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## University teaching in gynecology and obstetrics in Peru Docencia universitaria en ginecología y obstetricia en el Perú

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### ABSTRACT

The teaching of obstetrics and surgery in Peru began at the beginning of the 19th century, at the initiative of Hipólito Unanue. Cayetano Heredia and others structured it academically when the Faculty of Medicine of the Universidad Nacional Mayor de San Marcos was created in 1856. The chair of clinical gynecology was created at the end of the 19th century, appointing Constantino T. Carvallo as professor. In 1947, the Peruvian Society of Obstetrics and Gynecology (SPOG) was founded with the purpose of developing the science and continuous training of specialists in gynecology and obstetrics. Since 1955, The Peruvian Journal of Gynecology and Obstetrics is the scientific communication media of the SPOG, which publishes experiences and research in the specialty. The residency in Obstetrics dates back to 1958 at the Maternity Hospital of Lima and, between 1961 and 1962, Abraham Ludmir began the schooled residency in obstetrics and gynecology at the Hospital Materno Infantil San Bartolomé. The continuous and rapid progress given by scientific research, information and modernization of technology in the specialty has caused the emergence of several branches related to the pathology of women and perinates, integrated in medical institutions that advance at different speed and importance. The current SARS-CoV-2 coronavirus pandemic has highlighted the problems in national health care, resulting in hospital congestion, insufficient equipment, drugs and human resources, unfavorable indicators of surveillance, infections and deaths, which will require a change in health management. Teaching in medicine was also affected, with the conversion from classroom to virtual education, prohibition of on-site care for students and senior teachers, who will be returning to the hospitals. Medical education, scientific and technological advances and the vision of a rapidly changing world must give rise to new curricular plans for medical students and residents in the specialty, for appropriate health care.

**Key words:** Education, medical, undergraduate, postgraduate, Obstetrics and Gynecology, Coronavirus infections.

### RESUMEN

La docencia en obstetricia y cirugía en el Perú empezó a principios del siglo XIX, por iniciativa de Hipólito Unanue. Cayetano Heredia y otros la estructuraron académicamente al crearse la Facultad de Medicina de la Universidad Nacional Mayor de San Marcos, en 1856. La cátedra de clínica ginecológica fue creada finalizando el siglo XIX, nombrándose como catedrático a Constantino T. Carvallo. En 1947 se fundó la Sociedad Peruana de Obstetricia y Ginecología (SPOG), con la finalidad de desarrollar la ciencia y la capacitación continua de especialistas en ginecología y obstetricia. Desde 1955, la Revista Peruana de Ginecología y Obstetricia es el medio de comunicación científica de la SPOG, que publica experiencias e investigaciones en la especialidad. El residentado en Obstetricia data de 1958 en la Maternidad de Lima y, entre 1961 y 1962, Abraham Ludmir comenzó el residentado escolarizado de obstetricia y ginecología en el Hospital Materno Infantil San Bartolomé. El continuo y rápido avance dado por la investigación científica, información y modernización de la tecnología en la especialidad ha ocasionado la aparición de varios capítulos relacionados a la patología de la mujer y el perinato, integradas en instituciones médicas que avanzan a diferente velocidad e importancia. La actual pandemia del coronavirus SARS-CoV-2 ha puesto en evidencia los problemas en la atención de salud nacional, ocasionando congestión hospitalaria, insuficiencia de equipos, medicamentos y recursos humanos, indicadores desfavorables de vigilancia, infecciones y muertes, lo que requerirá girar la gestión en salud. La docencia en medicina también se vio afectada, con conversión de la educación presencial a virtual, prohibición de atención presencial de estudiantes y docentes mayores, que recién retornarán a los hospitales. La educación médica, los avances científicos y tecnológicos y la visión de un mundo rápidamente cambiante deben originar nuevos planes curriculares para los estudiantes de medicina y residentes en la especialidad, para una apropiada atención en salud.

**Palabras clave.** Educación de pregrado, posgrado, en medicina, Obstetricia y Ginecología, Infecciones por coronavirus.



Hipólito Unanue, appointed Protomedic of the Kingdom (1807), on August 13, 1808 got Viceroy Fernando de Abascal to found the Real Colegio de Medicina y Cirugía de San Fernando, being its first rector. Unanue introduced the study of natural and biological sciences. These included obstetrics, surgical and medical anatomy, incorporating for the first time a program of academic medical education.

Since then, several personalities, such as Cayetano Heredia, among other distinguished professors of the time, gave academic structure to the practice of obstetrics in Peru, through the creation of the Facultad de Medicina de San Fernando on September 9, 1856, at the Universidad Nacional Mayor de San Marcos (UNMSM). In its program of medical studies, San Fernando included the teaching of obstetrics as an appendix of the External or Surgical Clinic for Women, and Dr. Camilo Segura was in charge of this subject, simultaneously with the Chair of Children. Segura was followed by Rafael Benavides, who in 1864 was in charge of the Chair of Childbirth, Puerperal Diseases and Children. It was in 1866, when the Chair of Obstetric Clinic was created<sup>(1,2)</sup>.

On June 19, 1897, the following Supreme Resolution was issued: "Having been created by law on December 27, 1895, the Chair of Gynecological Clinic in the Faculty of Medicine of the Universidad Nacional Mayor de San Marcos and in accordance with the provisions of Article 255 of the General Regulations of Public Instruction: Appoint Dr. Constantino T. Carvallo as Professor". Thus began the history of Gynecology in Peru. For 165 years there has been a serious attempt to give Obstetrics an academic and systematic rigor from the university classrooms.

It is from the university classrooms where the concept of teaching in the specialty of gynecology and obstetrics seeks a space crossed by many vicissitudes and intentions, in which teachers and students learn ways of building knowledge -knowing and knowing how to think, researching and teaching how to think about reality-, in order to generalize it for the benefit of the community.

With the same spirit of teaching, 74 years ago, in 1947, the Peruvian Society of Obstetrics and Gynecology (SPOG) was founded, with the mission of contributing to the development of science and the continuous training of specialists in gynecology and obstetrics, for the benefit of Peruvian women.

Over time, to these two primary functions of scientific development and training, others have been added, such as ensuring that every pregnancy is planned, every birth is safe and that everyone reaches their full potential. All of them take care of the objectives that have always guided the practice of gynecology and obstetrics, which is to ensure the care and attention of women in all stages of their lives.

Within the framework of the functions of the SPOG and its important role in the training and teaching in gynecology and obstetrics is that the Journal of the SPOG, whose first issue appeared in 1955, has a transcendent role. Since its creation, through the journal, Peruvian medical specialists have had a means of scientific communication where they have published their experiences and research, contributing in an important way to scientific dissemination and, therefore, to teaching.

The fields where SPOG has intervened have been all areas of the specialty: reproductive medicine, early diagnosis of gynecological cancer, proper care of childbirth, reduction of maternal and perinatal mortality, obstetric hemorrhage, preeclampsia, gestation and newborn at high altitude, contraception, menopause, genital prolapse and urinary incontinence, breast pathology, genetics, ultrasound, endoscopic surgery, and many other related topics. SPOG members have created institutional chapters, such as the Peruvian Societies of Fertility, Perinatology, Climacteric and Menopause, Ultrasound, Laparoscopic Surgery, Contraception, Fetal Medicine, among others<sup>(3)</sup>.

The Universidad Nacional Mayor de San Marcos (UNMSM) approved the residency in Anatomic Pathology in 1958, and the first 3 residency positions in Obstetrics were created<sup>(4)</sup>, which were won by Manuel Alva Sáenz, José Exebio Adrián and Ramiro Yanque Montúfar.

Between 1961 and 1962, it was with Dr. Abraham Ludmir, professor of the UNMSM, when the medical residency of the specialty of Obstetrics and Gynecology was regularized, with its inclusion as an integral whole in the Hospital Materno Infantil de San Bartolomé, founded in Barrios Altos in 1636. This was the birth of a duly schooled specialty with a solid 3-year professional training program. It is in this experience where the



first volume of Norms and Procedures in Gynecology and Obstetrics was written, with emphasis on everything that was prevention, clearly establishing the value of early, periodic, suitable and specialized prenatal control, differentiating itself in the implementation of high-risk pregnancy clinics, infertility, human reproduction, family planning, colposcopy, environments for the psychophysical education of pregnant women, as well as adult gynecology clinics, pediatrics, among others<sup>(5)</sup>.

This program integrated interdependence with the intermediate services of laboratory, pathological anatomy, blood bank and others, in addition to the renowned theoretical and practical meetings with evaluation of maternal and perinatal morbimortality, gynecological pathology and infertility. It was the first time in Peru that a solid and intense program was duly organized in its three years of duration, with clear goals and objectives at each stage of training and a permanent evaluation system that demanded the exclusive dedication of its residents and practically also of its professors. Professor Ludmir trained disciples until 1989, when he finished his direct involvement in the teaching of 26 promotions of residents and 30 promotions of undergraduate students. Personally, ACR is honored to have been part of one of his graduating classes.

In 1968, the Universidad Peruana Cayetano Heredia (UPCH) started its own residency program, where also with a solid training, the aim is for the specialist in gynecology and obstetrics is able to provide specialized medical care to women, with or without pathology, and to perform comprehensive follow-up of the same, with preventive-promotional reproductive health actions from the early years<sup>(6)</sup>.

Since then, other universities also offer medical residency programs in the specialty, for example, the Universidad Nacional Federico Villareal, the universities of Arequipa, Trujillo, Ica and others.

With commendable effort, distinguished professors have also done a surprising editorial work by publishing treatises on the specialty. Doctors Abraham Ludmir with his book on Gynecology and Obstetrics, José Pacheco with the Treatise on Gynecology, Obstetrics and Reproduction, Andrés Mongrut with the Treatise on Gynecology are clear examples of the search for excel-

lence, putting in writing what they have taught and learned throughout their lives, disseminating knowledge and teaching.

It is necessary to mention that it is not only in and from the university classrooms or the scientific activities that SPOG, since its creation, organizes and disseminates regularly, that teaching can and is done. It is also through the daily work of our life as specialists, in all the acts that we have the good will to do. By example, we also teach.

As specialists in obstetrics and gynecology, we must contribute to achieve that the population has access to high quality sexual and reproductive health services, allowing them to exercise their right to decide how many children to have and when to have them, the right to safe pregnancies and healthy children, the right to enjoy and understand their sexuality and to live it free of fear, with health and without violence. We must contribute to establish respect for Human Rights, with special emphasis on the right to health, equity, solidarity, universality and integrality, showing solid ethical principles, taking into account cultural diversity, with solid and updated information, exercising leadership, with effective communication skills, working as a team, with high academic and professional level and, of course, committed to the development of the country's health.

The SPOG and The Peruvian Journal of Gynecology and Obstetrics take the challenge of participating in the training and teaching of physicians inclined to practice the specialty of gynecology and obstetrics, through the writings of illustrious masters of the moment. Up to now, the edition of the journal has been thanks to the hard work of its eleven Directors and Editorial Committees. Its current Editor has held this position ad-honorem for 27 years, a responsibility that has been exercised with well-deserved recognition by the entire national and international medical community. The journal has reached high levels of quality and readership, achieving a permanent edition with original research articles, systematic reviews, clinical cases, publication of consensus and action guides, as well as obtaining privileged indexing. This task corresponds to a level of early professionalization of the journal, as the organ of dissemination of current knowledge of the specialty of obstetrics and gynecology in Peru and the world. That is to say, to teach.



## OBSTETRICS AND GYNECOLOGY TEACHING

Although it is known that in Inca times the amautas were in charge of teaching the children of the nobles, previously this could have been through the forms, figures and paintings of the huacos, which were related to the characteristics of men and women, ways of life, nutrition, diseases, neoplasms, malformations, surgery, amputations, sexuality, gestation, childbirth. In other words, women, pregnancy and childbirth were the reason for the dissemination of knowledge among the inhabitants of pre-Hispanic Peru. Of admiration, the reliefs on the high stone walls of Sechin (Ancash, Peru), dating from around 2,300 BC, apart from warrior priests and mutilated bodies, present anatomical studies of various organs of the human body, possibly of the defeated and sacrificed combatants.

The teaching of safe childbirth care in Peru seems to have started at the beginning of the 19th century with the arrival of the French midwife Madame Benita Paulina Fessel. Soon after, Peruvian surgeons trained abroad performed amazing gynecological surgeries for that time and, later on, specialized hospitals were built for the care of women.

In previous paragraphs we have pointed out that, half a century ago, doctors trained in Europe and North America created schooled teaching in the specialty, first at the San Bartolomé Hospital, with Dr. Abraham Ludmir Grinberg at the San Fernando Faculty of Medicine of the Universidad Nacional Mayor de San Marcos and later in other schools in Lima and important regions of Peru, with regulations of the Ministry of Health. However, primary health care has not been implemented in Peru and the first level of health care has not been strengthened, a weakness in our health organization that became evident with the appearance of the COVID-19 pandemic, and that has required urgently and with limited budget to implement hospitals with services, equipment, materials and medicines adapted to the context and human resources that could not cope with the rapid and erratic advance of the infection.

## VIRTUAL-PRESENTIAL EDUCATION

One aspect seriously affected by the COVID-19 pandemic - today endemic - has been the training of human resources in health at undergrad-

uate and postgraduate levels. The mobility restrictions applied as a result of COVID-19 led to the adoption of online learning by institutions of higher education. Students of medicine, obstetrics, nursing, medical technology and health nutrition, among others, have had to vary their studies and face-to-face practice for strictly virtual education. Our specialty requires face-to-face practice given its personal health care characteristic and the need to acquire medical and surgical skills. The pandemic has delayed the training of resident physicians in the aspects of knowledge, skills and abilities.

Professors and students have had to adapt quickly to virtual teaching, with the academic, administrative and daily life changes that it brought with it, schedules that intersected with the work schedules of the teachers and problems with the availability of computer equipment and internet for students, in addition to the confinement at home. However, virtual teaching has brought some benefits for medical students. The virtual classroom can be taught at a punctual time - but with flexible schedules - and can be visited and reviewed at any time. In addition to acquiring digital skills, it allows active participation, feedback and autonomy of the student, with immediate access to information sources, better time management, savings in travel costs, social communication, among others. And he has been able to freely participate in high-level national and international conferences. The limitations for the student are the difficulties of concentration and socialization, the availability of internet, costs of computer equipment, geographical remoteness. As for the teachers, they were not prepared for the abrupt implementation of the virtual computer era. Curricular plans had to be urgently adapted, with few variations and needing to be improved. The pandemic and the advances in science will force the elaboration of new curricular plans for the new generations that will live in a changing world, with rapid scientific updating, simulation, educational videos, that is to say, for the new post-covid life.

Medical education relies on direct patient contact to create work-ready students. The theoretical aspects can be learned virtually. But the doctor-patient encounter -with women and pregnant women in our specialty- cannot. Students have repeatedly requested face-to-face education with the patient, which would have



entailed the risk of contact with people sick with the virus and/or cross paths with health personnel caring for patients with COVID-19. A similar situation was foreseen for health professionals and teachers of legal age, who were confined to their homes.

Important elements related to face-to-face medical education are patient-centered care, ethical considerations and prevention orientation. Our approach to each patient's health, a personalized and friendly anamnesis and clinical examination, the request for complementary tests adjusted to the necessary ones and the rapid therapeutic management based on new evidence, with cost-benefit calculation, is an invaluable learning experience for the student. These concepts can only be acquired by watching how the teacher does it and practicing it with the patient. Rather, at this stage of the pandemic, students have learned health prevention topics such as, for example, the usefulness of personal protective measures (masks, face masks, goggles), hand washing, distancing, avoiding crowds and the need for vaccines, prevention that has not only reduced COVID-19 infection, its severity and deaths, but is preventing other contagious and seasonal environmental diseases. These protective measures should be permanently considered and informedly advised by future physicians to patients, family and community.

In addition to the above, young people need to acquire more health knowledge of the country and its various regions, climates and customs, with emphasis on the most frequent diseases. In health prevention, it is urgent the knowledge and application of an adequate nutrition for the different Peruvian populations, and the practice of physical exercises from childhood in school and towards older age, aspects aimed at preventing the metabolic syndrome, overweight and obesity that lead to hypertension, coronary heart disease, type 2 diabetes mellitus and other related comorbidities, today universally increasing due to the habits of life of fast food and sedentary lifestyles. In the pandemic, it has been observed how the disease rages against overweight and obese people, as well as the malnourished and those with comorbidities and immunocompromised.

In the education of residents in obstetrics and gynecology, while remembering the basic sciences on the physiology and pathophysiology of women, emphasis should be placed on knowing the differences of these health situations with those of men, their variation in adolescence, gestation and senility, as well as the prevention of the most frequent causes of morbidity and mortality in the country. It will include the need to know about early prenatal care, sexuality, fertility, family planning, early diagnosis of cancer, aspects of menopause and older age of women. In the current five-year period 2021 to 2025, women have a life expectancy of 79.8 years and men 74.5 years in Peru<sup>(7)</sup>, which obliges us to know the health complications of older women and their prevention from an early age. The attention to the female patient will always be sympathetic, ethical, attentive listening, with concrete and intelligent questions, digitization of information in the digitalized clinical history, filling out the perinatal card and other health surveillance documents. In other words, they will be taught to practice comprehensive care centered on the woman during her life, in health and disease.

Obstetrics and gynecology education of students and resident physicians should include community health activities (primary care), with integrated programs of the Ministry of Health (MINSU), Essalud and the University, the Medical College and public and private health institutions. Likewise, and due to the bad experience in this aspect during the pandemic, care at the first level of care will be considered, where the student and the young physician will apply their knowledge to medical practice, as well as be able to communicate intelligently to the community how to take care of their health<sup>(8)</sup>.

With the current decrease in infections and deaths due to the pandemic, the student's early face-to-face practice is on the horizon. But, how long this situation will last is still unknown. The panorama is complicated by what is happening in Europe, Asia and North America, where vaccination has advanced significantly, but the presence of new variants of SARS-CoV-2 -mainly delta- and the resistance of an important population of people who do not accept to be vaccinated, are altering the favorable predictions. The student will have to continue to guard against the coronavirus for a long time to come.



Medical education does not end at the end of the residency in obstetrics and gynecology. Once graduated, the obstetrician-gynecologist is being trained in related subspecialties -ultrasound, endoscopy, robotization, fetal medicine, fetal surgery, reproductive medicine and infertility, pelvic surgery, climacteric and menopause, among others-; and, in the aspect of health management and academic degrees, he/she studies diploma, master's and doctorate degrees. In addition, they are required to undergo periodic evaluation through certification and recertification by the Peruvian Medical College, where they reaffirm their continuous training, skills and abilities, as well as their participation in academic activity and in research and publication. The health professional's education is lifelong.

### OBTAINING THE BEST INFORMATION, SCIENTIFIC KNOWLEDGE AND CLINICAL EXPERTISE

With regard to medical information, the pandemic has transformed from reading physical books and journals and visiting libraries to obtaining information from virtual journals, books and documents. At the same time, teachers are teaching their students to avoid non-validated, false or biased information, and to obtain knowledge only from reliable sources, peer-reviewed articles, systematic reviews from prestigious academic databases. The student is prepared to safely investigate every question that arises during their medical training or in patient care.

Since the onset of the COVID-19 pandemic, there has been an increased urgency to identify the pathophysiological features that lead to severe clinical course in patients infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). In the first months of 2020, scientists quickly discovered the structure and mode of action of the new coronavirus, its modifications to perfect its penetration into humans, as well as pointed out measures that could be used to prevent the disease, improve the health of those infected and prevent their mortality. Physicians, teachers and students increased the habit of checking the internet permanently in order to know what is new about the pandemic, its prevention and management. Given what was learned with other coronaviruses, rapid progress was made in formulating candidate vaccines that were used

on an emergency basis. As for the treatment of those infected with COVID-19, we saw with despair the successive failure of drugs, which were replaced by new anti-inflammatory molecules, anticoagulants, antibiotics and other medicines with long and difficult to pronounce names, without there still being a specific therapy for the new coronavirus. And, although we were forced to brush up on basic science, genetics, mutations and variants, immunology, infectology, hematology, lung capacity and others, we are only now learning that the variability of response of those affected to medical management may be due to the fact that not all humans have the same genomic sequence. Human leukocyte antigen (HLA) alleles have been suggested as possible host genetic factors affecting individual immune response to SARS-CoV-2. HLA-C\*04:01 carrier status has been found to be associated with severe clinical course of SARS-CoV-2. That is, HLA class I alleles would play a relevant role in the immune defense against SARS-CoV-2<sup>(9)</sup>.

### MANAGEMENT OF APPARENTLY RECOVERED COVID-19 PATIENTS

It is now known with astonishment that a high percentage of patients recovered from severe, and even mild, covid-19, and more so in women, maintain varied symptoms that persist for weeks and affect their life and work. Half of hospitalized COVID-19 survivors experience at least one persistent symptom one year after discharge. At six months, 68% appear to have at least one sequela symptom, decreasing to 49% at 12 months ( $p < .0001$ ). The proportion of patients with dyspnea is about 26% at six months and 30% at 12 months ( $p = .014$ ). In addition, more patients have anxiety or depression at 12 months (26%) than at six months (23%), always more in women than in men<sup>(10)</sup>. Seventeen percent of patients with long-term COVID reported fatigue, 13% had breathing difficulties and loss of taste or smell, and 11% reported muscle or joint pain. Five percent of respondents were hospitalized because of the virus<sup>(11)</sup>. In other words, although COVID-19 is known to primarily affect the lungs and usually leaves scarring damage, it can also damage many other organs, such as the heart muscle and nervous system, and can cause strokes, seizures, Guillain-Barré syndrome, Parkinson's and Alzheimer's disease<sup>(12)</sup> and much more.



We must prepare to care for these millions of people who will continue to require health care and rehabilitation for an as yet undetermined time after they have COVID-19. Undergraduate and graduate students should be trained to ask, diagnose and guide the treatment of any patient who have been ill with the coronavirus, and recommend follow-up and possible rehabilitation by specialized medical personnel.

### ACCELERATED TRAINING - RESEARCH

The young physician has needed accelerated training in this pandemic, guided by the pre-print published literature - without external evaluation until after its online publication -, to find lights in the dark, but at the same time found that treatments and drugs were replaced by others for its lack of effectiveness and/or harmfulness.

We imagine that the student and the physician have wondered if something different could be done to defeat the virus and the disease, since the wealth of information does not yet have firm answers. This could be the possibility to encourage research in health, so little present in our countries due to the lack of stimulus to scientists and the lack of economic resources. The National Council of Science, Technology and Innovation - Concytec is the governing body in charge of directing, promoting, coordinating, supervising and evaluating the research actions of the State in Peru. Apart from regulating and supporting research directly or through universities, it is integrating and classifying Peruvian researchers, has created the status of teaching researcher and encourages the advancement of new Peruvian technology and entrepreneurship, especially in young researchers. It is fair to highlight that several of the SPOG members are researchers in the specialty with publications in indexed journals and certified as teaching researchers and members of research groups in the National Scientific, Technological and Technological Innovation Registry - Renacyt, San Marcos Registry of Research Activities, ORCID, Google Scholar and h-index.

In addition, Concytec encourages the publication of research in indexed scientific journals, while supporting the permanence and excellence of scientific journals in the country. The Peruvian Journal of Gynecology and Obstetrics (RPGO),

founded in 1955 and with continuity until today thanks to the work of its 11 Directors -six of them past-presidents of SPOG-, is indexed in Scielo Peru, Redalyc, IMBIOMED, Dialnet, DOAJ, Redib, ESCI Web of Science, MIAR, EuroPub, Latindex, among others, which supports Peruvian and international obstetrics and gynecology researchers who publish in the RPGO, who do so in a journal with academic excellence. The RPGO has received financial support from Concytec to increase its indexing.

### THE EMOTIONAL IMPACT

Over the past two years, the health professional and students have had to face the pain, the fear, the continued work beyond their schedule, the fatigue, and the ethical decisions in dealing with the unknown and death. Observing the rapidly progressing, severe conditions, with machines, tubes, oxygen and IVs in patients who were begging for their lives, with no family around, only to lose their lives and be cremated, leaves a deep impression that the human being is fragile. The pandemic represents an especially critical element in medical education, as the demand for personnel has accelerated the graduation of many medical students and placed them in a highly stressful situation very early in their careers.

Undergraduate and graduate students are learning the need for rapid response to severe morbid cases, deferring emotions for what little downtime they may have when the workload grows. This is also an apprenticeship for our students, facing the unknown, knowing how to promptly choose the most appropriate procedure for each case, modifying it in time if necessary, knowing how to transmit the state of health to the patient and the news to the relatives, containing emotions, post-traumatic stress and anxiety, knowing how to overcome fatigue, knowing how to win and lose. In addition, they affirmed the need for teamwork to achieve the goal of a recovered patient.

On the other hand, the doctor and the student have learned how to take care of their own health, seeing their colleagues, teachers and relatives fall ill and die. As well as how to take care of their own family, many isolating themselves from them for some time, to avoid carrying the virus.



## MEDICAL EDUCATION IN THE FUTURE

The coronavirus crisis has shaken the foundations of almost every aspect of our world, so much so that it is very difficult to predict the future. We must adapt to the new reality and have a critical need to transform various aspects of medical education to reflect the changing medical landscape.

In university academia, we faculty understand that virtual and artificial reality is one of the biggest technology trends that will transform medicine and healthcare in the second decade of the 2000s.

Apart from e-learning, healthcare professionals and students are adapting to new technologies that will allow the monitoring of minor illnesses from home, including COVID-19 in cases where the condition is manageable. But also after recovery, which can be very prolonged, as we noted above. An example of novelty is given by sensors that monitor personal health through mobile devices and cell phones.

Telehealth has shown its immense usefulness in remote communication with the patient, as well as the exchange of knowledge among health professionals to solve difficult cases. Our future professionals have a new tool to solve health problems, as well as to transmit health education and semi-presential care to the population. This telemedicine is being complemented by the provision of necessary devices, such as blood pressure cuffs, remote stethoscopes, as well as the use of health data from Apple Watches and other patient devices. And, as coronavirus or other pandemics and endemics continue, greater acceptance of communication and treatment virtually could reduce the risk of contamination of healthcare professionals.

The use of computerized algorithms to detect, diagnose and treat patients is another of the advances that teachers and students are applying in practice<sup>(13)</sup>. It is observed with astonishment how, for example, machines equipped with specific software<sup>(14)</sup> can help in the targeting of genomic diagnoses<sup>(15)</sup>, their pathology, mutations and variants. This will help the medical community to better understand how diseases occur, how to treat them or even eradicate them. This

is a key component in the fight against COVID-19, as a person's genetic makeup has a critical impact on how his body responds to the virus.

## WILL EVERYTHING BE HANDLED BY NEW TECHNOLOGY ALONE?

Medical education of the future will require the inclusion of new technology and artificial intelligence. It is very easy to wish for it, but how to make it effective quickly in a country with limited research and few licenses for technological discoveries?

On the other hand, it will always be necessary to remind our students that decision making is still the exclusive preserve of our minds, knowledge and experience, and should not be totally replaced by new technology. We will emphasize the importance of a good clinical history with ample and understandable writing. This will be the basis for our medical practice, but also -later on- for the conformation of the algorithms of the software used by computers and our defense in case of litigation. The medical record must be entered from the beginning in a computer -electronic medical records-, in order to have the patient's complete information permanently and to use it at any time and place. In addition to personal data and anamnesis, the history includes the clinical examination, reports of auxiliary methods, diagnoses, medical and surgical management, follow-up and many other data, from birth to death<sup>(16)</sup>. The use of evidence derived from collected medical records in patient care has been a long-standing vision of clinicians and informaticists; implementation of this vision is now possible. Researchers have developed an on-demand query service to obtain evidence from patient data to answer clinicians' questions and support their decision making at the bedside. The methods of these services are publicly available to facilitate their widespread adoption by health systems and academic medical centers<sup>(17)</sup>.

But then, should all medical care always be performed with artificial technology?

A Chinese article addresses this aspect. It points out that medical education must adapt to different healthcare contexts, including digitized healthcare systems and a digital generation of





students in a hyper-connected world. To detect these developments, they searched PubMed, Scopus, Web of Science, and EBSCO ERIC for articles between 2011 and 2017. Key search terms were "undergraduate medical education," "future," "twenty-first century," "millennium," "curriculum," "teaching," "learning," and "assessment." Using a modified Hawler evaluation format, among the 7,616 abstracts initially identified, 28 full-text articles were selected to reflect trends in medical education and suggest appropriate educational programs. The integrative themes and subthemes of suggested future medical education are as follows: 1) a humanistic approach to patient safety involving the promotion of humanistic physicians and facilitating collaboration; 2) early experience and longitudinal integration through early exposure to patient-oriented integration and longitudinal integrated practices; 3) moving beyond hospitals into society by responding to changing community needs and showing respect for diversity; and 4) student-driven learning with advanced technology through active learning with individualization, social interaction, and accessibility to resources<sup>(18)</sup>. That is to say, as contemplated above, the formulation of the curricular plans of the new medical education cannot forget the pillars of the interpersonal performance of the health professional, with humanism and ethics, integrated with the other health care actors, knowing and integrating into the community of each place and applying the new knowledge and the new technology envisioned. Further studies will be required on how to adapt the new plans in postgraduate and continuing medical education, as well as to evaluate the results of the application of the new curricular programs in medical schools and the environments in which they will be applied.

Finally, many of the future medical professionals will eventually hold health management positions, and their vision should encompass preventing and managing health crises, and knowing how to rapidly organize health care from the community to the most complex levels.

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