

The rescue of medical education crippled by the COVID-19 pandemic

El rescate de la docencia dañada por la pandemia COVID-19

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Abstract

Background and Objective: The ravages caused by the COVID-19 pandemic have affected medical education by losing the tutorial teaching that we carried out in our Institution. **Method:** The strategies implemented through information and communication technologies are described in this article. **Results:** With the strategies carried out, it was possible to continue with all the theoretical education virtually at a distance, including the daily hospital rounds, the presentation of clinical cases, the remote analysis of laboratory and cabinet methods, as well as the teaching of the physical examination and the acquisition of diagnostic aid methods. In addition, the number of attendants for the weekly academic general session of the institute increased from 100 in-person attendants to 500 virtual attendants (average), with approximately 5000 reproductions of the recorded sessions. The advantages and disadvantages of these new techniques and the challenges for the future are discussed in this manuscript. **Conclusions:** Undoubtedly, the pandemic has caused damage to the teaching of two generations of medical students during 2020 and 2021, and we are still afraid that, in 2022, it will persist. Therefore, in our opinion, the medical education implemented by us is not ideal, but, at least, it constitutes a good palliative for the harm that the pandemic caused to medical education.

Keywords: COVID-19. Medical education. Students in pandemic. Effect of COVID-19 in medical education. Virtual education. Medical students in pandemic.

Resumen

Antecedentes y Objetivo: Los estragos causados por la pandemia COVID-19 alcanzaron también la educación médica perdiéndose la enseñanza tutorial que ejercíamos en nuestro Instituto. **Método:** Se implementaron estrategias a través de las tecnologías de la información y de la comunicación que se describen en este artículo. **Resultados:** Con las estrategias llevadas a cabo se pudo continuar con toda la educación teórica de manera virtual a distancia, incluyendo el pase cotidiano de visita a los enfermos, la presentación de casos clínicos, el análisis a distancia de los métodos de laboratorio y gabinete, así como la enseñanza de la exploración física y la adquisición de los métodos de ayuda diagnóstica de los gabinetes. El número de asistentes a la sesión general semanal del Instituto incremento de 100 asistentes presenciales a 500 virtuales (promedio) con reproducciones de las mismas en un promedio de 5,000. Se discuten las ventajas e inconvenientes de estas nuevas técnicas y cuáles son los desafíos para el futuro. **Conclusiones:** Sin duda alguna, la pandemia ha causado daño a

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la enseñanza de dos generaciones de estudiantes de la medicina en los años 2020 y 2021 y aún seguimos temerosos de que en el 2022 persista. A nuestro juicio la educación médica implementada por nosotros no es lo ideal, pero por lo menos constituye un buen paliativo del daño que la pandemia produjo en la educación médica.

Palabras clave: COVID-19. Educación médica. Estudiantes en pandemia. Efecto de la COVID-19 en la educación médica. Educación virtual. Estudiantes de medicina en la pandemia.

Introduction

Full medical knowledge is learned and consolidated in the hospital, not in the classroom, exactly at the patient's bedside, and instructed by a tutor experienced in the art of interrogation and physical examination. It is much more than the use, worship, and veneration of or diagnostic machines; although very helpful, they are only so after refining, perfecting, and fine-tuning the diagnosis, almost providing the exact location and extension of disease¹, thus allowing for superior planning and treatment results. An institution like ours generates most of the better-prepared cardiologists in our country. As a result, many of these cardiologists have held and still hold important positions in different health institutions in Mexico and other countries; giving examples of these is not the purpose of this publication. For practical purposes, it is enough to say that despite the excess of residents in training, postgraduate and undergraduate students, visitant residents in training, and medical interns in social service, who are currently under medical training in our hospital, we still maintain our academic seminars given by physicians specialized in physical examination. Moreover, we maintain the art of cardiac auscultation despite its near disappearance elsewhere.

The diagnosis must therefore be clinical, as has been done for the past 77 years since the Instituto Nacional de Cardiología Ignacio Chávez was founded². Books, articles, and digital tools are certainly pivotal to learn medicine, but they are unable to convey the art of the practice of medicine.

Sir William Osler correctly stated that: "He who studies medicine without books sails an uncharted sea, but he who studies medicine without patients does not go to sea at all"³.

Our leader, Dr. Ignacio Chávez, also affirmed that: "It is in the hospital where future physician train to examine patients, where he educates his spirit of observation and acquires his clinical judgment, where he obtains his wealth of experience. A Medical School without a complementary hospital annex is, therefore, inconceivable, nor can that hospital function without the elements required for efficacy"⁴.

The surge of the pandemic that currently scourges the world⁵, almost completely limited the tutorial teaching of medicine that we preach at our Institute, ousting students from the patient's bedside to follow the required strict sanitary measures aimed to decrease the risk of contagion, more so since the Institute was reconverted into the previously mentioned hybrid hospital.

This is how professors and tutors became unable to teach personalized interrogation and physical examination techniques at the bedside. A great challenge arose, and almost immediately, many conundrum overwhelmed our daily activities: How to remediate this loss of clinical practice? What strategies or new techniques could we implement to offset the pandemic's deleterious effects?

Material and methods

Integral educational strategy during the pandemic. The Medical Education Department implemented the following educational strategies and techniques to improve the learning of cardiology and compensate for the compulsory lack of in-person clinical education. The following strategies were implemented:

- Interactive activities (clinical cases, imaging challenges, and electrocardiography) in the "Cardiociencias" educational web-page
- Virtual provision of all theory classes and practical clinical cases
- Educational videos to teach physical examination skills and complementary diagnostic methods required to learn cardiology
- Uninterrupted transmission of the Institute's general weekly grand rounds
- "Cardiociencias" educational platform of the Instituto Nacional de Cardiología Ignacio Chávez.

The Cardiociencias platform (www.cardiociencias.com) is an academic product created by the Institute's Medical Education Department and the Medical Education Sub-direction, as well as an editorial committee of high-level, excellent specialists that have contributed their

work and expertise to the elaboration of the contents, organization, and management of the platform.

The motto that identifies “Cardiociencias” is: at the forefront in education, science, and evidence analysis. The educational platform’s objectives include:

- To offer educational content of excellence in various formats: virtual courses, interviews, interactive challenges, podcasts, editorials, information of academic value, and relevant news updates.
- To become a learning and communication tool for medical students, residents-in-training in various specialties, general physicians and specialists, basic and clinical investigators, nurses, and all other health disciplines that generate content of scientific and humanistic value.
- Analysis and dissemination of the best available evidence either published or presented in national and international meetings, promoting updated learning.
- To create a virtual community fostering collaborative work and the interaction of all specialists, investigators, and nurses. The platform has been available since March 1, 2021, and all content is free.

Description of the main academic content:

- Virtual courses. Courses in modules pertaining to the field of cardiology and other related specialties are available. They have well-specified educational purposes, last an appropriate amount of time to foster their viewing, they are continuously available, and include an evaluation to obtain curricular credit.
- Campus. A specific space with limited access was created to provide specific educational contents for medical students and residents-in-training that are currently taking a course or are part of a formal specialty or high-specialty program. It aims to provide personalized digital contents as classes, scientific articles, information on the academic program, and complementary didactic material in video format on physical examination techniques or technical procedures. In the case of the UNAM’s undergraduate course, a specific access was created with a personalized account, where students can obtain the course’s entire content, including the previously described complementary didactic material.
- Interactive challenges. Three types of interactive content are available:
 - The electrocardiography challenge has the purpose of teaching the interpretation of electrocardiograms based on the Mexican school of deductive electrocardiography. Four options are presented that stimulate thought, synthesis and ECG analysis, with a complementary clinical focus.
 - The imaging challenge. An image (echocardiogram, magnetic resonance, tomography, angiography, etc.) and a clinical vignette with four alternatives are presented to foment critical analysis with a clinical perspective. The correct answer is explained, and incorrect responses are discussed to provide complete and integral information.
 - Interactive clinical case. A clinical vignette is presented, and four questions are asked, all focusing on physical examination findings, physiopathology, diagnosis, treatment, or prognosis, with complementary images or other studies. Solving this type of challenges fosters interpretation, analysis, and reflection on the case’s clinical features.
- Editorials. Scientific publications of relevance to clinical practice and with specific methodology are analyzed (SMART analysis), to aid in the interpretation of evidence and underscore its importance in clinical practice. Reviews of specialized topics with immediate clinical application are also available.
- Interviews. Interviews known as “chat with my mentor” are also available, in which we interview highly recognized professors of cardiology and other specialties with a focus on their life experiences and their humane qualities, to inspire, and motivate the new generations in-training.
- Podcasts. Academic contents in an audio format are a current great revolution since they can be consulted anywhere, and include interviews and topic reviews. Several podcasts have been released, reviewing cardiology, humanistic, and artistic topics. They are available in “Cardiociencias” and in the Spotify platform to encourage their consultation.
- News. These are published weekly and include very relevant topics with associated link to the original content.
- Cardiosynthesis. This is a feature presented in audio, video, news, and editorial formats that cover the best national and international meetings and facilitate the best possible evidence on the scientific information presented.
- Investigation. There is a space devoted to the basic and clinical research conducted at the Institute; its content includes virtual courses, editorials, access to the journal Archivos de Cardiología, and links that allow the consultation of the research conducted at the INC. The aim of “Cardiociencias”

is to link and lead to the interaction of researchers with clinicians to learn and promote translational investigation.

- Grand Rounds are transmitted every Wednesday at noon, in real-time. It is possible to interact by asking questions or making comments through the available chat feature. The previous sessions can also be consulted by clicking on the specific poster.
- Nursing. Various academic contents are presented with a focus on nursing students and specialty nurses.
- Social media. We are interacting with Twitter and Facebook social media, informing on new contents, and establishing direct contact with our specialists.
- Cardiopulmonary resuscitation training center. The training center can be contacted, and updates on cardiopulmonary resuscitation are available.

Virtual provision of all theoretical classes and clinical cases, with a focus on problem-based medicine. All theory classes were provided in the Cisco Webex Meetings and Zoom platforms from the INC facilities, or the Professors' homes if they needed to be confined. The academic program and all classes were completely met.

An fundamental objective is the training of new professors so that they can acquire early teaching abilities skills. The incorporation of those residents with the best academic performance into the clinical instructor pool fulfilled this objective. From the time of admission to the Institute, residents are trained to become professors as their training progresses. They participate in the review of clinical histories with students and teach clinical skills. In the virtual courses, they were entrusted with the preparation of clinical cases focused on problem-based medicine, an understanding of signs and symptoms, laboratory and ancillary studies, the analysis of cases transmitted in digital platforms, and all under the supervision of the courses' full and assistant professors. This was interactively implemented, with constantly asking the students questions during the case presentation:

What would you do? What study is required next? How do you interpret...? What diagnosis did you reach? etc...

- Educational videos on physical examination skills and ancillary diagnostic methods in the field of cardiology. Educational videos were created and edited by experienced cardiologists, showing step by step and sequentially, how to perform a physical examination of the head, neck, chest, abdomen, extremities, evaluation of the eye fundus, and the optimal technique for blood

pressure measurement. The videos include complementary graphs and figures to facilitate the process learning.

At our Institute, the order in which interrogation, physical examination, and the interpretation of imaging and laboratory results is of crucial importance to reach a correct diagnosis, and this guideline is emphasized in the videos. They also include how to perform an electrocardiogram, echocardiogram, treadmill stress test, and the correct methodology to measure blood pressure, fundoscopic examination and collect and process samples for laboratory testing. Those videos are explained:

- Physical examination. Head, neck, and chest palpation. Duration 40 min
- Physical examination. Precordium auscultation and exploration maneuvers. Duration 45 min
- Examination of the abdomen and extremities. Duration 15 min
- Correct technique to measure blood pressure. Duration 7 min
- Fundoscopic examination. Duration 13 min
- Obtaining an electrocardiogram. Duration 11 min
- Obtaining an echocardiogram, handling the transducer, and most common examination positions. Duration 28 min
- Collection of specimens for laboratory work-up
- Uninterrupted transmission of grand rounds.

The Institute's Grand Rounds are the most important academic activity since the Institute's founding; it is conducted every Wednesday at noon, and transmitted virtually since June 2019. During the pandemic, maintaining grand rounds were a challenge, but they have also proved to be of great practical use to face the demanding necessity of updating on the management of patients with COVID-19. Grand Rounds take place in the Institute's Ignacio Chávez Rivera auditorium, with a maximal occupancy of 404 individuals. Between March 2020 (the month in which the pandemic was declared)⁶ and December of that same year, we had an audience of 35,744 health personnel, with an average of 871.8 individuals assisting virtually, more than double our Auditorium's capacity. In 2020, a total of 41 sessions were transmitted, and 11 more this year.

Grand Rounds are available on the "CardioCiencias" platform and Facebook social media. These platforms allow users to interact with questions and comments. All sessions can be watched asynchronously in the educational platform, allowing us to maintain contact with our Institute's former graduates.

All the procedures developed to replace face-to-face education were applied to undergraduate students from the different medical schools in the country, to residents from the first to fifth degree of cardiology training, to medical interns in social service, and to rotating doctors from other institutions, both genders and ages ranging between 20 and 35 years. The nationalities of the undergraduate students (social service interns, students, and rotating doctors) were all of Mexican origin.

The resident doctors were a total of 267, of which 77 are foreigners, seven from Bolivia, eleven from Colombia, nine from Ecuador, eight from Salvador, 13 from Guatemala, eight from Honduras, six from Nicaragua, one from Paraguay, one from Panama, seven from Peru, and two from the Dominican Republic. The rest 190 were of Mexican.

Of these residents, 175 are in the specialty of cardiology and 92 are in high specialty. One hundred and eighty-two of these residents were male and their ages ranged between 30 and 41 years old.

Results

Advances and innovation

The advent of this pandemic, the most severe suffered by humanity, led to high mortality rates, the enormous loss of health in many individuals, permanent in some, with the consequent economic chaos that we have all – poor and rich – endured, and undoubtedly, a breakdown in our habitual way of life⁷. Education was no exception, and particularly, medical education since its practice requires close contact with sick individuals.

The different educational videos that we have created on physical examination and ancillary examination procedures have allowed students to learn the correct manner to interrogate and examine patients. Likewise, we have been able to transmit all manner of information on electrocardiography, radiology and imaging, echocardiograph, scintigraphy, magnetic resonance, and tomography. The use of mobile devices at the bedside was of great use to interact with the students that could observe patient examinations during virtual rounds.

Our patients' collaboration was striking since they allowed us to literally transmit their disease and interact with the students. They felt cared for and thankful for the attention provided. This does not seem to be the result of modernity and technology but rather stems

from the discipline and empathy when treating patients that Master Chávez bequeathed us.

The virtual community has significantly grown. The average number of followers of "CARDIOCIENCIAS" on Twitter is 1,900, and 18,566 on Facebook as of July 2021. During the year 2020, virtual lectures were given through any of the available platforms to 205 students from four universities in Mexico City and 168 so far this year.

This past year, we have learned about the management of digital platforms, the development of digital content, and distance learning. We can now contact former students that are currently in positions of relevance in several institutions or universities throughout the world and enjoy their teachings without investing in travel allowances and they, in turn, can actively participate in our students' and residents' training. Likewise, our professors can not only be seen from other areas in our country but from anywhere in the world.

Discussion

These efforts have allowed us to palliate, and only palliate, the absence of students in the hospital, and the lack of bedside training. Now, disciples can digitally see and learn how to conduct an interrogation and physical examination, although this method does not allow them to perceive with their senses what we wish to teach. How can we conceive a physician's training in surgery⁸, interventional cardiology, or electrophysiology by only watching the procedures, even if the techniques were explained in detail? It is impossible for residents, and how do you ask a student to recognize whether an organ is enlarged or to recognize a murmur without having heard it many times? We greatly fear that these generations completing their training and soon to be incorporated into society to practice the profession, will carry with them deficiencies that we were unable to mend despite having done our best to abate the harm.

We undoubtedly miss the closeness, direct contact, using the stethoscope at the student's side, the mentor's hand on the right carotid artery while the student palpates the left one, and explaining what is occurring. We recognize that these types of misgivings may not seem too forbidding, nor should we worry new generations, such as those in our workgroup in the Department of Medical Education.

At-a-distance platforms preclude knowing one another closely, surveilling students' behavior, appearance, and learning abilities, as well as for students to know us.

The lack of direct contact with the patient and the absence of privacy resulting from virtual learning methods, evidently impinge on the symbiosis provided by the teacher-student-patient triad. Once the threat of COVID-19 decreases, the recovery of many procedures and clinical practices is imperative, as well as tutorial teaching and lectures between the student and the tutor; all, without relinquishing the associated fraternal warmth and the example provided by The patient's closeness to the learned man, that conveys the equanimity of his knowledge and his desire to ameliorate the stricken's health.

Future perspectives

It has been a great challenge to not only implement new educational techniques, but to evaluate their real impact on physicians-in-training, optimize every new technique, train teachers in education technology, and understand an adaptative hybrid competency-based model with face-to-face and virtual classes, clinical practices, and the use of simulators.

Virtual educational activity must be planned and evaluated with the same rigor as in-person teaching and learning, in terms of contents and learning activities, following, monitoring, and performance evaluation. Distance learning supported by information and communication technologies is a powerful tool to optimize learning at any stage of professional training, and particularly in terms of continuous medical education⁹, but concerns have been raised on the quality of care through digital media, and even the potential risk of fraudulent behavior¹⁰.

It is important to slow down, and reflect/recapitulate more patiently to evaluate all educational processes, and consolidate virtual education based on pedagogical principles, the scientific method, and well-structured educational models.

Finally, we must never lose our humanistic focal point and closeness with our patients and professors.

Conclusions

Undoubtedly, the pandemic has caused damage to the teaching of two generations of medical students during 2020 and 2021, and we are still afraid that, in 2022, it will persist. Therefore, in our opinion, the

medical education implemented by us is not ideal, but, at least, it constitutes a good palliative for the harm that the pandemic caused to medical education.

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Conflicts of interest

None.

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 no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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