

Restructuring of a pediatric hospital in the face of the COVID-19 pandemic

Reestructuración de un hospital pediátrico ante la pandemia de COVID-19

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Overview of the pandemic

In December 2019, a new virus named SARS-CoV-2 was reported in Wuhan province, China. The first case of COVID-19 in Mexico was confirmed on February 28, 2020, and the World Health Organization declared the pandemic on March 11. As of July 2020, ~20.5 million confirmed cases and more than 700,000 deaths have been reported worldwide¹. In Mexico², reports have documented more than 500,000 confirmed cases, and the number of deaths has surpassed 55,000.

COVID-19 mainly affects the adult population, but between 1 and 5% of the cases correspond to pediatric patients. Fortunately, the disease is less severe in children and adolescents. Only ~0.2% of the cases evolve to severe disease in these age groups³.

The most frequent clinical manifestations of the disease are cough and fever, although this last sign may be absent in more than 50% of the cases⁴. Gastrointestinal manifestations such as diarrhea,

vomiting, or abdominal pain may also be present. In severe cases, the disease may show a multisystemic inflammatory syndrome with severe heart disease⁵. Few cases of newborns born from mothers who were positive for COVID-19 have been reported. Most of them have shown a favorable evolution, although vertical transmission has not been conclusively demonstrated⁶.

Actions of the Hospital Infantil de México Federico Gómez in response to the pandemic

Since the beginning of 2020, Mexico has been preparing for the COVID-19 pandemic. One of the measures was the restructuring of hospitals. The Hospital Infantil de México Federico Gómez (HIMFG) was designated as a COVID-19 hospital for the pediatric population's care, for which actions were taken to identify

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needs and to organize and implement measures to face the pandemic. The most relevant actions carried out in the different hospital areas were the following:

1. *Restructuring of the hospitalization areas.* Initially, 14 beds were assigned in the Emergency Department for patients with suspected COVID-19, and the adjacent Ambulatory Surgery area, with a capacity of 17 beds, was reserved for confirmed patients. For severe cases, ten beds were assigned in the Intensive Care Unit (ICU) and seven places in the Neonatal Intensive Care Unit (NICU). As an additional measure, the auditorium lobby was equipped to attend 12 adult convalescent patients (Figure 1). Because of the pandemic, the hospital capacity for the care of these patients increased. Overall, the hospital has 57 places for COVID-19 patients: 43 places for confirmed patients (10 in the ICU, 5 in the NICU, and 28 in noncritical hospital settings), and 14 places for suspected patients in the Emergency Department.
2. *Human resources.* Thanks to the support of the Ministry of Health through INSABI, seven physicians were hired to strengthen the Emergency Department, the Intensive Care, and the Infectious Diseases services. Also, three internal and general medicine specialists and 55 nurses were hired.
3. *Identification of needs.* According to the estimated patients to be attended, the needs for personal protective equipment (PPE), alcohol gel, wound care materials, and hospital supplies were defined.
4. *Staff training.* Courses, workshops, and lectures have been given to physicians, nurses, general service, and administrative staff. Information about epidemiological, clinical, and prevention aspects of the disease, as well as the proper use of PPE, training in collecting samples, among others, have been distributed. Additionally, the Epidemiology Department has collaborated in the dissemination and tuition of information for first-contact physicians.
5. *Identification of cases and contacts.* Each confirmed case of COVID-19, whether of healthcare personnel or patients, is evaluated by the Epidemiology or Infectology Department, and prevention, care, and follow-up measures are established according to the flow diagrams shown in Figures 2 and 3.
6. *Production of reference material.* Considering the type of personnel/family and their activities, the PPE thermometer (Figure 4) and the consultation application for its use (<https://epp-dot-sincere-charmer-238823.uc.r.appspot.com>) were designed accordingly to identify their protection needs.



Figure 1. The lobby area equipped with 12 beds.

7. *Triage.* The temperature of patients, relatives, and staff members was measured in all the hospital's access points (Figure 5). Additionally, triage was performed at the patient access area to identify patients with respiratory symptoms, who are then referred to an exclusive attention area. Also, sick family members are prohibited from entering.
8. *Control of supplies.* The *Dirección de Planeación* (Planning Directorate) and the *Departamento de Calidad* (Quality Department), in coordination with the *Subdirección de Atención integral al Paciente* (Sub-directorate of Comprehensive Patient Care) and the Nursing Department, concentrate and distribute the PPE. We carry out a strict control of the supplies from hospital purchases and donations by individuals and organizations.
9. *Generation of information.* Every day, information on the pandemic is collected from different hospital areas and sent to the *Comisión Coordinadora de los Institutos Nacionales de Salud y Hospitales de Alta Especialidad* (Coordinating Commission of the National Institutes of Health and High Specialty Hospitals), *Secretaría de Salud* (Ministry of Health), *Secretaría de Hacienda* (Ministry of Finance), Government and C5 of the CDMX (Mexico City). In turn, the *Dirección de Planeación* concentrates the data for internal use. Figures 6 and 7 show the incidence of suspected and confirmed cases during the pandemic in the HIMFG up to July 31, 2020.
10. *Medical care for health care personnel.* An area with the qualified medical staff was set up to take care of sick personnel, including swabbing for diagnostic confirmation by RT-PCR (reverse transcriptase-polymerase chain reaction). Additionally, the Dermatology and Ophthalmology services

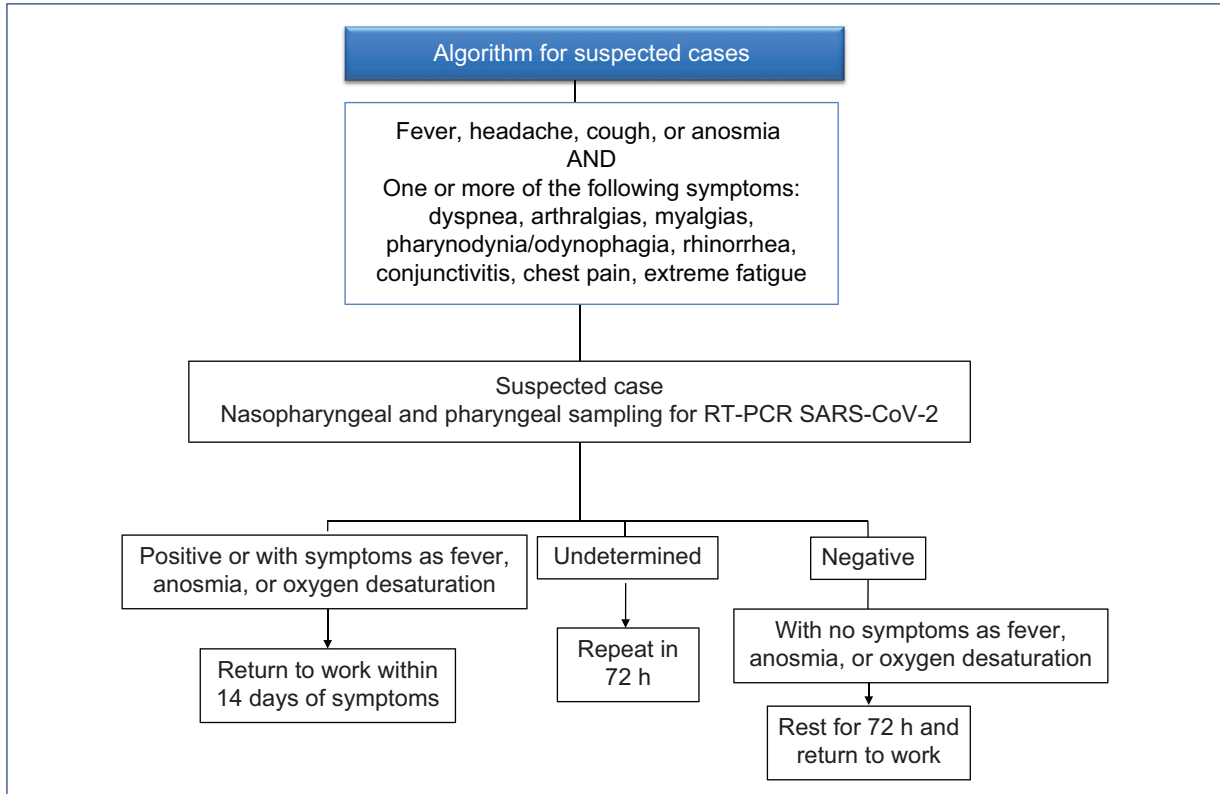


Figure 2. Algorithm of care for healthcare personnel as a suspected case of COVID-19.

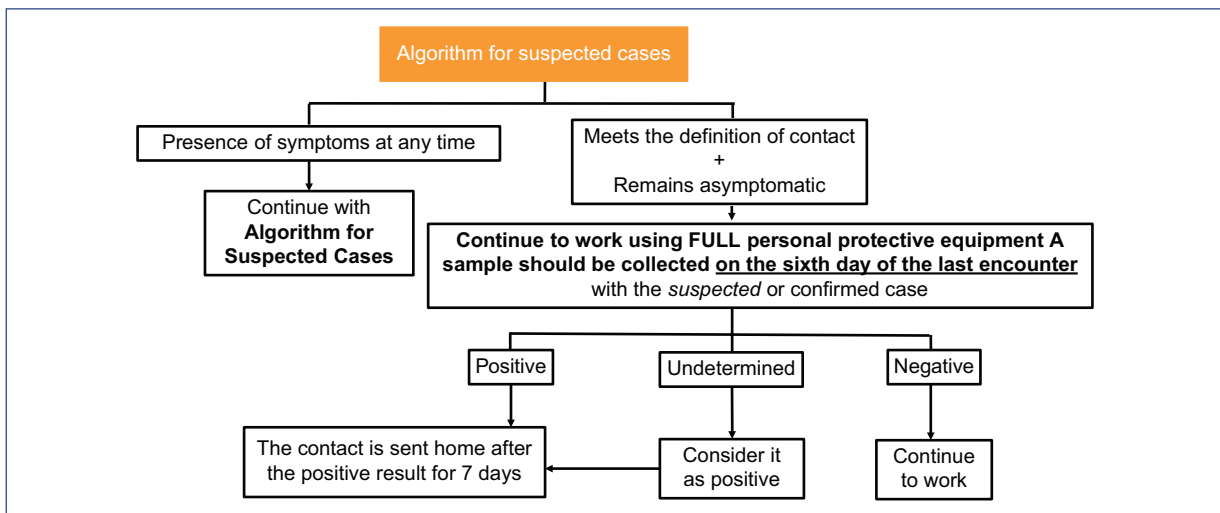


Figure 3. Algorithm of care for COVID-19 positive patient contacts

provide assistance in cases of injuries related to the use of PPE.

11. *Laboratory*. From March 23, the *Instituto de Diagnóstico y Referencia Epidemiológicos* (Institute of

Epidemiological Diagnosis and Reference) validated the HIMFG Molecular Biology Laboratory to perform the RT-PCR test for SARS-CoV-2. As of July 31, 1,972 tests have been performed: 1,188 on

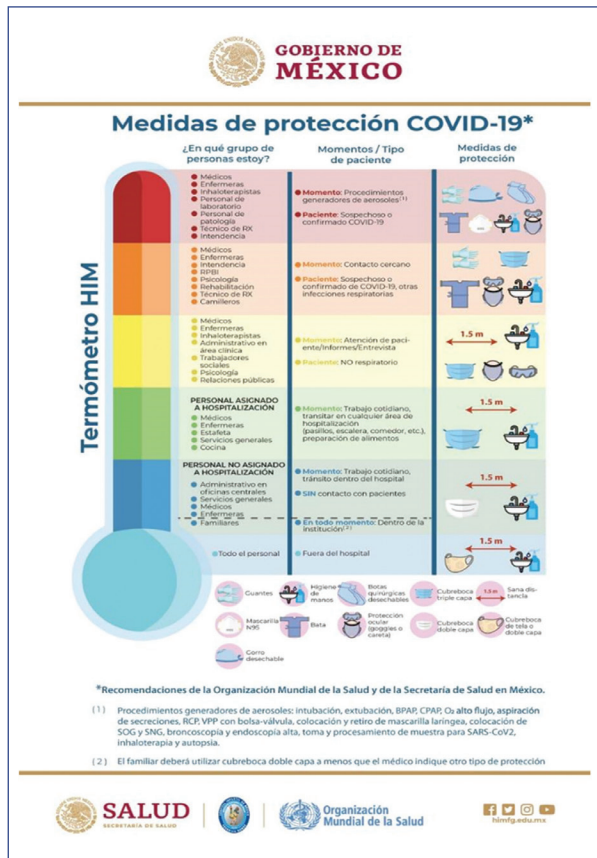


Figure 4. The thermometer of the Hospital Infantil de México Federico Gómez indicates the personal protection equipment required according to the type of personnel and their activity.



Figure 5. Respiratory triage.

patients and 773 on healthcare personnel, with positive results in 203 (17.1%) and 193 (25%) cases, respectively.

12. *Biomedical engineering and maintenance actions.* Ultraviolet lightboxes for the sterilization of N95 masks were developed in strict compliance with regulations and validation by professionals (Figure 8). “Capsules” were designed for the transfer of patients with COVID-19 within the hospital (Figure 9), and acrylics were placed to limit individual spaces in the dining-room (Figure 10).
13. *Social communication.* Videos related to the COVID-19 pandemic have been produced with the topics indicated in Appendix 1. Additionally, information has been transmitted through posters, social networks (Facebook, YouTube, Twitter, Instagram, and WhatsApp), and the dissemination of informative material prepared by the *Secretaría de Salud* has been promoted.
14. *Psychological support.* The Department of Psychiatry and Psychology has conducted activities to identify and treat psychological disturbances resulting from the pandemic in patients, families, and health care personnel.
15. *Primary caregivers in the COVID areas.* We collaborated to establish guidelines to allow a family member to accompany the patient diagnosed with COVID-19 during hospitalization with the necessary protection measures⁷. With the implementation of these measures, caregivers support the healthcare team and reduce the emotional consequences of the separation in the pediatric patient.
16. *Work meetings.* Since the beginning of the pandemic, the COE (*Centro de Operaciones de Emergencia*)-COVID group has been meeting daily to analyze the problems and make relevant decisions.
17. *Call center.* A space with computers and telephone lines was set up for medical personnel to provide internal and external counseling about COVID-19 and provide information about blood donation requirements and psychological support.
18. *Security.* The National Guard supports the safety of staff and patients.
19. *Research projects.* Laboratories and research units were reorganized to prioritize integrating the research projects with the medical care of patients and healthcare personnel affected by COVID-19. Eleven protocols related to the diagnosis, prognosis, and treatment of patients have been registered, and three of them have financial support from the *Consejo Nacional de Ciencia y Tecnología* (National Council of Science and Technology). A specific laboratory with biosafety level 2 (COVID HIMFG Laboratory) was enabled to store samples of suspicious and confirmed cases.

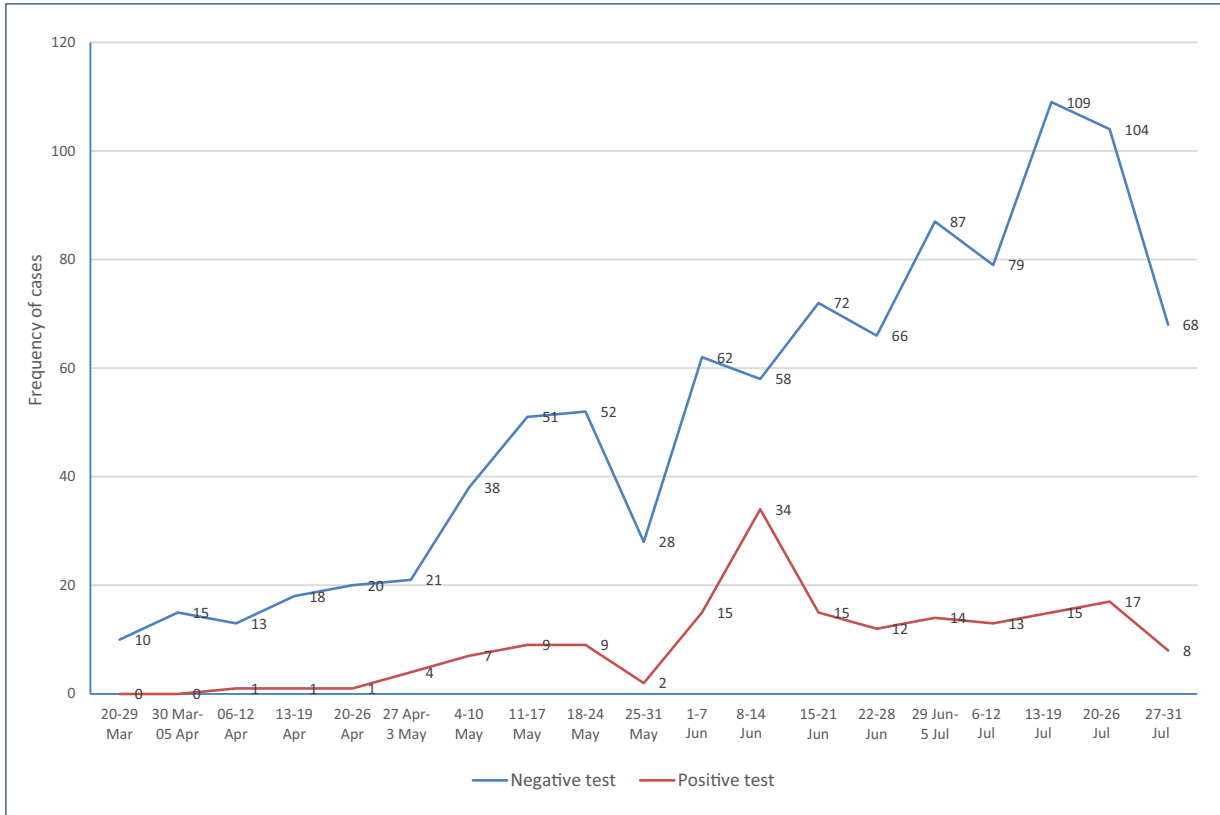


Figure 6. Weekly trend of results in COVID-19 suspected cases. Suspected COVID-19 cases per week (N = 1161). Positive SARS-CoV-2 cases = 190 (16.3%).

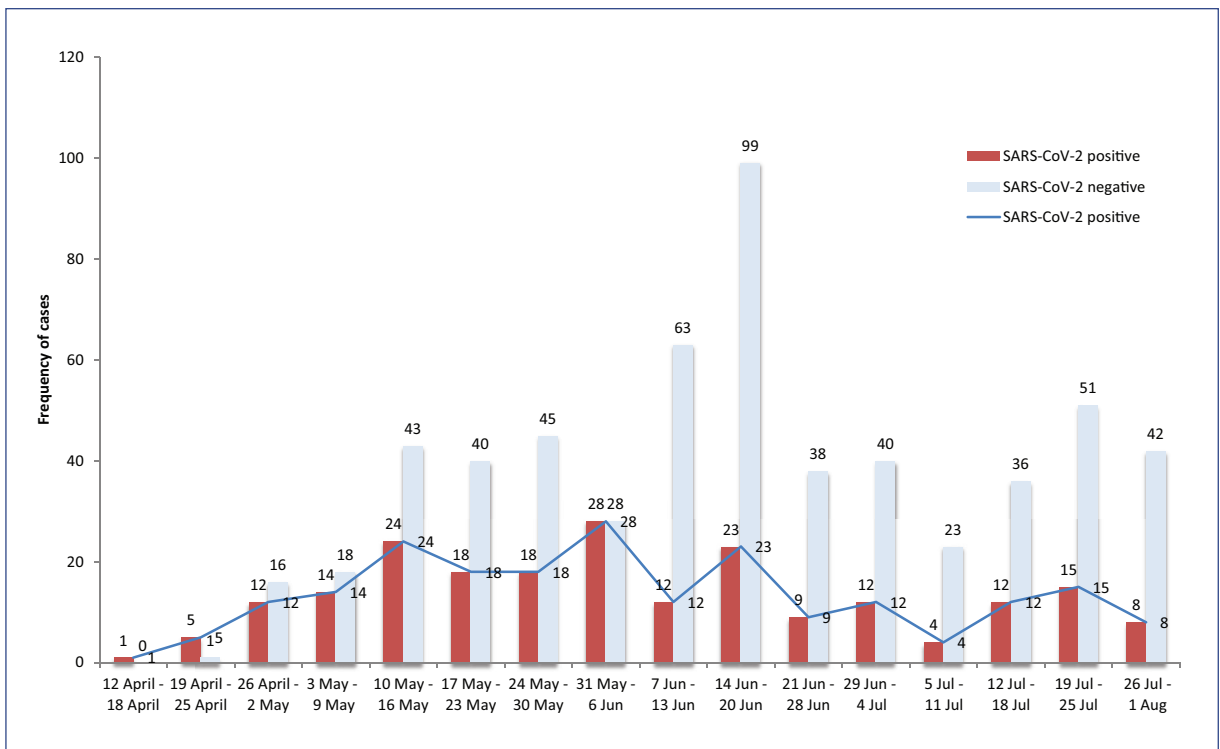


Figure 7. Weekly outcome of COVID-19 cases in healthcare personnel. Healthcare personnel with suspected COVID-19 per week (N = 792). Positive SARS-CoV-2 cases = 215 (27.1%).



Figure 8. An ultraviolet lightbox designed by the Biomedical Engineering department to re-sterilize N95 respirators. It contains two 280 nm lamps that emit radiation in the range of 280-420 nm to achieve exposure of 0.5-1 J/cm².

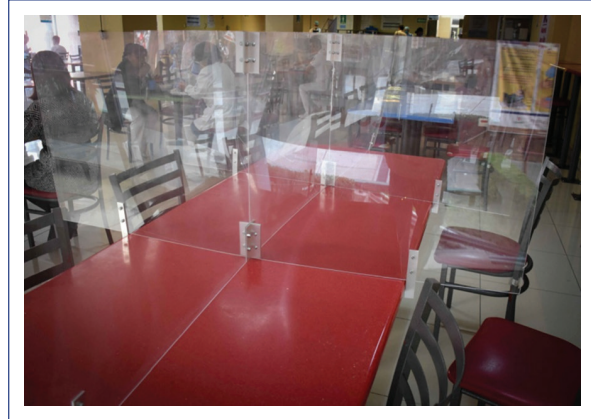


Figure 10. Adaptations to the dining room with acrylic divisions.



Figure 9. Transfer “capsules” for COVID-19 patients.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on patient data publication.

Right to privacy and informed consent. The authors have obtained the written informed consent of the

patients or subjects mentioned in the article. The corresponding author has this document.

Conflicts of interest

The authors declare no conflict of interest.

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None.

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Appendix 1

Videos produced by the Social Communication department

1. Current status of the coronavirus. February 18, 2020. Available from: <https://www.youtube.com/watch?v=1-N75kamB1M>
2. Second training course for instructors on COVID-19 caused by SARS-CoV-2. March 03, 2020. Available from: <https://www.youtube.com/watch?v=HQv9a0lAncw>
3. COVID 19 epidemiology and viral characterization of SARS-CoV-2 beta coronavirus family. March 09, 2020. Available from: https://www.youtube.com/watch?v=U5UEi_PK2fU
4. Epidemiological surveillance actions (medical units, country entry points, and diagnosis). March 09, 2020. Available from: <https://www.youtube.com/watch?v=AC063LwDMEA>
5. Reference criteria and management of the critically ill patient with suspected or confirmed COVID-19. March 09, 2020. Available from: <https://www.youtube.com/watch?v=JDlqomj3lBM>
6. Standard measures to prevent SARS-CoV-2 infection. March 09, 2020. Available from: <https://www.youtube.com/watch?v=Z6RMZzuVAyU>
7. Myths and realities regarding COVID-19. March 09, 2020. Available from: <https://www.youtube.com/watch?v=WjoCjknkMyl>
8. Frequently asked questions about COVID-19. March 09, 2020. Available from: <https://www.youtube.com/watch?v=XEFTRDGSlIQ>
9. General recommendation regarding sample taking, analysis, and handling. March 18, 2020. Available from: <https://www.youtube.com/watch?v=jgdXeWUunnis>
10. Fitting of personal protective equipment for healthcare workers. March 23, 2020. Available from: https://www.youtube.com/watch?v=prz0_7XmjIU
11. Handwashing technique with soap and water. April 01, 2020. Available from: <https://www.youtube.com/watch?v=v3Gvgr4tM34>
12. Appropriate hand hygiene protocol. April 01, 2020. Available from: <https://www.youtube.com/watch?v=vwjdiT3T2vg>
13. Disinfecting solution for cleaning surfaces (chlorine). April 03, 2020. Available from: <https://www.youtube.com/watch?v=voYdPGu8N6U>
14. When you care, we all care! April 08, 2020. Available from: https://www.youtube.com/watch?v=yZ_rJxsc_7g
15. Disinfecting solution for cleaning surfaces (chlorine). April 15, 2020. Available from: <https://www.youtube.com/watch?v=KHJER6M-y0>
16. How does SARS-CoV-2 behave in the environment, and how does it enter the body? April 17, 2020. Available from: <https://www.youtube.com/watch?v=CZqv32RTY6o>
17. Transmission of COVID-19 from surfaces. April 18, 2020. Available from: <https://www.youtube.com/watch?v=CEUXxl0yfk4>
18. How to avoid transmission at work? April 21, 2020. Available from: <https://www.youtube.com/watch?v=FKqG5EK2i94>
19. What are the phases of COVID-19? April 22, 2020. Available from: <https://www.youtube.com/watch?v=3Gd6ftbLuIE>
20. How should we respond to the COVID-19 pandemic? April 23, 2020. Available from: <https://www.youtube.com/watch?v=doP6up2PCT8>
21. Fitting, removal, and cleaning of an acetate face shield. April 23, 2020. Available from: <https://www.youtube.com/watch?v=mwjE7jy1E4g>
22. Basic mask. April 23, 2020. Available from: <https://www.youtube.com/watch?v=cdH69-F2kRU>
23. Fitting, removal, and cleaning of the face shield. April 23, 2020. Available from: <https://www.youtube.com/watch?v=asC5Ji8mnQE>
24. Fitting, removal, and cleaning of plastic safety glasses. April 23, 2020. Available from: <https://www.youtube.com/watch?v=sal4Nxas7e4>
25. Fitting, removal, and cleaning of plastic safety glasses. April 23, 2020. Available from: <https://www.youtube.com/watch?v=bZYHXfto5Bk>
26. Cloth mask. April 23, 2020. Available from: <https://www.youtube.com/watch?v=2mTG21QTfTU>
27. Three-layer mask with face shield. April 23, 2020. Available from: <https://www.youtube.com/watch?v=nWN8a4kdmkQ>
28. Three-layer mask. April 23, 2020. Available from: <https://www.youtube.com/watch?v=KP0K8Ds2zKY>
29. N95 respirator. April 23, 2020. Available from: <https://www.youtube.com/watch?v=fK2qsrLFwaE>
30. Appropriate hand hygiene protocol. April 24, 2020. Available from: https://www.youtube.com/watch?v=tx_OnbEfQWk
31. Fitting and removal of protective glasses and masks. April 27, 2020. Available from: https://www.youtube.com/watch?v=W3_XGSAKV5w
32. Fitting and removal of gloves. April 27, 2020. Available from: <https://www.youtube.com/watch?v=NQByohmDTI4>
33. Fitting and removal of the medical gown. April 27, 2020. Available from: <https://www.youtube.com/watch?v=w9Y-kSLHKxs>
34. Fitting, removal, and cleaning of plastic safety glasses. April 28, 2020. Available from: <https://www.youtube.com/watch?v=h4wLMqOG-cY>
35. Fitting, removal, and cleaning of plastic glasses. April 28, 2020. Available from: <https://www.youtube.com/watch?v=uFqzaq4vgCc>
36. Fitting, removal, and cleaning of the face shield. April 28, 2020. Available from: https://www.youtube.com/watch?v=thJY_ykP6Xg
37. Fitting, removal, and cleaning of the acetate face shield. April 28, 2020. Available from: <https://www.youtube.com/watch?v=WSrC29e8Nq8>
38. Support line for people in general with crises due to the new coronavirus. April 30, 2020. Available from: <https://www.youtube.com/watch?v=rDxR-PkQBQ1c>
39. How do I know if my child has COVID-19? May 06, 2020. Available from: <https://www.youtube.com/watch?v=jubGjM9-8Hw>
40. Correct use of the mask. May 07, 2020. Available from: <https://www.youtube.com/watch?v=HMPecE5dVCC>
41. Mental health in children and adolescents in the face of COVID-19. May 07, 2020. Available from: https://www.youtube.com/watch?v=7od-C2axY_qY
42. Confinement due to COVID-19 in children and adolescents (recommendations). May 13, 2020. Available from: <https://www.youtube.com/watch?v=9iokrzpxUOY>
43. Facial injuries caused by protective equipment (handling). May 15, 2020. Available from: <https://www.youtube.com/watch?v=YLAyyCI0imo>
44. Contact dermatitis—Dr. Adriana Valencia. May 15, 2020. Available from: <https://www.youtube.com/watch?v=6bjrRnuxKps>
45. Stress disorders in children—Dr. Arturo Soria. May 18, 2020. Available from: <https://www.youtube.com/watch?v=m8qrmYK-0B4>
46. Eight key moments of hand washing. 20 May 2020. Available from: <https://www.youtube.com/watch?v=OnuOwfJSVKw>
47. Exercises for children from 6 to 12 years old—Jorge Vargas. May 26, 2020. Available from: https://www.youtube.com/watch?v=joOy4_Jh3Qw
48. Exercises for people over 65 years old—Jorge Vargas. May 26, 2020. Available from: https://www.youtube.com/watch?v=Qyq9B4Y_t-0
49. Exercises for healthy adults—Jorge Vargas. May 26, 2020. Available from: <https://www.youtube.com/watch?v=UHZe5lym0Qw>
50. Exercises for adults with obesity—Jorge Vargas. May 26, 2020. Available from: <https://www.youtube.com/watch?v=WgkDZw-21HA>
51. Use the mask correctly. June 2, 2020. Available from: <https://www.youtube.com/watch?v=1qK4-hNCT18>
52. Coronavirus infections. June 4, 2020. Available from: https://www.youtube.com/watch?v=5_LRReoDfif8
53. Donation request—Dr. Eduardo Barragán AMHIM. May 01, 2020. Available from: <https://www.facebook.com/AMHIMCDMX/videos/558012261764452/>
54. Donation request—Dr. Eduardo Barragán AMHIM. May 01, 2020. Available from: <https://www.facebook.com/AMHIMCDMX/videos/2721307074661568/>
55. Whom do I want to be during the COVID? Available from: <https://www.youtube.com/watch?v=ZCM2IL8dCIY>
56. Basic mask for administrative staff. Available from: <https://www.youtube.com/watch?v=cdH69-F2kRU>
57. COVID psychiatry course for teaching platform—Dr. Arturo Soria. Available from: http://ense.himfg.edu.mx/educacion_distancia/com