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POSITION ARTICLE

Medical training in Latin America in the face of the challenges of CRES+5 and the University 4.0

La formación médica en América Latina frente a los desafíos de la CRES+5 y la Universidad 4.0

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ABSTRACT
CRES+5, a follow-up meeting to the Regional Conference on Higher Education for Latin America and the Caribbean, was recently held. It addressed the most relevant challenges faced by Higher Education Institutions in contributing to sustainable development. These challenges particularly impact medical education, and align with the demands of University 4.0, to guide the training of physicians amidst current requirements and the serious health problems in the Latin American region. To analyze the most significant challenges to medical education in Latin America derived from CRES+5 and University 4.0, to contribute to the responsible fulfillment of its social mission. The study was based on documentary analysis of specialized literature, and theoretical methods linked to the authors´ professional experience. Medical education must prioritize teacher preparation, a relevant curriculum, and a focus on science and innovation as essential pillars to ensure quality. These actions must align with the principles of University 4.0 and Education 4.0, which promote strategies to train physicians capable of fulfilling their social mission responsibly.

Keywords: CRES+5; Higher Education; Medical Education; University 4.0.

RESUMEN
La CRES+5, una reunión de seguimiento de la Conferencia Regional de Educación Superior para América Latina y el Caribe, se celebró recientemente. Abordó los desafíos más relevantes que enfrentan las Instituciones de Educación Superior para contribuir al desarrollo sostenible. Estos desafíos impactan particularmente en la educación médica y se alinean con las demandas de la Universidad 4.0, para orientar la formación de los médicos ante los requerimientos actuales y los graves problemas de salud en la región latinoamericana. El objetivo es analizar los desafíos más significativos para la educación médica en América Latina derivados de la CRES+5 y la Universidad 4.0, a fin de contribuir al cumplimiento responsable de su misión social. El estudio se basó en un análisis documental de literatura especializada y en métodos teóricos vinculados a la experiencia profesional de los autores. La educación médica debe priorizar la preparación del profesorado, un currículo pertinente y un enfoque en la ciencia y la innovación como pilares esenciales para garantizar la calidad. Estas acciones deben alinearse con los principios de la Universidad 4.0 y la Educación 4.0, que promueven estrategias para formar médicos capaces de cumplir responsablemente con su misión social.

Palabras clave: CRES+5; Educación Superior; Educación Médica; Universidad 4.0.

INTRODUCTION

The broad dynamism and turbulence that characterize the current global context imbues it with excessive complexity, not only in the interpretation of underlying phenomena, but also in the process of seeking solutions to the most pressing problems affecting planetary equilibrium.

From this fact stems the conviction that simple solutions always fall short in the attempt to confront situations that are often multi-causal. To address them and attempt to minimize or solve them, the document approved by the General Assembly of the United Nations (UN, 2015) was conceived: "Transforming our world: the 2030 Agenda for Sustainable Development," in which education, and specifically higher education, is conceived of as one of the axes of global issues. Specifically, Objective No. 3 states: "Ensure healthy lives and promote well-being for all at all ages," and Objective No. 4 proposes: "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all."

In this endeavor, knowledge is recognized as one of the foundations for economic, social, and environmental development. Therefore, higher education becomes a crucial factor for the generation, transfer, and socialization of knowledge. Recently, at the follow-up meeting of the Regional Conference on Higher Education (CRES+5), held in Brasilia, Brazil, from March 13 to 15, 2024, it was emphasized that:

> We postulate that to defend higher education, we must defend democracy, and to defend democracy, we must defend the university, a diverse higher education system, and an open, plural, inclusive, humanistic science, and reaffirm the public sense of knowledge. In the 21st century, Higher Education Institutions (HEIs), have a fundamental role by being the basis of a self-determined and globally connected development of knowledge, as a crucial component of science, technology, and innovation systems, and in connection with other sectors of society. They are the ones who ensure that the benefits of research and the generation of new knowledge are accessible to all citizens. (UNESCO, 2024, p. 2)

Knowledge generation and its transfer will only translate into greater collective well-being and reduced inequality if institutional frameworks and public policies are purposefully designed to that end. We reaffirm that the dialogue among knowledge systems is inherent to higher education; we must strengthen the integration of knowledge and cultures from ancestral communities, local populations, grassroots sectors, and labor groups into the creation, application, and ownership of knowledge (UNESCO, 2024).

Furthermore, we acknowledge that the COVID-19 pandemic has disrupted every aspect of human life, impacting both individual and population health. Since its onset, the world has faced not only a public health crisis but also an economic and social one. This crisis extends beyond the pandemic's direct consequences, exacerbating preexisting challenges in public health. Post-pandemic adverse effects have disproportionately affected vulnerable populations, including older adults, low-income groups, ethnic minorities, migrants, and those living in extreme poverty and marginalization (López et al., 2023a).

Regarding the health situation in the region, a new report by the Pan American Health Organization (PAHO, 2024) reveals that, while life expectancy has risen in the Americas, so has the number of people living with non-communicable diseases (NCDs). Rapid population aging has driven an increase in poor health and disabilities caused by NCDs and injuries. The report urges countries to take action to address challenges posed by aging and notes that the total number of deaths in the Americas rose by 31% between 2000 and 2019, a higher percentage increase than in any other region. Overall, NCDs were the leading cause of death in the region, with a mortality rate of 412 deaths per 100,000 inhabitants in 2019 for both women and men combined.

Regarding this issue, Hennis (2024), Director of Noncommunicable Diseases and Mental Health at PAHO, stated that: "NCDs and their external causes remain a major challenge, not only for health systems but also for the social and economic development of the Americas." (p. 5). He added: "It is critical for countries to implement proven interventions to reduce risk factors, as well as strengthen the provision of quality care at the primary health level." (p. 5)

However, these are not the only challenges. Other pressing issues include violence, infectious diseases, alcohol or drug abuse, and additional public health concerns: a high number of malnourished, hungry, and sick children, pregnant women and older adults lacking medical care, rising rates of sexually transmitted infections (STIs), shortages of medications, and widespread unsanitary conditions.

Other critical factors include the deterioration of already insufficient health services, which have further reduced accessibility for large segments of the population, and the predominance of a subject-centered care model combined with the use of high-cost technologies lacking basic rationality. All those practices hinder all attempts at an equitable allocation of existing resources.

To reverse this dire situation, higher education institutions (HEIs) must take decisive responsibility for the comprehensive training of highly qualified professionals, capable of addressing population health needs. This, in turn, requires guarantees regarding the competence and reliability of physicians entrusted with patient care. Given the growing demands placed on HEIs, quality and its management must be established as a core principle of university systems and routinely addressed in policy discussions across Latin America (Atherton, 2022).

On this topic, Almuiñas & Galarza (2014) emphasize that: Quality management must be integrated into the institutional management system and depends on each HEI's conceptualization of quality, which lies at the foundation of the assurance system, its theoretical model, and its supporting methodology. Quality management follows the functional management cycle: planning, organizing, implementation, and control.

Likewise, the reference document issued by the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2022) titled "Quality and relevance of higher education programs", which served as the basis for discussions at the III World Conference on Higher Education held in Barcelona, Spain, proposed that: To achieve a renewed, relevant, and robust definition of quality, it is important to consider current expectations of higher education, given the dynamically growing impact of Information and Communication Technologies (ICT), the rising trends in the development of intelligent systems, and the diversification of higher education offerings.

Practically, these trends lead to an economy in which nearly all professions will require higher levels of knowledge to survive the increasing competition and to meet established goals. Thus, relevance becomes the concept that should guide the current and future evolution of quality and quality assurance in higher education, regardless of the types of rules and laws. (UNESCO, 2022; Rojas, 2023)

Based on the above, the authors of this text aim to analyze the most significant challenges in medical education in Latin America, stemming from "CRES+5" and "University 4.0". The purpose is to identify key foundations that can serve as a reference to guide the work of Higher Education Institutions (HEIs) in contributing to the responsible fulfillment of their social mission. From this, strategies may be proposed to steer progress toward a feasible future state, prioritizing the training of professionals required by the healthcare sector in the Latin American region.

METHODOLOGY

This position paper employed a documentary and theoretical approach, following the methodological principles outlined by Hernández et al. (2014) for qualitative and reflective studies. The analysis was based on the review of specialized literature on higher education, medical education, and the conceptual frameworks derived from CRES+5 and University 4.0. The process included documentary analysis, understood as the selection, review, and critical examination of texts, reports, and institutional declarations, as described by Gómez (2002) in his definition of documentary analysis as a valid basis for scientific inquiry. Official documents from UNESCO, PAHO, and other recognized organizations were considered, along with recent academic articles that address challenges in medical education within Latin America.

Additionally, theoretical methods—analysis, synthesis, comparison, and abstraction—were applied to integrate and contrast information, following the criteria proposed by de Barrera (2010), who emphasize the role of conceptual reflection in scientific studies. The authors' own professional experiences in university management and medical education provided a practical lens to enrich the interpretation of the collected data.

RESULTS AND DISCUSSIONS

Background of medical education and expression in Latin America

Throughout history, the concept of medical education has been a topic of great interest for professionals responsible for training physicians. This is because it relates not only to understanding the pillars of education (past or future) but also to acknowledging and embracing the role we, as educators, play in preparing such vital professionals. However, as Buzzi (2012) notes, the teaching methods used by ancient civilizations like the Egyptians and Assyro-Babylonians remain unclear. It has been inferred that during this period, medicine had a predominantly religious character, and learning occurred through personal experience transmitted across generations.

Focusing on the Hippocratic School, clinical judgment in medicine was based on observation and examination, which in turn were grounded in moral and ethical principles. At the Alexandrian medical school, human cadaver dissections were introduced for the first time, as a method to teach Anatomy, while in Rome, medicine was initially not considered a dignified profession and was practiced by slaves. Later, in the post-Galenic era, scientific medicine stagnated under the influence of the Christian Church; medical care was provided in monasteries and included spiritual and material comfort. The study of human morphology and bodily functions was relegated to the background. Disease was viewed as a divine punishment for sin or a test for soul salvation, leading to a mythical-magical interpretation. Among Arab scholars, however, medicine advanced rapidly, even implementing exams for aspiring practitioners and issuing certifications to recognize skill development. During this period, hospitals housed excellent libraries with vast collections of books.

Subsequently, the development of medical education in Europe led to the University of Bologna pioneering human cadaver dissections, though teaching remained largely theoretical. At Oxford, for example, three

degrees were awarded: Bachelor, Licentiate, and Doctor. Textbooks by Galen, Hippocrates, and Salernitan authors were used. In medieval France, books were notably scarce, and graduation exams focused on analyzing Hippocratic principles and describing specific diseases.

The Renaissance marked a pivotal era in medical education, characterized by theoretical-practical studies of human anatomy and new paradigms in teaching, learning, and research. Universities in Northern Italy, particularly Padua and Bologna, stood out due to the work of renowned professors such as Vesalius, Casalpino, Fallopius, Fabricius, and Berengario da Carpi.

By the first half of the 19th century, medical education decisively aligned with science, influenced by positivism and experimental methods. The clinical method was developed, emphasizing observation and physical examination. By the end of that century, medical education had reached a high scientific standard, particularly in Europe.

The Latin American region in the 20th century was a prolific area in introducing innovations in health workforce training. (González et al., 2023; Ramírez et al., 2022; López et al., 2023a). In 1910, Flexner (1910) produced a landmark document, known as the Flexner Report, based on his study of medical education across 155 medical schools in the United States and Canada. His proposal centered on the physician's role in treating disease and went as far as suggesting that if diseases did not exist, the societal role of physicians would be unnecessary. This contributed to establishing a biomedical-clinical model focused on individual care and cure. The report led to quality criteria that spurred significant changes in medical curricula and the creation of standardized academic programs. It also caused a drastic reduction in the number of medical schools; in New York, for example, the number dropped from forty-three to eleven. Later, Flexner's work was continued by the Council on Medical Education of the American Medical Association.

In subsequent decades, globally and particularly in Latin America, a series of developments laid the groundwork for a new paradigm in medical education that prevailed in the 21st century.

Advances in theoretical and practical conceptions of public health, preventive medicine, epidemiology, and social medicine heralded this new paradigm. Key aspects of this paradigm include:

- The emphasis on Primary Health Care as a core strategy for promoting, maintaining, and restoring health.;
- A growing trend toward outpatient treatment for various conditions and reduced hospital stays in other cases.
- Increasing recognition of the social dimensions of medicine.
- The gradual decline of private medical practice.
- Enhanced community knowledge, participation, and responsibility in health-related matters (Hernández & Ruiz, 2022; López et al., 2023b; Sánchez et al., 2023).

This paradigm drove significant changes in medical curricula and training processes, leading to new approaches for evaluating curriculum quality, teaching methods, and graduate outcomes. These approaches are rooted in a medical-social model, which integrates academic, hospital, and community settings into university training. Such approaches and criteria for quality assessment can be translated into specific performance indicators to evaluate effectiveness.

Similarly, at the World Conference on Medical Education held in 1988, the Edinburgh Declaration (Goić, 1989) was drafted, guiding the training of physicians to work toward improving the health of entire populations. It advocates for education to integrate health and its promotion, community issues, and a holistic understanding of individuals; social and moral values, communication skills, and the development of active, self-directed methods to cultivate students' ability to learn and communicate.

Furthermore, as disease patterns and medical practice evolved—alongside a growing emphasis on prevention—it became necessary for students to broaden and deepen their knowledge in Social Sciences, Epidemiology, Clinical Practice, Information Sciences, and Communication. Training processes also needed to extend beyond university spaces through community engagement (González et al., 2023; Ramírez et al., 2022).

As medical training progresses, it predominantly occurs in hospital settings, where students encounter health problems increasingly unrepresentative of those faced in community-based practice. This fact calls for a methodological shift in teaching approaches, aimed at forming professionals capable of addressing societal demands. Their actions must align with the characteristics of the society in which they will serve as responsible citizens driving qualitative social transformations. A systemic approach is essential, requiring coordinated efforts among all components to achieve these goals (González et al., 2023; Ramírez et al., 2022).

The development of both postgraduate studies and research training are critical to guarantee a good medical education. The way to ensure the quality and integrity of higher education must include opportunities for ongoing research and training for the academic staff. Equally vital is fostering community engagement in medical training. The role of educators is paramount. Their preparation in pedagogy and didactics is indispensable to uphold educational quality. Thus, these educators must increase their training to effectively contribute to medical programs (Ramírez et al., 2022).

Progress to the present has relied on innovative teaching methods, rigorous student selection, extended postgraduate education (via specialization courses), and particularly the hospital residency system. This medical-educational care system has yielded excellent results and was partly a response to the excessive proliferation of underprepared medical schools in North America. However, given new demands of the profession and higher education as a whole, we will outline the key challenges for medical education emerging from CRES+5 and its connection to the foundations of University 4.0. (López et al., 2023b; González et al., 2023; Ramírez et al., 2022).

The Mark of Medical Education in the Face of CRES+5 Challenges

The milestones for higher education development in the coming years were recently outlined at the follow-up meeting of the Regional Conference on Higher Education for Latin America and the Caribbean (CRES+5) (UNESCO, 2024), held in Brasilia in 2024. Undoubtedly, the elements derived from the Final Declaration of this landmark event highlight the core guidelines for the mission of universities, which directly impact medical education. This education must be increasingly aligned with social demands and with the health challenges in Latin America. Thus, there is a clear emphasis on enhancing the quality of professional training, which must incorporate essential elements to demonstrate excellence. To clarify these challenges, the following considerations are presented:

Higher education in Latin America must be built and consolidated with a strong commitment to social transformation. This requires governments to strengthen political will and ensure progressive investment in universalizing higher education, science, technology, and innovation by 2030. In this context, Higher Education Institutions (HEIs) remain the most valuable spaces for fostering a promising future based on harmony with citizens, social justice, sustainable development, and regional integration.

For higher education to thrive and uphold equity, it must vigorously commit to lifelong quality training, without neglecting the role of States in sustainably funding strategic actions linked to the progressive transformation of higher education (Díaz et al., 2024).

Equally critical is the ongoing dialogue of knowledge, inherent to university life, which blends academic knowledge, ancestral cultural identities, and partnerships with communities and strategic allies. This fosters endogenous development at local, territorial, and national levels.

The core of university work will remain centered on students, whose professional, ethical, and human development drives the teaching and administrative activities of our institutions. Students themselves shape pedagogical, didactic, and research approaches that enhance training. This includes prioritizing communication, empathy, emotional intelligence, teamwork, and other skills that bring ethical meaning to interpersonal relationships, aiding decision-making to address pressing challenges in professional education.

Significant achievements will remain elusive without effective, transformative leadership in higher education. Strategic and forward-looking vision must prioritize continuous improvement and quality management of university processes. Moral authority, exemplary conduct, and dedication to work will always inspire individuals and teams committed to social and human growth at individual, collective, institutional, and global levels.

The integration of science, knowledge, and new technologies must be open, grounded in free access, and recognized as human rights and social benefit. The drivers of digital transformation must be inclusive and applied ethically, always serving the members of Higher Education Institutions (HEIs) and society at large.

The internationalization of higher education must be strengthened, prioritizing mobility programs, knowledge networks, and joint research on shared interests. These efforts should reinforce regional integration among Latin American and Caribbean countries and foster international ties, promoting student and faculty exchanges while building strong cultural bonds across communities.

These challenges align coherently with the core principles of higher education development, which aspire to establish University 4.0 as a paradigm. A closer look at its characteristics and implications for medical education follows.

The Challenge of Medical Education in the Context of "University 4.0"

Today, HEIs must adapt educational models to meet modern training demands. This entails rethinking traditional approaches, leveraging technology, and harnessing opportunities from Industry 4.0. Consequently, the conventional education model must evolve, driven by research and innovation. This requires a redesign of teaching methods to empower students to understand how they learn and prepare for the future. One of those challenges is the use of AI tools both in the teaching-learning process, and in clinical practice (Topol & Masters, 2022).

Within this framework, the urgency to grasp and understand the scope of University 4.0 emerges. Presently, it starts to draw from diverse ongoing global initiatives, with documents on the future of higher education emerging across continents.

University 4.0 is envisioned as a hub of knowledge and talent for the future, built on four pillars:

1. A new collaborative model: Universities act as knowledge hubs, engaging in emerging markets and fostering partnerships between graduates and industries.

2. Deepened international cooperation: Universities become key players in the global knowledge economy, creating international campuses to enhance competitiveness.

3. Knowledge capitalization: Universities prioritize acquiring intellectual property rights.

4. Value-driven transformation: Universities focus on transferring new values, creating innovative academic environments, and driving entrepreneurship (Pedroza, 2018).

Regarding this, Engovatova & Kuznetsov (2016) states:

> Universities are essential institutions for research-based innovation. Their new role in the knowledge society lies in contributing to national innovation development (...). Universities not only conduct research and development but also actively create their own technologies, establish tech enterprises, and lead as hubs for new industrial technologies. (p.1)

Consequently, the University of the Future must train scientists and technologists to renew the virtuous cycle of innovation. The traditional R&D (Research & Development) formula is incomplete without innovation; the new formula to promote in University 4.0 is R&D&i (Research, Development, & Innovation). Furthermore, by integrating future professional training, the complete formula becomes T + R&D&i (Training + Research, Development, & Innovation), or in other words, professional training grounded in research to drive academic, scientific, and innovative development.

Regardless of the varying names for this new university model, there is consensus on where its academic innovations are concentrated. According to Mintz (2014), these include:

New modalities: Hybrid models, synchronous and asynchronous virtual models, customizable learning pathways (e.g., Station 1, Just-in-Time).

New certifications: Short-term certifications (under two years): badges, nanodegrees, MicroMasters.

New pedagogical practices: Problem-based learning, research-based learning, project-based learning, gamification (application of game-like elements to non-game contexts such as teaching-learning to motivate participation, engagement and desired behaviors), personalized learning, and flipped classroom, which shifts the teacher´s role from a "knowledge transmitter" to a facilitator, thus prioritizing collaborative practical learning during class time.

New educator roles: Innovative educator, guide and facilitator and learning architect.

Innovations in educational technologies: Virtual laboratories, digital neuro-learning labs, and holographic simulations, and seventh dimension (7D) presentations.

New assessment strategies: Formative assessment, performance-based evaluation, multiple intelligences assessment, and innovation-driven evaluation.

New student support models: proactive learning models, open tutorial models, feedback-driven models and peer mentoring systems.

Technological collaboration networks: Universities increasingly share services and technologies to enhance learning outcomes and scientific-technological contributions.

Curriculum Innovations: This is a cornerstone for disruptive change, shifting from credit/competency-based systems to disruptive curricular designs.

A standout feature of these academic innovations is the redefinition of teaching-learning, as it disrupts multiple aspects of traditional models and university academic practices. The trend in education is shifting toward an adaptive model. Educators are evolving with the increasingly integrated use of hybrid intelligence (which combines human and artificial intelligence) both inside and outside the classroom.

A forward-looking vision suggests a global transition from the knowledge society to the hybrid intelligence society, creating a symbiosis between human and artificial intelligence. This will impact universities by fostering positive, creative disruption in teaching and learning. Thus, it is appropriate to state that we are at the intersection between the smart university and "University 4.0".

As part of the advancing virtuous cycle of intelligence, curricular innovation is also steering toward "Smart Curriculum 1.0", characterized by the connectivity between virtual networks and physical spaces both within and beyond university campuses.

University 4.0 focuses on fostering intelligent innovation in science, technology, and academic life. This involves renewing teaching-learning processes through a "Smart Curriculum 1.0", where human and artificial intelligence take center stage, redefining the essence of the university. Unlike the traditional model confined to libraries and classrooms, University 4.0 embraces a limitless vision of knowledge in a digitized reality.

As Pedroza (2018) states:

> University 4.0 is a disruptive institution housing Smart Curriculum 1.0, where everything interconnects. Each part is independent of the whole yet gains meaning through mutual interaction. This is not word-play—the 1.0 curriculum is a Matrix: a global network composed of natural and artificial interactions forming knowledge stations. As interconnected learnings flow, they pave the way for new knowledge and technologies.

Thus, the challenge lies in adopting new visions and trends in higher education—including medical training—without compromising quality. This opens a niche for theoretical-methodological frameworks to guide the transition to University 4.0 and the implementation of smart curricula.

In summary, the authors argue that medical education must break free from traditional teaching-learning paradigms. Students must assume a proactive role, grounded in scientific rigor and aligned with an era of explosive knowledge growth, while retaining a humanistic focus. This requires ensuring closer ties of the students to future professional scenarios, promoting student-led scientific activity (Richard, 2024), and transforming educators, teaching methods, and learning environments.

CONCLUSIONS

The challenges currently faced by higher education have been analyzed in various international forums and events. One such event, CRES+5, recently addressed the most relevant pillars guiding the development of Higher Education Institutions (HEIs) to contribute to sustainable development. Key focuses include equity and social justice, the role of science and knowledge in social progress, internationalization as a core axis of university work, and the preservation of cultural and ancestral values of communities, among others. Within this context, medical education has developed unique characteristics throughout its historical evolution and now confronts new challenges arising from global demands and the serious health issues underlying the Latin American region.

Therefore, medical education must emphasize the importance of faculty training, curriculum relevance, and the value of science and innovation as central pillars of quality management. These elements must align with the foundations of University 4.0 and Education 4.0, enabling the development of strategies aimed at training physicians who can responsibly fulfill their social mission.

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