-declaration of good health.
Exclusions ^a	Formerly covid-positive subjects: those who have tested positive for Covid-19 from 23 November 2020, included, up to 21 days before the arrival in Cortina, are excluded from preventive tests and continuous screening if they are able to show the RT-PCR test report showing positivity to SARS-CoV2, accompanied by a medical certificate of recovery or by a report of virological negativization. Those who have completed the covid-19 vaccination schedule are excluded from preventive tests and continuous screening.	

^aOnly if asymptomatic.

The *Abbott Panbio™ COVID-19 Ag Rapid Test Device* was chosen as screening test. Tests were performed by the White Cross crew in four different ‘covid points’ within the municipality of Cortina. Test results were viewed and signed by two doctors from the Local Health Unit ‘Aulss1 - Dolomiti’ Prevention Department.

Every positive rapid antigenic swab had to be confirmed by an RT-PCR molecular nasopharyngeal swab, processed by the ‘Aulss1 – Dolomiti’ laboratory.

Confirmed positive cases were immediately isolated by an expert nurse of the Foundation, who was also in charge of contact tracing and of reporting the positives to the Local Health Unit.

Accreditations were validated only to those coming to Cortina with the correct required RT-PCR negative tests (if red or yellow bubble, see [Table 1](#)) and after undergoing a first rapid antigen test at the arrival (for all bubbles except the green one). The accreditation expired after 72 hours and a new rapid test had to be performed to have the accreditation validated again. All participants had to complete daily a health questionnaire and leave an e-mail and a phone number to get the test results and other communications. A dedicated

online platform and database was implemented to help the daily validation process.

Results

Approximately 20 000 antigenic swabs (19 031 registered in the Cortina2021 database plus a tiny minority consisting of those performed by military doctors for the Police) have been performed for the safety of Cortina2021 Alpine World Ski Championships ([Table 2](#)). Only 22 were found positive to SARS-CoV2 and 25 people were identified as close contacts and immediately isolated and excluded from the venue.

Some people had been in contact with positive cases but did not meet the criteria to be considered close contacts (i.e. body contact or staying in the same close space for more than 15 minutes without social distancing or face masks): for 10 days following the contact, these people were screened daily and their accreditation validity expired after 24 hours instead of after 3 (or 7) days. On two different days, 2 people belonging to the same national ski team were tested positive and, though neither declared any close contact, this led to the decision of performing an extra screening by antigen test on

Table 2 Rapid antigen swabs executed daily during the World Championships and the week before, and respective SARS-CoV2 positive subjects emerged from the screening and their close contacts that have been further quarantined. Source: dedicated IT database

<i>Date</i>	<i>Rapid antigen swabs performed (n)</i>	<i>Confirmed positive subjects (n)</i>	<i>Quarantined close contacts (n)</i>	<i>Annotations</i>
01/02/2021	634	0	0	
02/02/2021	310	0	0	
03/02/2021	404	1	0	
04/02/2021	708	0	0	
05/02/2021	697	1	0	
06/02/2021	953	0	0	
07/02/2021	1138	2	1	3 not-close contacts ^b were not quarantined but screened daily by antigenic swab; the quarantined close contact turned positive during the quarantine.
08/02/2021	916	3	14	1 not-close contact was not quarantined but screened daily by antigenic swab.
09/02/2021	941	1	0	The positive subject to rapid antigen test was not confirmed in Cortina because he/she immediately returned to his/her hometown.
10/02/2021	1242	0	0	
11/02/2021	841	0	0	
12/02/2021	1099	0	0	
13/02/2021	1159	1	0	
14/02/2021	953	4	2	
15/02/2021	1213	4	3	
16/02/2021	1121	0	0	1 false positive rapid antigenic swab (denied by PCR)
17/02/2021	1162	0	0	
18/02/2021	1224	3	4	One national team was screened by rapid antigenic swab on the day after.
19/02/2021	1256	0	0	
20/02/2021	960	2	1	
21/02/2021	100	0	0	
TOTAL	19 031	22	25	

NB: Some of the police forces involved in the organization were screened by rapid antigen test by their own military medical services and then communicated the results to the Cortina2021 covid-19 staff (doctors and other staff of the 'covid points'). If screened positive, the RT-PCR nasopharyngeal swab was performed by the Aulss1 Health Authority. Contact tracing for police positive cases was conducted alternatively or jointly by Aulss1 Prevention Department doctors/nurse or by their military doctor.

^bFor the definition of 'contact' and 'close contact': Rapporto ISS COVID-19 n. 53/2020 - Guida per la ricerca e gestione dei contatti (contact tracing) dei casi di COVID-19, Version of 25 June 2020.

the whole team. No more positives emerged from this small 'outbreak' and athletes and their staff could participate in the races.

Some overall data from the Protocol implementation are represented in Table 3. The participants at any level regularly accredited for the event (entirely or only for some days) were 5640, of whom 956 (16.95%) were screened on a weekly basis (meaning that they were staff

from the accommodations and food and beverage, though some hotels and restaurants/catering had their personnel screened every third day just like the other members of the bubbles) and 4612 (81.77%) were screened every third day.

A minority of guests (174 people from green bubble) resorted to Cortina2021 'covid points' to undergo the requested test to enter the hospitality area.

Table 3 General data emerging from the implementation of the 'Covid-19 Prevention and Hygiene Protocol'. 'Immune participants' are defined as those who had covid-19 from 23 November 2020, up to 21 days before their arrival in Cortina. Source: dedicated IT database

	<i>N</i>	<i>Denominator</i>	<i>Denominator definition</i>	<i>Rate</i>
Overall accredited participants	5,640	—	—	—
Blue bubble positive tests	18	11 089	Overall blue-bubble swabs	0.16%
Yellow bubble positive tests	0	3242	Overall yellow-bubble swabs	0.00%
Red bubble positive tests	4	4525	Overall red-bubble swabs	0.09%
Green bubble positive tests	0	174	Overall green-bubble swabs	0.00%
Vaccinated participants	57	5640	Overall participants	1.01%
Immune participants	15	5640	Overall participants	0.27%
Participants screened every 3rd day	4612	5640	Overall participants	81.77%
Participants screened every 7th day	956	5640	Overall participants	16.95%
Swabs done in the preparatory week (1st–6th Feb)	3706	19 031	Overall swabs performed	19.47%

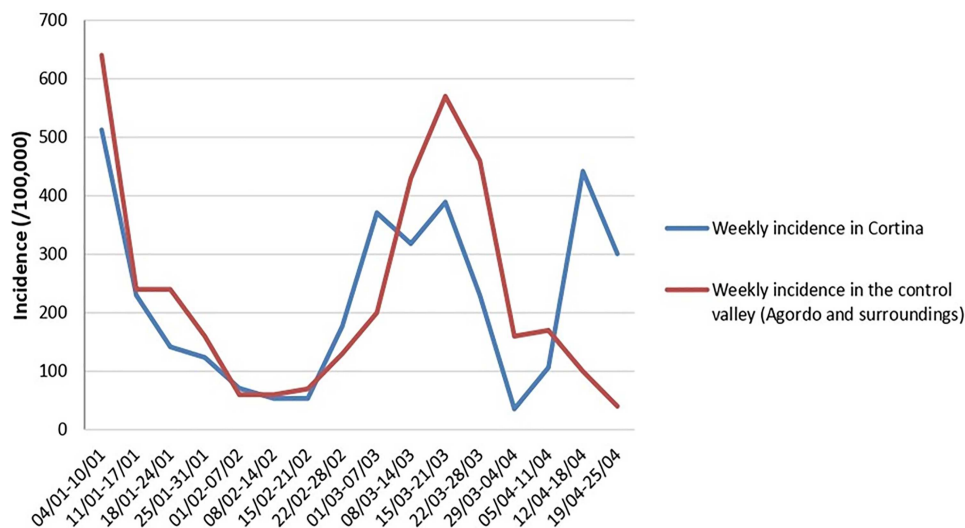


Fig. 1 Incidence rates of new SARS-CoV2 positive subjects among the resident population respectively of Cortina (blue line) and of a similar municipality (Agordo) and its surroundings (red line), in the weeks before, during and after the World Championships.

All 22 confirmed covid-19 cases were asymptomatic or pauci-symptomatic.

As for people who were legitimately excluded from rapid antigen tests, 57 people were already fully vaccinated and 15 were people recovered from covid-19 within the correct exclusion period.

Figure 1 shows a comparison between the weekly incidence rates of covid-19 in Cortina and the one registered in another touristic municipality with similar demography in the alpine territory of the province of Belluno: though the two lines appear different especially after the end of February, no relevant differences appear that could be macroscopically traced back to the World Championships in Cortina.

Discussion

Hosting a venue of this magnitude, which assumed gathering in a close valley thousands of people in the time of covid-19 pandemic, has meant taking up an almost unprecedented challenge both for sports and public health.

To compare the incidence rates of covid-19 cases within and outside Cortina is difficult and may lead to misunderstandings, since February is typically a highly touristic period for Cortina and since the province has quite a heterogeneous socio-demographic composition. The only approachable comparison is the one shown in Fig. 1, with another similar valley, thus avoiding at least partially the bias deriving from general winter tourism.

Anyhow, absolute numbers demonstrate a very satisfactory pandemic control within the Alpine World Ski Championships. Data prove a very limited viral circulation among participants and the existence of few small screen-detected outbreaks (Table 2). This shows the importance of such a massive screening and generally of traditional public health measures (i.e. isolation and quarantine), to detect and block the asymptomatic or pauci-symptomatic viral spread, implementing the ‘epidemic intelligence’, whose essentiality in such gatherings has been repeatedly asserted by international institutions^{11–13} and scientific literature already before covid-19.^{14,15}

It must be noted that in February 2021, the covid-19 vaccination campaign was internationally limited to the elderly people and to healthcare professionals.

There are some previous experiences of epidemic intelligence during mass gatherings and/or sport events, though none of them occurred during a pandemic of a magnitude comparable with covid-19.

Predictably, every Olympics or Football World or European Cup has had its specific public health strengthening plan, principal issues being gastroenteritis or other food- or water-borne outbreaks, miscellaneous acute respiratory infections, meningitis or more unusual diseases such as diphtheria, and non-communicable health threats, such as heat related illnesses,^{16–19} or possible bioterrorism-related outbreaks.^{20,21}

Apart from these almost routine surveillance activities, it is of utmost interest to compare the experience of Cortina2021 with other previous mass gatherings held in times of other epidemics threatening the local or international scenarios.

The 2008 European football championship was held in Austria and Switzerland, while a massive measles outbreak was being registered (2944 cases reported in Switzerland since November 2006 to June 2008 and 332 cases in Austria during the period March–June 2008): visitors coming for the European Cup were recommended to be fully vaccinated against measles and Italy, Germany, Austria and Switzerland were asked to provide ECDC with weekly updates on the number of measles cases 2 weeks prior and after the Euro 2008.^{22,23}

In July 2009, Serbia hosted a Universiade and an open-air music festival, in the context of swine influenza A (H1N1) pandemic²⁴: 7 H1N1 cases were reported at the Universiade and 62 at the festival, several of whom being travel-related. ***No official quarantine or isolation measures were implemented, but positive cases were strongly recommended to remain isolated in the accommodation or in dedicated spaces provided by the organization; also suspected cases had to keep isolated and daily report symptoms to the local health

Authority while waiting for the definitive diagnosis; people were recommended not to enter Serbia from abroad if they had any flu-like symptom.

In 2016, the Olympics were held in Rio de Janeiro, while Zika virus was spreading throughout Brazil: efforts were concentrated on preventive measures such as recommendations on barrier methods against mosquitoes and discouraging women who were pregnant or planning a pregnancy to come to Brazil if not strictly necessary.²⁵

All these experiences, as well as Cortina2021, prove that mass gatherings can take place even in times of epidemic threats, if adequately planned and by providing public health recommendations tailored on the viral circulation foreseen by the time the event is due.

If new epidemics should arise in the future, hopefully, the public health management of Cortina2021 Alpine World Ski Championships may be a template for next massive sports tournaments or other mass gatherings to be held, as far as possible, despite the viral circulation.

Limitations

The present work suffers from some limitations. First, there may be some inaccuracies in the reported numbers (such as the total number of accredited people and of tests performed), due to the variability of cases among the participants (as mentioned before, police only referred to the Organization for RT-PCR tests). Anyhow, possible deviations from real values are very limited and reported values approximate reality very reliably. Moreover, green bubble is the one that suffers from most issues, since it is very difficult to find the exact number of daily guests, and they were hardly distinguishable from general winter tourists. Finally, no data are available about the residual screening activity in the week after the end of the competition, though very few tests were performed and the lack of these data does not affect the overall count.

Supplementary data

Supplementary data are available at the *Journal of Public Health* online.

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