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Artificial intelligence in medical education: Latin American context

Inteligencia artificial en la educación médica: contexto Latinoamericano

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ABSTRACT

Introduction: Artificial Intelligence (AI) is an algorithm and statistic technology used in many human competences. In health, it works as a support tool centered in managing the use of data for clinical performance and learning medical skills, improving the health response from professionals. **Methods:** This paper collects and analyzes previous research, in electronic databases, related to the use of artificial intelligence in medical education within the Latin American context. No exclusion criteria were applied. **Results:** Artificial intelligence (AI) is considered an effective support tool for the development of multidisciplinary learning and teaching strategies focused on improving medical care through updating the process in medical training. For its correct use, it is important to define a support approach and its competent training to facilitate its effective implementation, reducing the gap between ethical and legal debates. The Latin American region, due to its political and sociocultural context, presents different challenges that must be faced to integrate these technologies into health education, occupation, and acceptation. **Conclusion:** In medical education AI is used as a tool which is a support for students and doctors, but it won't be a replacement. In Latin American it is the key for improving the education. AI must be operated or regulated by humans because it doesn't consider civil liberties and it hasn't conscience.

Keywords: artificial intelligence; medical education; Latin American; medical skills; support tool; updating; effectiveness; challenges.

RESUMEN

Introducción: La Inteligencia Artificial (IA) es una tecnología algorítmica y estadística utilizada en muchas competencias humanas. En salud, funciona como una herramienta de apoyo centrada en la gestión del uso de datos para el desempeño clínico y el aprendizaje de habilidades médicas, mejorando la respuesta sanitaria de los profesionales. **Métodos:** Este trabajo recopila y analiza investigaciones previas, en bases de datos electrónicas, relacionadas con el uso de la inteligencia artificial en la educación médica en el contexto latinoamericano. No se aplicaron criterios de exclusión. **Resultados:** La inteligencia artificial (IA) es considerada una herramienta de apoyo eficaz para el desarrollo de estrategias multidisciplinarias de aprendizaje y enseñanza enfocadas a mejorar la atención médica a través de la actualización del proceso en la formación médica. Para su correcto uso, es importante definir un enfoque de apoyo y su formación competente para facilitar su aplicación efectiva, reduciendo la brecha entre los debates éticos y legales. La región latinoamericana, por su contexto político y sociocultural, presenta diferentes desafíos que deben ser enfrentados para integrar estas tecnologías en la educación, ocupación y aceptación de la salud. **Conclusiones:** En la educación médica la IA se utiliza como una herramienta de apoyo para estudiantes y médicos, pero no será un reemplazo. En América Latina es la clave para mejorar la educación. La IA debe ser operada o regulada por humanos porque no considera las libertades civiles y no tiene conciencia.

Palabras clave: inteligencia artificial; educación médica; Latinoamérica; habilidades médicas; herramienta de apoyo; actualización; efectividad; desafíos.

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INTRODUCTION

The application of artificial intelligence (AI) in the field of healthcare represents important advances in the creation of opportunities to improve the quality of care and therapy provided to the patient, either to reach a diagnosis or to follow up on the disease or treatment identified. Therefore, it is important to recognize artificial intelligence as an analogous tool to the technology used in the world of programming and statistics, especially enhanced by Machine Learning, described as a set of algorithms and statistical techniques, programmed in a computer, which allow optimizing and directing the results towards the clinic, since it provides accuracy in diagnoses and helps to reduce the burden of the healthcare professional in terms of data interpretation, calculation of characteristics, prognoses, screening or collection and classification of relevant information about the disease[1].

In this sense, it is important to recognize that the incorporation of artificial intelligence in the health area, at a professional and academic level, is not intended to replace human labor or knowledge[2], but aims to support the practice of medicine at the professional level, and to provide the necessary learning tools to the subject, facilitating their understanding during their academic training.

Given the technological advances observed in the present XXI century, the influence of AI in medical education is inevitable, so it is necessary to strength the skills of future specialists, focused on the management of artificial intelligence in their favor, since this tool allows complementing unsatisfied subjects of study, by developing active feedback programs that provide coherent and truthful information, capable of adapting to the daily routine (schedules) and learning styles of the person, which enhances their understanding and learning, while, encourages the individual to put the knowledge acquired into practice[3].

In the same way, its application allows interdisciplinary and interprofessional communication to expand the spectrum of interpretation, interaction and transmission of relevant information worldwide, thanks to the communication network that facilitates international collaboration, which broadens the diagnostic and treatment scenarios applicable to a specific pathology/diagnosis. However, in the Latin American context, it is recognized that there is limited research on the use of artificial intelligence in medical education[4], mainly restricted by the high prices involved in the acquisition of this new type of technology, which limits its accessibility, exclusively for those who can cover its costs[5]. That is why, in this article, we intend to analyze the impact and scope that the implementation of artificial intelligence could have in the educational field and the health area, specifically focused on the training of Latin American medical professionals, since, so far, it is recognized that it is necessary to promote collaboration between specialists to enhance the development and improvement of new technologies related to artificial intelligence, that allow to reduce costs and speed up the development of some kind of software capable of providing transparent, clear, objective and easy to interpret information for human experts, to satisfy the medical needs of social interest and to increase its accessibility to the public and the medical-scientific society in general.

MATERIALS AND METHODS

This paper is a bibliographic review that collects and analyzes previous research related to the use of AI in medical education within the Latin American context. Studies from the period 2018-2023 were reviewed because this is the period with the highest scientific production. A comprehensive search was conducted in electronic databases such as PubMed, Scopus, and Google Scholar, using keywords related to AI, medical education, and the Latin American con-

text. Inclusion criteria were established to select relevant studies, which included research published in scientific journals conducted in Latin American countries addressing the application of artificial intelligence in medical education. One limitation of this bibliographic review is its dependence on the availability and quality of previously published studies. Additionally, the analysis is based on the data and results reported in the selected articles, without direct access to study subjects or complete details of the procedures used. The quality of the selected studies was evaluated following rigorous criteria to guarantee the reliability and validity of the information obtained. Several aspects were considered to determine the quality of the studies, such as the methodology used, the research design, the sample size, the representativeness of the study population, the rigor of the data analysis and the validity of the results. In addition, the reputation of the scientific journals where the studies were published and the relevance of the researchers in the field of artificial intelligence in medical education were considered. This critical evaluation of the quality of the studies allowed us to select those that offered the most solid and reliable evidence to support our conclusions and recommendations in the study.

Selection criteria

To perform the literature search relevant to this research, literature was searched mainly in PubMed, Scopus, and Google Scholar. Searches were conducted using terms such as AI, medical education, applications, challenges, Latin America, among others, in various combinations. We also conducted searches using the terminology MeSH (AI and medical education). The searches were limited to studies published in English language scientific journals in the last 5 years. In addition, the studies had to belong to the following types of articles: literature reviews, systematic review, cost-effectiveness, paper discussion, e-Delphi study, and integrative review (*Figure 1*).

We excluded studies with: focus on AI applications outside the field of medical education, articles from non-academic sources, and studies that, due to geographical limitation, are not related to the implementation and challenges specific to the Latin American region.

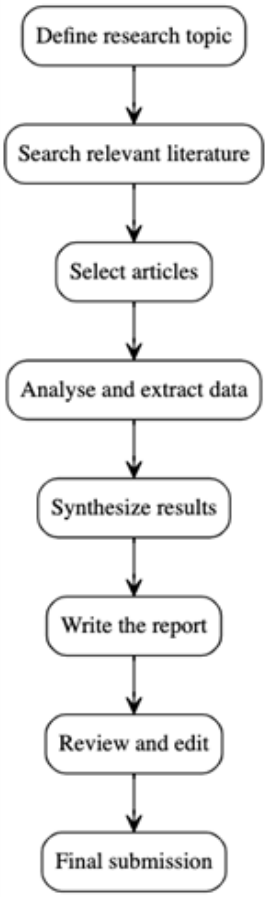

Figure 1. Flow-chart of literature review methodology.

RESULTS

Overview of existence research of AI in medical education in Latin America

The intrinsic qualities of AI have overwhelmed a framework of possibilities in different fields of human occupations. Education has been an invariable purpose of innovation in teaching and learning techniques adap-

ted to the needs of society's socio-cultural environment[6]. The implementation of AI in education is mainly focused on the use of technological tools based on information management models and the adaptability and influence in educational roles such as content development, evaluation and administration, among others[3]. Suggesting that medical education is an area that progresses in accordance with technological development to respond to the quality in demand for professional training of doctors.

At present, health sciences have become more complex due to the constant renewal of techniques, medicine, tests, and the amount of data obtained, exceeding the limits of what the human mind can understand. Therefore, in response, different learning and education techniques appear, such as AI[1]. AI influences all areas of health, creating opportunities such as improving therapy and patient care.

One of the tools that AI offers is Machine Learning, described as a set of algorithms and statistical techniques programmed in a computer to optimize the results that can be obtained on a specific task. This type of technique, although it's mainly aimed at the world of programming and statistics, can be focused on the clinic, helping reduce the burden for the health professional at the time of data collection, calculation of characteristics, prognosis, screening, and diagnosis, highlighting the latter, since it is estimated that a health professional will fail at least once in the diagnosis throughout his professional career[1].

For example, on several occasions, the ChatGPT model, which uses AI and natural language processing, has been used to try to solve different international medical exams. In 2022 in Spain, a cross-sectional descriptive analysis was carried out in which Chat GPT technology was used to solve all the questions of the MIR 2022. ChatGPT was able to correctly answer 51.4% of the questions, which is approximately equal to 69 correct answers, obtaining position number 7688. Even though it ranked below the median of the population, by using this model it is possible to pass the cut-off score and choose many specialties. These results were slightly worse than those that ChatGPT obtained in the American exams, USMLE[7]. The development and influence of AI in medical education is inevitable. It is essential

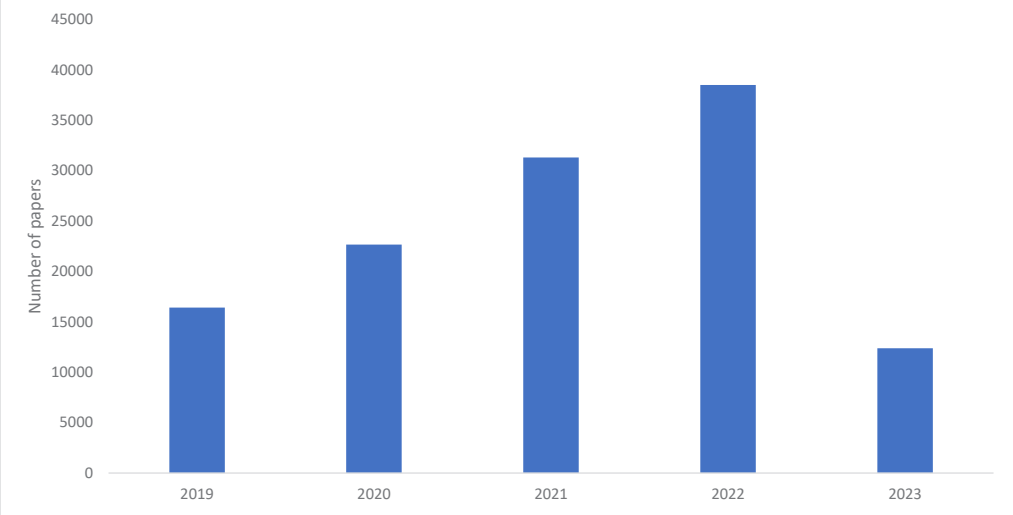

Figure 2. Scientific production on artificial intelligence in the last 5 years.

to train future specialists in the new reality of AI so that they can use them and obtain benefits in a reasoned and safe way.

Today, health educators must train future professionals on the different advantages and opportunities that AI offers. Among those, some valuable would be the decrease in the doctor's workload in repetitive tasks[2]. Another positive aspect is the way in which it would contribute to improving the trust of patients in health professionals because the information provided is transparent, clear, objective and easy to interpret for the human experts. But to maintain this level, constant learning of human-machine interactive techniques is needed[8].

Finally, there is a misconception regarding AI and its evolution in the field of medicine, since it has come to be thought that this technology can replace the health care professional. Therefore, in order to forsake this prejudice, it is necessary not to compare it as a potential rival, but as an analogue that becomes the doctor's support hand while he uses it[2]. There is limited research on the use of AI in medical education in Latin America[4].

Challenges and opportunities of implementing AI in medical education in Latin America

Medical education must be adapted as much as the times and the contexts of students and patients[8]. (AI) is the key to improve education in Latin America, as well as bringing opportunities, but it also brings challenges in its implementation. Medical education evaluates the possibility of simulations, platforms and study habits provided by AI where students can reflect on their results and have more accessible practices for the development of their knowledge[5].

On the other hand, there are obstacles to creating applications with AI and their limitations when using them. To develop applications or machines with artificial intelligence requires a lot of time, money and specialized members, so their accessibility is limited[5]. Therefore, medical professionals and specialists are collaborating to reduce costs and be efficient in the development of some type of software capable of satisfying these needs.

In education, AI presents innovative teaching methods such as active feedback to teachers and students or the ability to adapt to different learning styles, whether visual or auditory, which allows students to understand and put knowledge into practice more easily. It also tries to complement unsatisfied topics of study with programs capable of presenting coherent and truthful information[3].

The presentation of holographic images and virtual reality where AI can take part to provide suggestions, recommendations and correct specific errors made during practice. AI seeks to lean into medical research by applying the use of "big data" algorithms, guided by the clinical history of patients for advanced studies of cardiovascular and neuronal diseases to produce complex statistical models with values incapable of being done by people in a time limit[9].

Another advantage is that AI reduces the efforts required by health professionals to interpret data, improving the accuracy of diagnoses and treatments it facilitates collaboration between professionals, and students can access education at any time and place[5]. In contrast to classical education, by implementing AI in the educational scheme, they keep an intercommunication network which allows sharing information and the collaboration from different health professionals, this also generates that Latin American students can access educational topics and courses of their interest in flexible schedules and in the places they decide.

The implementation of AI also has some challenges, its use for diagnostic can represent a problem, it's about professional "trusting"

the results to much that can cause loss of skills or something more serious like a misdiagnosis the cases already documented by Anh et al, in a study of electrocardiograms where atrial fibrillation was incorrectly categorized due to flaws in the AI algorithm[10].

Another challenge is that not all locations are suitable for AI deployment[5]. In all countries there are areas with limited resources that cannot afford the costs of implementing or maintaining artificial intelligence. In Latin America are several low-income areas where the internet connection and electrical system are not adequate, making the use of AI impossible.

In summary, the main challenge in Latin America for the implementation of AI is the limitation of resources, but once that aspect is successfully resolved we have many advantages that generate a greater security for health professionals and students because it helps and it promote better education, that aspect allows the development of more detailed and precise diagnoses with its role in treatments of various diseases, which supported by professional judgment provides greater safety to patients.

The potential impact of AI in medical education in Latin America

The implementation of Artificial Intelligence (AI) in medical scenarios has been perceived through several perspectives. A lot of people think that AI will totally replace doctors, as machines can perform the same activities equally as doctors. But what if this thought is seen through another edge? It is necessary to think about AI as an efficient and powerful tool to improve medical education. In one side this implement could be used with the purpose of enhancing some of the medical staff activities, nor to generate future roles for them to be trained on, this will require new medical formation. For example, interacting more with AI diagnostic systems or learning about robotic surgery[3].

To generate an impact with AI, first it is important to consider that there is a lack of information about the efficient use of AI. Medical schools must incorporate the acquiring of competences involving the use of AI in medical undergraduate courses. As AI can process data, finding a pattern or creating predictions and advice. As AI can process data, finding a pattern or creating predictions and advice, Ötleş[12], suggests that the use of AI in medical education should follow an analytic hierarchy that links AI functions. It is organized in three stages: descriptive, predictive, and prescriptive analytics. This will help to impulse the interest of students in this area to apply or even develop new AI tools.

Both students and instructors in the medical education field should know about the benefits and dangers involving the use of AI, and likewise the ethical use of this computational system. This involves that medical students should receive adequate training in important aspects involving patients' personal data as: privacy and protection of data and confidentiality, considering that people have this internalized fear involving a robot taking control of their information. One of the potential effects of AI in the educational process involving future health professionals is to build confidence in the patient and improving interprofessional collaboration, for example digital experts, to define the actual and sophisticated needs and applications of AI in health care[2]. Finally, it's important to remember that AI has also its relevance in terms of mental health in medical students, which is a concerning topic to act on.

In Latin America, the inclusion of AI educational methods for medical students has not been recognized on a big scale. Nevertheless, it is useful to know some applications of AI that will boost education for both students and educators. For example, Intelligent Tutoring Systems (ITS) can help students to reach and create their own personal study

environment. This type of application emulates a tutor that will complement traditional education with explanations and finding mistakes that the student may have. This reduces the workload of medical educators and improves their performance when they impart knowledge[13]. Another interesting use of AI in medical education is an online software that interacts with the student as a virtual patient. It shows real patient data and offers clinical approaches for students to practice examinations, diagnostic and treatments, enhancing their critical thinking skills and giving feedback when a mistake is committed[14].

Talking about the clinical approaches, it's important to understand the value of this AI, but not just as materials or technology innovation. For medical students, their most scary scenarios are those where they must be in front of real people. With AI, they will be able to solve problems in artificial cases, however this technology helps them to improve their skills and gives them confidence to confront the real cases with real patients. This is common in education, not only in Latin America, but also in the whole world. The main idea is not to forget the humanistic part[15].

In conclusion, AI has been having a potential impact on the way of learning medicine at universities in Latin America. It provides students and educators with different kinds of strategies to strengthen their knowledge. For the future, there's a challenge that includes the economic factor which lets us know that there're universities with more purchasing power and, therefore they can implement more AI tools.

The role of artificial intelligence in the assessment of medical students in Latin America

In this new era technology has been gaining power along multiple dimensions, one of them is medical education. Today's technology is mostly influenced by (AI) which is defined as the ability of machines to imitate human behavior[16], and is described as the integration of induced machine processing and skills of learning[17]. In Medicine this represents a total advantage in education since students can achieve multiple competences while practicing medical procedures to a great extent in machines like a real human being; however, they are still unconscious[16].

AI attends medical student needs while letting them become smarter, more efficient and competent in making future clinical procedures and ensure adequate and successful patient care full of values and protection of human right[16,17]. Keeping with student assessment, there was a AI systems allows student to receive automatic feedback based on performance metrics and benchmarks students know what to improve; however, the systems lack emotions or subjective behavior in contrast to humans, in this scenario a great suggestion would be to include positive feedback in what students already know so that neglect, frustration and discomfort are avoided[16]. To this date, artificial intelligence in medical education is poorly studied and developed. One of the main reasons is the limitation of A.I. to make a rigorously personalized review of the patient or the illness related to the individual conditions of a patient[18]. Nevertheless, a performance study regarding Large Language Model (LLM) based A.I. called ChatGTP was done in early 2023 to see how well this A.I. can be incorporated in medical education by quantitatively evaluating its pass rate on the United States Medical Licensing Examination[18]. The studied conclusions were that ChatGTP could be used as a complement in the learning process of a medicine student, this because, although ChatGTP lacks personalized problem evaluation, the algorithm used some specific analysis of the situation to fit to the most probable cause by evaluating certain parameters. This means that a student could learn how to make a speci-

fic, personalized and individual analysis of a situation by learning how to solve medical related problems implementing rigorous decomposition of an universal issue and all of its different variants, so this A.I. can be an instrument that helps the student to comprehend the whole "theory" and variants within a problem and using the knowledge acquired during the career to personalize it and give the proper solution, developing critical thinking and helping to speed up many of the long-lasting diagnostic processes[18].

Assessing medical students in Latin America using (AI) presents both opportunities and challenges. On one hand, AI can aid in the objective and precise assessment of medical knowledge and skills, which could improve the quality of medical education in the region. Additionally, AI could also be used to validate and enhance traditional assessments by automating error and bias detection[18,19].

However, there are significant challenges associated with implementing AI in medical student assessment. One of these challenges is the lack of high-quality data to train AI algorithms. Additionally, AI may not account for cultural and linguistic factors, which could result in unfair outcomes for certain student groups[17,19].

To overcome these challenges, continuous research on the application of AI in medical student assessment in Latin America is necessary. The aim of this research should be to design fair and equitable AI algorithms that consider the cultural and linguistic diversity of the region. Moreover, a collaboration between medical educators and AI experts is required to ensure the effective and responsible implementation of technology in student assessment. With careful planning and ethical implementation, AI has the potential to significantly improve medical education in Latin America[17,19].

Currently Chile is one of the countries that has a noticeable advance in terms of artificial intelligence applied to medicine. The "Centro de Innovación en Salud de la Dirección Académica de Clínica las Condes" is a Chilean organization that, following the Chilean A.I. politics and sustainable development centered in safety and inclusion, aims to the development of A.I. and automated learning regarding health care in the country and Latin America[20].

Integration of AI into medical curriculum desing in Latin America

(AI) is gaining more strength in all areas of work and education, and medicine is no exception. In education, the development and updating of the curriculum is continuous since it must respond to changing expectations in order to remain useful and relevant[6].

Medical education must evolve, since in the future there will be different health contexts than now thanks to innovations in technology, so it can be conjectured that practically all doctors will use AI soon. It is predicted that artificial intelligence systems will not replace doctors, but that this system will serve as a tool for the doctor in fields that have been strongly impacted using AI technologies, such as image-based diagnosis in radiology, ophthalmology, pathology, dermatology, robotic surgery, clinical results, genome interpretation, biomarkers, health status by portable equipment, prediction and patient follow-up[6].

Despite this, the applications of AI in medical education have been little explored and there are doubts about its didactic application in the curriculum. Furthermore, another factor influencing the adoption of AI in medical education is that digitization of the curriculum is not always possible due to costs[1].

Even more so in Latin America, where countries do not have enough resources to adopt AI in the curriculum.

Training of medical educators on the use of AI in medical education in Latin America

AI is on the rise and soon many professions will need to adapt and integrate AI into their curriculum, including medical education. For professors to be adequately prepared for this, they must have at least a basic understanding of AI related to learning and teaching, and the way in which medical education will be impacted by this tool.

Among the things that students should be taught is to be able to inform AI systems about relevant information and combine it with previously obtained data to ask clinicians to request more information in areas that are not so clear[1].

In Latin America this is a little more difficult, since AI programs are not as common as they are in first world countries and, therefore, there are no facilities for educators to be trained and prepared to teach in schools. of medicine on the use of AI. It is also for this reason that the curricula have not yet had the urgency to make changes and implement classes on AI, since there are no professionals trained for this.

Analysis of the cost- effectiveness of implementing AI in medical education in Latin America

Some studies have assessed the cost effectiveness of using AI in medicine. For example, in a study carried out in the USA where AI is used for the detection of colorectal cancer, it was found that the costs of the use of AI and post-detection treatment of diseases were reduced by 3%. The relative reduction in the incidence of colon cancer with screening colonoscopy without AI was 44.2%, while in colonoscopy with AI it was 48.9%, that is, a 4.8% difference. In relation to mortality from colorectal cancer with screening without AI it was 48.7%, while with AI it was 52.3%[7].

There is also utility in breast cancer screening, since in one study it was found that the use of AI to stratify the risk of breast cancer in women between 40 and 49 years was more cost effective than only screening based on family history or factors polygenic risk[2].

There are many benefits in the field of cost effectiveness on the use of AI in medicine, however, there are still no studies on the cost effectiveness of the use of AI in medical education in Latin America. All medical schools should consider implementing AI into their curriculum as science advances and physicians will need to work in conjunction with AI in the future to achieve more timely patient care.

Exploration of the potential of AI to improve access to medical education in Latin America

The main barrier to the use of AI is the lack of digitization, which prevents having the necessary requirements to develop a system based on AI. This limitation is much more evident in Latin America, since digital tools are not used for many things, such as the curriculum, evaluations, teaching, etc.

Despite the evidence that AI skills will inevitably be a requirement for medical graduation in the future, there are still many challenges in implementing AI in medical education. The use of AI that can be used to teach skills such as EKG, decision making and probability prediction as an aid in making a diagnosis.

One of the problems is the extra time that should be increased for classes and the lack of hours available in the curriculum to adjust this new area of knowledge. Also, medical schools do not have faculty with the necessary experience to teach AI content in medicine, but this could be improved by increasing cross-faculty collaborations such as engineering and informatics with the medical school.

In conclusion, the role of AI in medical education will become increasingly important and in the future new spaces and roles will open for doctors and medical students based on the use of AI[8].

Analysis of the legal framework for the use of AI in medical education in Latin America

As it is known, artificial intelligence (AI) is still a tool under development within the medical field. Consequently, a legal framework has not been established yet because of a constant debate in the ethics involved in the use of AI. Nowadays, health professionals have a vague vision and basic guidelines for the management of AI in the medical field. At the same time, costs for the use of AI in the healthcare field do not help the initial problem, even first world countries report high costs and difficulties to assume the payments. For this reason, the responsibility a health professional must have is described below in 3 main categories[21].

1. Accountability

We achieve accountability by verifying the result of the IA procedure. Knowing the decision making and constant learning of the IA is relevant to understanding systems problems that can be catastrophic for health. For every single procedure that health is involved in, such as diagnosis, education, and medical surgeries, it's necessary to have a backup of how the information is obtained or implemented to minimize future errors[21].

2. Liability

A robot, even if it is autonomous, cannot be held responsible for its actions, so the damage caused to the patient will fall under the full responsibility of the manufacturer, operator, or person responsible for maintenance. The legal framework is insufficient, as it cannot fully cover the damage caused by robots with the ability to learn, adapt and autonomous capabilities, resulting in unpredictable behaviors. Traditional rules are not sufficient when a robot can make its own decisions, as they will not allow the identification of a responsible person to be held accountable. Finally, liability is tied to accountability[21].

3. Culpability

An AI program can't receive a punishment based on a legal framework due to its lack of civil liberties, free will and conscience. As a result, a human must be considered guilty for the robot´s or AI failures to determine the legal judgment. Mainly, people who can be considered guilty are manufacturers, dealers, owners, and anyone in charge of operating the AI program[21].

Medical Procedures

Although AI robots are already used for medical procedures such as rehabilitation, diagnosis and prosthetics, a constant debate relies on the use of this kind of technology in surgeries. For this reason, the following information is focused on the use of AI in surgical medical procedures. To accomplish accountability, it is suggested to include a system which can register actions and provide protection to intellectual property rights as part of the surgery robot design[22].

As a surgery robot can't be reliable due to its unpredictable behavior, complete autonomy cannot be given, and a surgeon or trained operator always has to be able to control any action during any medical procedure that involves AI robots. Therefore, a human must be behind the operation of the AI surgery robot, so there is a suitable appliance of law. For instance, if the surgery robot causes the death of the patient because of a technique mistake the surgeon will be guilty or if it was because of a failure in the robot´s system the manufacturer will be responsible. Finally, there are fewer ethical problems when the surgery robot doesn't have autonomy.

Nevertheless, as a contribution to the ethics of the procedure, people behind its control must be properly trained constantly. Additionally, secure informed consent must be provided to the patient before any surgical procedure with an AI robot[21].

Diagnostic Procedures

Global commitments on the protection of rights, freedoms, non-discrimination, prevention of mass surveillance and protection of journalistic sources must be fulfilled in Latin American countries. AI training should be independent of each country and along with its prevalence and population demographics. AI should have in their operating system the procedure for obtaining data and identifying errors in real time. The AI is incapable of being responsible for a bad diagnosis, that is why it should be used as a statistical method to redirect a differential diagnosis, but not a final diagnosis[3]. The culpability should fall on manufacturers, dealers, owners, and health professionals who use it as an only and definitive diagnostic method. For instance, AI and big data have already been applied in Latin America to reduce COVID-19 quarantine and form epidemiological fences[23,24].

Health teaching in medicine field

The development of public policies in Latin America (LA) the government plays an important role to implement partnerships with the private sector, as this is the one that has a greater acquisition of AI, since the public sector by its high level of complexity will not be able to innovate. Consequently, inclusion and equity are factors LA governments should consider. Furthermore, professors should be trained for the implementation of AI, allowing anticipation of the difficulties that may arise in the learning analysis systems of students. Moreover, AI may transform education to identify educational disadvantage and marginalization among populations such as refugees, displaced and disabled people in LA[25].

CONCLUSION

Artificial Intelligence (AI) in education is mainly used as an education tool or the doctor's support hand and not as a replacement. Medical education is an area that progresses with technological development to respond to the quality in demand for professional training of doctors.

AI can be used as a Machine learning tool for prognosis, data collection, improving therapy, and diagnosis to some extent. Moreover, AI is already a tool for surgical procedures by being part of a surgery robot's system. Additionally, it can provide education study habits with simulations and platforms that increase the student's good results in practices, the development of knowledge and critical thinking. Today, health educators must train future professionals on the use of AI in order to increase the trust of patients on health professionals, as well as to reduce the doctor’s workload in repetitive tasks.

In Latin America (LA) AI is the key to improving education. Although, it represents a challenge due to the high costs, limited AI research, lack of economy and government stability. Owing to the advantages AI may offer in LA, the countries in this region should aim to progressively include it, so educational and even social problems can be solved. For instance, educational disadvantage and marginalization among populations such as refugees and disabled people.

Furthermore, all professionals must be aware of the competences, advantages, dangers, and ethics that are involved in the use of AI. However, a legal framework has not been established yet because of a constant debate. Therefore, health professionals have basic guidelines for the management of AI in the medical field which establishes that AI cannot be reliable due to the absence of civil liberties, free will and conscience. Consequently, a human must be responsi-

ble for the AI operation so a suitable legal judgment can be executed.

Authors' contribution

Conception and design of the work: Dr. Daniel Aguilar Bucheli.

All authors collaborated in collection of results, critical review, analysis and interpretation of the data, and drafting of the manuscript.

Conflict of interest

The authors declared that they have no personal, financial, intellectual, economic, and corporate conflicts of interest with Hospital Metropolitano and the members of the journal MetroCiencia.

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