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Experience and recommendations for a COVID-19 free face-to-face educational activity

Experiencia y recomendaciones para una actividad educativa presencial libre de COVID-19

Claudia Arroyo Berezowsky, Sara Bernal Lastiri,‡*
Ingmar Buffo Sequeira,§ Rodrigo Fernando Pesantez Hoyos¶

**Hand and Orthopedic Surgeon in ABC Medical Center, Mexico City, Mexico; ‡Orthopedics and Trauma Coordinator at Tlalpan Hospital, Mexico City, Mexico; §Orthopedic Surgeon at Centro Médico Dalinde, Mexico City, Mexico; ¶Orthopedic Surgeon at Trauma and orthopedics Department, Fundación Santa Fe de Bogotá, Colombia.*

Abstract

Introduction: Since March 11, 2020, the COVID-19 pandemic was declared by the World Health Organization. This has disrupted face to face educational activities all over the world. During 2021, face-to-face educational events have been slowly reinstated. **Objective:** The objective of this report is to share our experience during the first face-to-face educational activities after 17 months without face-to-face events from AO Trauma Latin America. **Material and methods:** Sanitary precautions were followed closely throughout the courses. CO_2 level monitoring helped us improve ventilation and airflow in the different areas of the hotel where the course took place. Three hundred and sixty surveys were sent to the basic principles course participants to inquire for COVID-19 symptoms five days after the courses. **Results:** We managed to keep the CO_2 levels under 500 ppm for most of the time. Only 41 participants responded. Only one participant from the Chilean courses reported having symptoms and had a positive SARS-CoV-2 PCR test five days after the course. No participants, faculty or staff members from the Mexican courses reported symptoms. **Conclusion:** Careful planning and scouting of the physical space for incorporating safety measures where the activity will take place should be considered. Independent of vaccination status and pre-course testing, we suggest enforcing the mandatory use of facemasks by everyone indoors, constant hand hygiene, and short intervals of space occupation. These interventions, together with adequate ventilation strategies, and CO_2 monitoring can help decrease the possibility of COVID-19 outbreaks while allowing face-to-face events to take place.

Keywords: COVID-19, educational status, orthopedics, fracture course, pandemic.

Resumen

Introducción: *Desde el 11 de marzo de 2020, la Organización Mundial de la Salud declaró la pandemia de COVID-19. Esto ha interrumpido las actividades educativas presenciales en todo el mundo. Durante 2021, los eventos educativos presenciales se han ido restableciendo lentamente.* ***Objetivo:*** *El objetivo de este informe es compartir nuestra experiencia durante las primeras actividades educativas presenciales después de 17 meses sin eventos presenciales de AO Trauma Latinoamérica.* ***Material y métodos:*** *Las precauciones sanitarias se siguieron al pie de la letra durante los cursos. La monitorización del nivel de CO_2 nos ayudó a mejorar la ventilación y el flujo de aire en las diferentes áreas del hotel donde se impartió el curso. Se enviaron 360 encuestas a los participantes en los cursos de principios básicos para indagar sobre los síntomas de COVID-19 cinco días después de los cursos.* ***Resultados:*** *Conseguimos mantener los niveles de CO_2 por debajo de 500 ppm durante la mayor parte del tiempo. Sólo 41 participantes respondieron. Sólo un participante de los cursos chilenos informó de que tenía síntomas y dio positivo en la prueba PCR del SARS-CoV-2 cinco días después del curso. Ningún participante, profesor o miembro del personal de los cursos mexicanos informó de síntomas.* ***Conclusión:*** *Se debe considerar una cuidadosa planificación y exploración del espacio físico para incorporar medidas de seguridad donde se desarrollará la actividad. Independientemente del estado de vacunación y de las pruebas previas al curso, sugerimos que se imponga el uso obligatorio de mascarillas por parte de todos los que se encuentren en el interior, la higiene constante de las manos y los intervalos cortos de ocupación del espacio. Estas intervenciones, junto con las estrategias de ventilación adecuadas, y la monitorización del CO_2 pueden ayudar a disminuir la posibilidad de brotes de COVID-19, al tiempo que permiten la realización de eventos cara a cara.*

Palabras clave: *COVID-19, situación educativa, ortopedia, curso de fractura, pandemia.*

Correspondence:
Claudia Arroyo Berezowsky
E-mail: dra.carroyob@gmail.com

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Introduction

On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic and life as we knew it changed drastically. As of 5:11 pm on November 5th, 2021, there have been 248'467,363 confirmed cases reported worldwide. With 484,880 new cases in the last 24 hours and a total of 5'027,183 deaths reported by COVID-19 worldwide. 94'977,975 cases have been attributed to the Americas.[1] Medical education activities were suspended worldwide with much uncertainty as to how and when restart them.

During 2021, a decision was made by the Latin American AO Trauma board to go forward with basic and advanced principles of fracture management courses in strategic locations for Latin America. The chosen countries for hosting the courses were: Mexico, Chile, and Colombia. The courses would take place as hybrid courses, with both asynchronous prerecorded lectures, and synchronous activities online over a month. The face-to-face, synchronous activities would take place over two days for each course and would focus primarily on hand-on activities such as the skills lab, practical exercises, and case discussions.

The objective of this report is to share our experience during the first face-to-face educational activities after 17 months without face-to-face events from AO Trauma Latin America. We also reviewed and analyzed the evidence supporting preventive measures taken as dictated by the general AO Foundation guidelines, the local authorities, and decisions made by the course director, chair, and co-chair so that future educational activities can take place as safely as possible.

Material and methods

There were two basic principles of fracture management courses on hybrid mode in Mexico. They had both synchronous and asynchronous activities. The participants had one month to complete the online activities. The asynchronous online activities included: prerecorded lectures and online discussion forums. The synchronous activities included four zoom meetings to discuss topics that were not included in the prerecorded lectures.

This system was the same for all the Latin American courses. All courses had to follow the guidelines established by the AO Foundation, the AO Foundation's commercial partner's (De-Puy Synthes) health guidelines, and local government guidelines as well.

Mexican courses

The face to face, synchronous activities took place throughout August 9 to August 12. Each course lasted two days, and it was designed for 40 participants. We had 20 faculty members, one general director for both courses, and a chair and co-chairperson per course. We had seven faculty members from Central America: three from Guatemala, two from El Salvador, two from Costa Rica and 21 from Mexico. Some faculty members participated in both basic principles courses and some participated in a basic principles course and then in the advanced principles course. We also had the former Latin America Education board member, and current Latin America Chairperson, both from Colombia.

The courses took place in a hotel. General COVID-19 preventive measures as dictated by the AO Foundation were: N95 or KN95 and face shield had to be always worn by all participants, faculty and staff members. Nitrile gloves were to be used during practical exercises. There was alcohol gel available in each room. Each participant was handed the following kit during registration: two KN95 masks, one face shield, an individual alcohol gel bottle.

The course participants and faculty members were divided in two halves: red and blue. Each half worked independently, and they did not meet during the whole course *(Figure 1)*.

The skills labs took place in three different rooms that connected between them with movable walls. Three stations were set in each room (each station against a wall in each room), and a small room was used for the final station. Each of the three main rooms also had a small working table where staff members left material and nitrile gloves were always available in each room. Each station had a can of Lysol® that was used after participants changed stations.

Each room could only hold 10 persons at a time: three faculty members (one per table), two participants per station, and one staff member from the industry. Some of the faculty members wore a portable microphone with individual speaker to make speaking easier. Skills labs were distributed in two halves, each lasting 45 minutes. After this time, participants stepped outside for 15 minutes to allow ventilation and sanitization by hotel staff.

We placed commercially available, generic CO_2 detectors bought online in each of the three main rooms. These detectors used infrared (NDIR) to measure CO_2 concentration, they had a detection range from 0 to 6,000 ppm, sampling time in 1.5 seconds, detection temperature ranged from -10 to 70

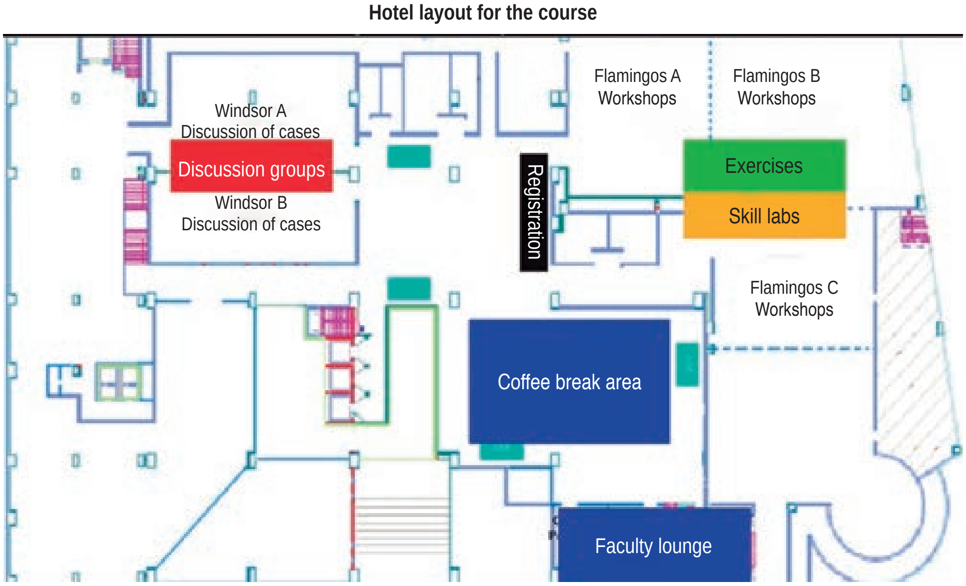

Figure 1:

General hotel layout. The spaces used for the skills lab and the practical exercises were the same, but the stations were distributed for each activity.

ºC, relative shyness from 10 to 99%. They were left always connected via their USB port for battery life.

Air conditioners were turned on to full intensity between 19º to 21º for the duration of the courses, and a series of ventilators placed backwards to work as a makeshift extraction system. The setting for the skills labs, including ventilator setup can be observed in *Figure 2*.

For practical exercises, the three big rooms were converted, two of them had three stations, and the bigger room had four stations. Each of them had a flat screen. The distribution for each room was: two rooms with six participants and one with eight participants, each of them with one faculty member and a staff person from the industry. Each exercise lasted 45 minutes, and after that, a 15-minute break was taken to allow for ventilation, sanitization by hotel staff, and group switch when needed. During practical exercises, there is usually an instructional video and further discussion with participants. This initial discussion did not take place to respect the time frame and social distancing of participants *(Figure 3)*.

There were three lounges assigned for case discussions. These lounges were equipped with air conditioning, the doors always remained open, there were tables and chairs for each participant were spaced at two meters from each other. The distribution for the discussion case lounges was: two lounges with seven participants and two faculty members, and the smaller one with six participants and two faculty members *(Figure 4)*.

The same commercially available models of CO_2 detectors were placed in each lounge. If at any time, CO_2 measurements exceeded the recommendations of 700 ppm, activities were to be suspended and rooms ventilated.

Coffee breaks took place in the hotel's Mezzanine. A division line was set so that both groups did not mix during these breaks. There was a faculty lounge and faculty members rested between activities.

Mealtime took place in the hotel's restaurant, only allowing four persons per table.

Survey

After every AO Trauma course, a survey is sent to participants to assess educational impact. With Latin America's chairperson's approval, an additional survey on Survey Monkey was sent to participants after the basic principles course in Mexico, Chile, and Colombia asking about country of origin, country of residence, age, experience, COVID-19 symptoms five days after the course, PCR testing if symptomatic, and appreciation of the protective measures taken. We calculated frequencies; ranges and average were calculated for each variable and described.

Results

Participant's epidemiology

Out of the 360 surveys sent to the basic principles course participants from Chile, Mexico, and Colombia, only 41 participants responded. Out of these, 20 participated in the courses that took part in Chile, one participated in the Colombian courses, and 20 participated in the courses in Mexico.

Average age of the participants was 32.12 years. Most of the participants were residents. There were 23 residents in total, three second years, seven third years, no fourth years, two fellows, 13 residents with unspecified level of experience. Nine orthopedic surgeon attending, one fellowship trained orthopedic surgeon, and six orthopedic surgeons with unknown level of expertise.

Fourteen respondents were from Mexico, fifteen from Chile, four from Venezuela, two from Costa Rica, two from Guatemala, one from Argentina, one from Perú, one from Bolivia and one from Panama. The respondent's countries of residence were: twenty-one lived in Chile, fourteen in Mexico, two in Costa Rica, two in Guatemala, one in Panama and one in Peru. All participants in the Chilean courses were from Chile. The only participant who responded from the Colombian course, traveled there from Chile.

Participants from Peru, Costa Rica, Guatemala, and Panama traveled to the Mexican courses. International travel for Mexico does not require proof of COVID-19 vaccination, a negative SARS-CoV-2 PCR or antigen test result to travel to Mexico.

On a Likert scale from 1 to 10, where 1 was terrible, and 10 was excellent, the average grading for the COVID-19 preventive measures was 9.5 for all the

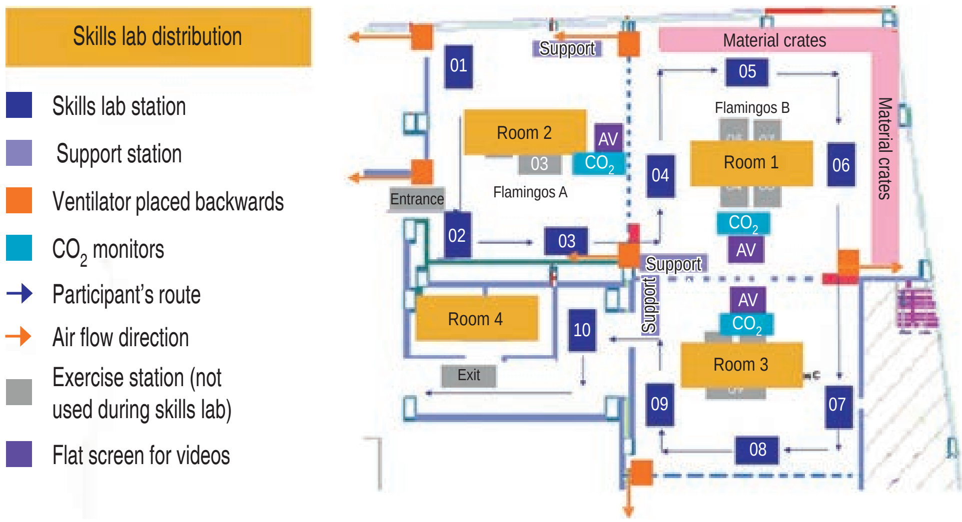

Figure 2: Skills lab layout. This space consisted on three large rooms that were separated and joined by movable walls. Tables set against the wall were used as stations. A small room next to room 3 was used for the last station only during the skills labs. Elements such as ventilators, and CO_2 monitors are shown on the figure.

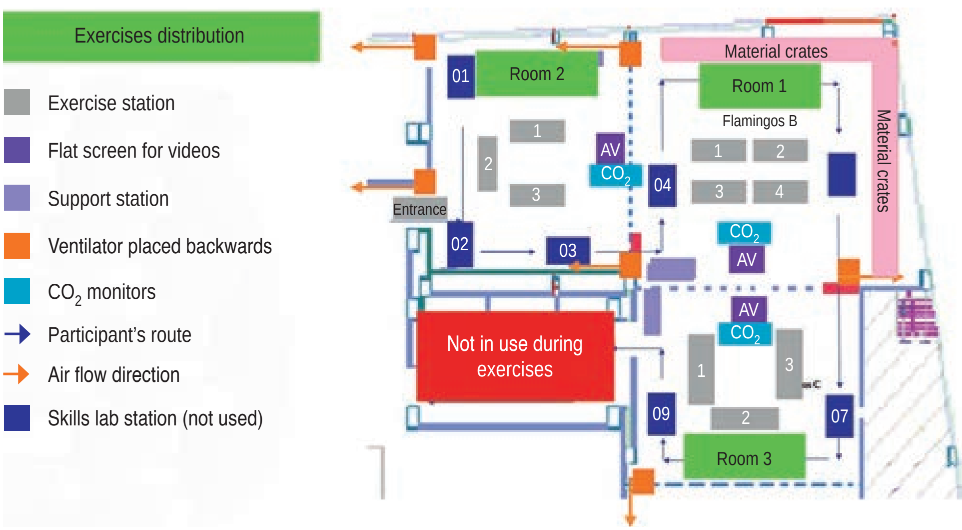

Figure 3: Exercise layout. This space consisted on three large rooms that were separated and joined by movable walls. The tables set against the wall that were used as stations during skills lab were not used again. Tables were placed near the center of the room to serve as working stations. Elements such as ventilators, and CO_2 monitors are shown on the figure.

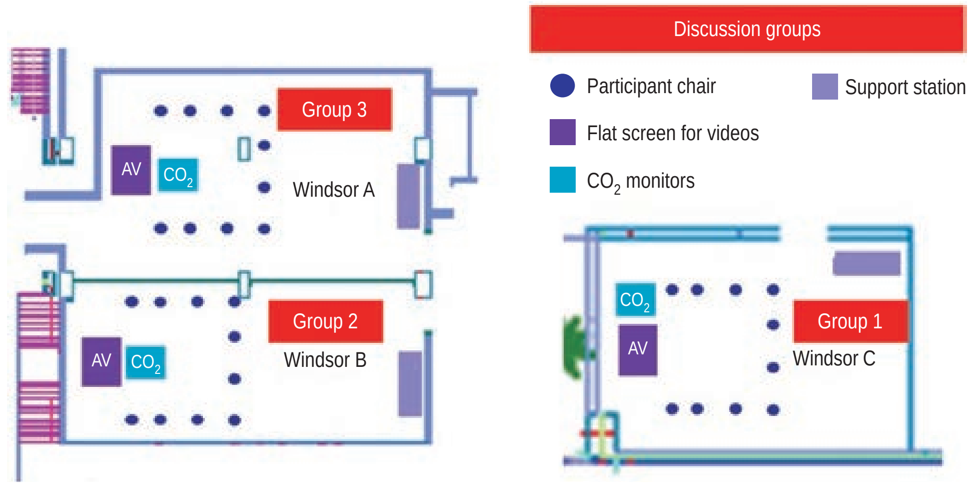

Figure 4: Discussion group space layout. Two of the lounges were on the same level as the exercise rooms, and the other one was in a level below, near the hotel's lobby.

courses. The range was 5 to 10. The average score for the Chilean courses was 9.45, and the average score for the Mexican courses was 9.55. The range for both countries was still 5 to 10. The only grading for the Colombian course was 10.

Out of 41 participants for all the courses, only one reported symptoms five days after the course, and had a positive SARS-CoV-2 PCR test that confirmed COVID-19. This participant was from the Chilean basic principles courses.

CO_2 monitoring during Mexican courses

During the first few station rotations of the skills labs, we observed that the CO_2 concentration increased up to 2216 ppm *(Figure 5A)* and up to 6,000 ppm in the lobby/registration area *(Figure 5B)*. At first, we believed that they were malfunctioning, and took them outside to compare readings. With heavy traffic, the readings were 2,304 ppm after a few minutes *(Figure 5C)*.

We observed that when people moved around in a room, CO_2 concentration increased. We also observed that when air conditioning was turned off by hotel staff, the CO_2 concentrations spiked. After this, we maintained the air conditioning turned on constantly, we also improved the ventilator setup in the skills labs and practical exercises rooms, and the doors were always open. This was the best we could do to direct air flow without laminar flow. We also paid close attention to the number of people in each room and took care not to have people moving around too much. Finally, we enforced the use of KN95 o N95 facemasks instead of regular surgical masks. With these interventions, we managed to maintain CO_2 concentration under 500 ppm throughout the course. Most rooms were steady with 400-460 ppm even with all the participants in them discussing or working for most of the first course and all the second course *(Figure 5D)*.

Discussion

After 17 months without face-to-face activities for AO Trauma Latin America, we managed to host two COVID-19 free basic principles of fracture management courses in hybrid mode in Mexico. Almost simultaneously, Chile hosted another two courses, and Colombia hosted two courses a month later. In Chile only one participant reported symptoms within five days after the course, and a diagnosis was confirmed with SARS-CoV-2 PCR test.

The August 2021 courses were the first AO Trauma Latin America courses in hybrid mode with face-to-face activities after almost 17 months since the pandemic was declared in March 2020. Prerecorded talks were available online for a month and synchronous zoom meetings took place during that month as well. The two face-to-face days were dedicated to practical exercises and case discussions only. There were no lectures during the face-to-face part of the course.

Throughout the months leading to the courses, much discussion took place considering if the courses should take place or if they should be cancelled. Two days before the courses started, Mexico City turned to red light because of COVID-19 case surge entering the county's third wave. Mexico has been using a stoplight system throughout the pandemic to identify infection risk, hospital occupation, and to determine which activities needed suspension and lockdown and which were able to function normally. Initially, the red light meant that only basic high priority activities could take place and the city went into lockdown the first time we were in red light.[2]

Considering that no official restrictions were enforced by the government, even with a red light, almost every participant and faculty member was fully vaccinated because they were all healthcare personnel, and preventive measures were based on current international recommendations, the decision to move forward with the courses was made.[3]

Since there is currently no definite treatment for COVID-19 and major emphasis has been placed in NPI (non-pharmaceutical interventions) for prevention of infection. These include wearing a medical face mask, good personal hygiene like constant hand washing, social distancing, avoiding crowded places, and recently, ventilation of closed spaces has been proposed.[4]

Non-pharmaceutical interventions

Current evidence suggests that SARS-CoV-2 virus is transmitted via droplets and aerosols that could travel a long way and stay suspended in places with little ventilation.[4,5] Bio aerosols < 5 μm in diameter cause airborne transmission, while the larger ones set down on surfaces.[6] Van Doremalen et al. studied this transmission and found that the SARS-CoV-2 virus remained viable in aerosols for about three hours, it was more stable on plastic, and stainless steel than on copper and carboard, and it was still viable after 72 hours on these surfaces.[7]

Facemask wearing has been the most important recommendations by the WHO and local governments although there is limited evidence in the context of clinical controlled trials to support this. During the 2003 SARS infection, face masks helped mitigate the spread.[6] Facemasks should cover the upper airway, not allowing virus inhalations and so, preventing the ACE2 proteins found in the mucous membranes of

Figure 5:

A) CO_2 measurement during the first activity of the day. **B)** Initial CO_2 measurement in the resting area and check in station. **C)** Initial CO_2 measurement in the street to test that the device was working. **D)** CO_2 measurement during practical exercises.

mouth and nose to enter in contact with the virus.[5] It has also been one of the most resisted measures by certain groups of people worldwide.

A study published by Cheng, et al during the first 100 days of COVID-19 pandemic. Hong Kong population had an early adoption of wide face mask use, together with hand washing and social distancing. During the first 100 days, they reported a total of 961 cases. They found a significance difference between mask-off settings and mask-on settings ($p = 0.036$) in Hong Kong.[8] They also found a statistically significant difference in case numbers when comparing with other major cities in countries where the use of facemasks was not widely implemented. On day 100 (April 8th, 2020), the incidence of COVID-19 per million population in Singapore and South Korea was higher than that in Hong Kong ($p < 0.001$).[8]

A retrospective cohort study by Wang et al. in Beijing found that wearing a mask at home before a primary case developed illness was protective for a family to develop illness, however, if facemask use started after the primary case presented with COVID-19 illness, the use of facemask was not protective.[9]

A meta-analysis by Tabatabaeizadeh suggests, like other meta-analysis, that there was a statistically significant association between face mask use and decreased risk of COVID-19 infection; with a pooled RR (95% CI) was 0.12 (0.06, 0.27) ($p < 0.001$).[6]

Distancing two meters from other persons has been adopted as an additional measure by the World Health Organization, as well as many governments around the world[5] (Int. J. Environ. Res. Public Health 2020). Current research shows that even this distance could not be enough because small particles containing viable virus could travel up to 10 meters from the origin source. It has even been suggested that the aerosol route should be considered a pathway for viral transmission. However, it has been proposed that if every person in a room uses a facemask, then the two meters of social distance could be enough to prevent transmission.[5]

A high particulate matter fraction (PM) concentration has been associated to an increase in abundance of viruses and infectious disease transmission since 2009.[10] Highly contaminated cities like Beijing and Mexico City have a high PM concentration. A study by Wu et al. suggests that aerosol droplets can be stabilized in the air while coalescing with PM at high concentrations under atmospheric stability conditions.[11,12]

In densely occupied rooms, considering that there is no outdoor air pollution, and no major source of pollution within the room, human bio effluents have been reported as the major source of pollution indoors. It has been recognized that the only means to maintain a good indoor air quality is having adequate ventilation.[13] The use of CO_2 monitoring has been proposed to track ventilation in rooms. And the hygienic limit value in Swiss schools has been established as a value of 2,000 ppm for CO_2.[13] WHO has established an acceptable level of 1,000 ppm of CO_2 indoors.[13] During the COVID-19 pandemic, the recommended value for CO_2 within classrooms in Italy was established at 700 ppm.[14] Spain recommended CO_2 concentrations should not exceed 550 ppm in hallways and 700 ppm in classrooms.[13]

Natural ventilation can help in decreasing CO_2 ventilation, although artificial ventilation has been shown to possibly disseminate infected particles between different spaces, while also creating air redistribution and turbulence.[15] Bazant et al published guidelines to avoid infection indoors based on studies of airborne transmission in a well-mixed airborne room. These include avoid spending extended periods in highly populated areas, rooms with large volume and high ventilation rates are preferable. There is greater risk in rooms where people increase respiration rates and exhalation in activities such as: working out, singing, or shouting. Finally, masks worn by both infected and susceptible people will decrease the risk of transmission.[15]

As early as Aril 23, 2020, Setti et al. recommend that mandatory adoption of facemasks would be desirable, since they contain droplets exhaled by infected persons, and prevent inhalation of these droplets by non-infected persons. They also suggested that more than two meters of social distance should be considered because or aerosol dispersion. But, considering universal facemask use, two meters should be enough. Finally, they also proposed that the association of PM levels and SARS-CoV-2 spreading should encourage strategies for reduction of PM emitted by living forms.[5]

Many of the measures taken to decrease COVID-19 disease during the courses were established by the AO Foundation for activities worldwide. These included: the use of facemasks, face-shields, hand hygiene, the use of nitrile gloves, the number of persons in a room and the clustering of participants and faculties that would never meet, and sanitization. The sanitization protocol was not established, and it was left to the hotel's internal protocol. They sanitized with quaternary ammonia salts.

The separation of both groups was achieved during the course activities, however, on the first day of the first course we noticed that everyone gathered during coffee breaks and lunch time. We divided the group during coffee breaks, but it was impossible to separate everyone for lunch time. The hotel just wasn't big enough. The general director and one of the course's chairs had previously visited the hotel. This helped us plan the distribution and participant flow better and adapt the guidelines to the actual space we had.

Measures established by the Mexican government included: measuring temperature of every person when they first accessed the hotel's facilities and feet sanitization when accessing facilities, and open doors.

The measures added by the course's general director, chair, and co-chairs were ventilators placed backwards in strategic positions to improve air extraction, CO_2 monitoring, and air conditioning turned on. Initially, we had not placed ventilators, but during the first couple of hours of the course, we observed an alarmin increase in CO_2 concentration, over 2,000 ppm. After checking that the monitors were working, we asked that the air conditioning be turned on, which helped a little but did not really decrease the CO_2 concentration significantly initially. There was also the risk that we would spread contaminated air in all areas. After that, we added the ventilators facing backwards to use them like extraction systems. They were all lined up and faced the exits with open doors. This really helped decrease the CO_2 concentrations to adequate levels. We struggled with the hotel's cooperation because they tended to turn off the air conditioning frequently. So we had to monitor concentrations and air flow constantly. To the best of our knowledge, we were the first group to use CO_2 monitoring during a face-to-face educational event in orthopedics.

Participants complained of being cold, but this did not change our decision. We also noticed that during the first activities, participants were wearing surgical masks instead of the KN95, so we asked everyone to wear the KN95. Finally, when people moved around a lot, we observed that CO_2 concentrations quickly rose from 400 ppm to over 1,500 ppm, we believe this is due to turbulence and the absence of laminar flow. So, we were careful to limit the number or persons in each room and to limit movement within each room.

Because this was a hands-on course, participants were constantly touching and handling instruments, they all had alcohol gel, and everything was cleaned before and after with a commercially available disinfectant. Everyone wore nitrile gloves during practical exercises.

We noticed that after hours went by, most people removed their face shields, since it was difficult to listen. This led to people reaching to their faces more frequently. The most frustrating part was that meals were held for everyone at the same time in the same space, so we felt that all the effort put into everything was cut short during this time. We suggest that this be considered before events and that maybe the whole group could be clustered for meals as well if clustering is really intended.

Recommendations

Considering the available scientific evidence and our own experience during the courses, we recommend that best practices for these kinds of events should include: mandatory face mask use for everyone at all times (except during meals and coffee breaks), frequent hand hygiene –before and after manipulating instruments– (the use of gloves is controversial and it could be substituted with frequent hand hygiene), CO_2 monitoring could be very useful to identify the adequacy of ventilation, frequent ventilation and breaks, and maybe consider some sort of eye protection.

The practices we found were not as useful were the use of nitrile gloves, face shield, mealtimes, temperature measuring, shoe sanitation, and clustering of participants and faculty members during the course. This final measure seemed pointless, since there weren't enough faculty members to avoid crossing over from one course to another, and we sometimes had to fill in for someone from the other cluster because of different reasons. Faculty members also met in the faculty lounge. And everyone got together for the meals in the same place, at the same time. Even after this, we had no reported cases of COVID-19. Although not every participant responded the survey, we did not hear from any more positive cases five to ten days after the courses.

Study limitations

The limitations of this study are that this is only a description of the way our courses were planned based on current evidence and regulations. There were no control or intervention groups, and there was no way to measure air flow or the actual effect of N95 or KN95 masks and ventilation. We have no data on the differences between each country's interventions or any way of knowing if they made any differences. Finally, only a small number of participants completed the surveys.

Regardless, analyzing the physical space while planning face- to- face activities NPIs can help plan the activities for the upcoming years. Knowing that preventive measures work and enforcing them can help safe academic activities take place while the pandemic lasts.

Face-to-face activities will probably increase in the upcoming months and well into 2022, as the academic world attempts to return to the pre-pandemic normality. Careful planning and scouting of the physical space for incorporating safety measures where the activity will take place should be considered.

Conclusion

Independent of vaccination status and pre-course testing, we suggest enforcing the mandatory use of facemasks by everyone indoors, constant hand hygiene, short intervals of occupation, adequate ventilation strategies, and CO_2 monitoring can help decrease the possibility of COVID-19 outbreaks while allowing face-to-face events to take place.

Hybrid models should be considered, and face-to-face time should be saved for the activities that benefit the most from this time, such as practical exercises and surgical simulation.

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Conflict of interests

All authors are AO Trauma faculty members.

CAB is a consultant for Johnson & Johnson Medical Mexico, she declares no conflict of interest regarding this report.

The rest of the authors declare no conflict of interest regarding this report.