

Artificial Intelligence in Health: Advances in Modern Medicine

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Summary

Artificial Intelligence (AI) is the ability of algorithms to process requirements and provide responses without the need to be specifically programmed for all possible scenarios. AI can perform tasks that require a high level of precision and reliability. In the health field, AI has been used for diagnosis, patient guidance, administrative management and research. This technology is linked to different aspects that cannot be omitted: the requirement for quality data for AI training, ethical concerns, requirements in the current health system for its implementation, among others.

Healthcare professionals will play a fundamental role in the inclusion of AI in the healthcare field, as they will be the ones who will impact the entire process of design, use and monitoring of AI-enhanced systems, and, on the other hand, the importance of their continuous training in the most recent technological innovations is highlighted.

Keywords: Artificial Intelligence (AI), Modern Medicine, Future of Medicine, Limitations of AI in Healthcare.

Introduction: Artificial intelligence is transforming the healthcare field, offering new tools that improve the diagnosis of diseases, optimize treatments, and accelerate medical research. AI refers to the ability of algorithms integrated into systems, or, in other words, computer systems, to perform tasks that normally require human intelligence, such as learning, decision-making, and problem-solving, without the need for a human to specifically program each step. Among the most relevant aspects for the use of AI are those tasks that require a high level of precision and reliability. It should be noted that, in order to obtain the expected results, the AI must be adequately trained. Likewise, it is totally unacceptable to separate the ethical aspect from what is involved in using an algorithm to solve health problems.

Artificial intelligence in the health field

According to the WHO (2024), artificial intelligence refers to “the ability of algorithms embedded in systems and tools to learn from data so that they can perform automated tasks without the need for a human to explicitly program each step”. There are various types of artificial intelligence that can help perform tasks, one of the most widely used for health applications is large multi-modal models (LMM).

The main function of LMMs is to perform tasks that require a high level of precision and reliability with the aim of “improving the capacity of health systems and promoting the interests of patients” (WHO, 2024).

The WHO (2024) indicates the five most common uses of LMM applied in the health field:

1. Diagnosis and clinical care, providing answers to frequently asked questions by patients in writing. One of its notable benefits is the accessibility that patients can have to make their queries at any time of the day.
2. Patient guidance on symptom research and treatments, clarifying that at no time should it replace medical care.
3. Administrative and office management, including relevant information on patient follow-ups in electronic medical records.

4. Support in the training of healthcare personnel. The use of simulators for teaching is an increasingly common practice, as it allows practice in a controlled environment. If, in addition to this, the simulator is able to resemble the interaction of a real-life patient, a more comprehensive and beneficial training is obtained for healthcare personnel. The similarity with a real-life patient is obtained thanks to the LMM.

5. Research, development of new drugs or compounds. When LMMs are properly trained, as already mentioned, they are capable of developing high levels of precision and reliability that can be decisive when making the decision between one molecule or another to develop.

Limitations of AI in the health field

AI has very strong points that are worth developing for its implementation as a tool to help decision-making in the health area, however, it also has major limitations and challenges that must be considered:

o Limitation of high-quality information

AI depends heavily on the information with which it is trained for one purpose or another, so optimal results cannot be guaranteed if it is not possible to provide it with high-quality information in the first instance to train it, so that it can subsequently optimally perform tasks for which it has not been specifically programmed (Rezaei et al., 2023).

o Lack of ability to interpret. AI algorithms are efficient at making accurate predictions, but the lack of the ability to explain or justify these results in a barrier in the health area, where every decision for public welfare must be transparent and explainable (Rezaei et al., 2023). The need for human thought is evident: rational and analytical, which takes the inputs provided by AI and based on this, proposes applicable, reasoned and justified strategies for a specific problem.

o Ethical concerns

Considering the ethical factor for the application of AI, the following can be mentioned first: problems related to patient privacy and biases, not to mention that AI may reproduce biases from healthcare personnel, clarifying that, unintentionally, this could lead to disparate diagnoses or treatments (Rezaei et al., 2023).

o Limited generalization

The AI algorithm is trained with specific databases of populations with particular characteristics, so extrapolating its results or analysis techniques to the entire population may cause methodological analysis errors to provide appropriate solutions for a particular population (Rezaei et al., 2023).

o Integrating AI with the existing healthcare system AI integration can be particularly challenging for healthcare systems, as there may be cultural, technical, organizational, economic or even regulatory barriers to the inclusion of AI as a tool to support the diagnosis and treatment of patients (Rezaei et al., 2023).

The WHO (2024) proposes that in order to mitigate these limitations in some way, it is necessary that those involved (authorities, developers, health care providers, patients and society) actively participate in all stages of development, which, it should be clarified, includes supervision, regulation and implementation of the same.

Regarding the above, it is important to take these limitations into account since the risk-benefit ratio is assessed for the patient and also at the public health level. However, AI can increase the capacity of health care facilities by improving the care provided to patients, providing accurate diagnoses, optimizing treatment plans, supporting preparation and response to pandemics, among others. Therefore, to take full advantage of the potential of AI, health professionals and the health system must have detailed information about it, so that the general operation can be safe and effective, with reliable and appropriate results. The relationships between AI and ethics, health professionals and regulatory authorities in our country, could see the need to be updated to generate together a future with innovation within everyone's reach (Noticias ONU, 2023).

AI and ethics relationship

As described in the Guidance on Ethics and Governance of Artificial Intelligence in Health (2024), WHO reiterated that:

"Autonomy must be protected; human well-being, human security, and the public interest promoted; transparency and intelligibility ensured; responsibility and accountability fostered; inclusion and equity ensured; and autonomy protected when designing, developing, and applying artificial intelligence in order to ensure its use is trustworthy and sustainable."

It is therefore important to mention that those responsible for developing health policies should use it to guarantee the safety and protection of patients, while manufacturers and technology companies work to market the language models and algorithms generated by artificial intelligence.

It should be noted that any technology developed by humans is never neutral, as it inherits the biases of its creators or founders. Therefore, it is necessary for AI to be developed under basic ethical principles and thus minimize the risks that may be introduced by its misuse, in this way it would be possible to make use of its benefits and advantages. Likewise, as will be detailed later, education on the use of these technologies is essential, since it can generate an increase in inequality and discrimination in certain populations, so the data with which AI is fed must be diversified as much as possible. This is imperative, since by not making these inclusions within AI, they could be stereotyped by excluding minorities, so only the fraction of society will be promoted, making it less human, less democratic and would ultimately be a setback at the level of public health.

Wanting rapid or instant changes to create a pace of development at the level of public health does not lead to any safe path, so making the appropriate changes in advance in AI, especially in its regulation, will be necessary so that no one is left behind, through the inclusion and respect of the fundamental rights of all human beings at the health level.

The use of data from real clinical environments is very beneficial for the development of AI applied to the health area, however, when evaluating this from an ethical perspective it becomes a bit complex. What is indicated is to have systems that ensure the use of data from clinical records, protecting the confidentiality of the subjects, where there is informed consent from the people who provide their information in order to train or develop an AI, to feed a database, among others (WHO, 2023).

Ethically, the development of AI should seek to minimize as much as possible the possibility of misuse of real clinical information, that is, the possible misinformation that may be unintentionally generated by an AI, the danger of this is that the statements may seem very convincing but be totally incorrect or have particularly serious errors that the general public cannot differentiate (WHO, 2023), for which WHO (2023) details that "regulatory bodies are recommended to guarantee the safety and protection of the patient, while technology companies strive to market the great linguistic models."

Relationship between AI and health professionals

It is expected that AI will bring remarkable changes to the health field, but there is some uncertainty among health professionals regarding the incorporation of this technology into routine practice. They fear that it might replace them. However, studies indicate that

health personnel should play a key role in all processes related to the incorporation of AI. It is necessary to specify that AI should serve as a complement in decision-making and clinical support, aiding, for instance, in eliminating repetitive tasks by automating them and thereby reducing the workload for health professionals. In general, AI-based medical tools being developed for application in the healthcare sector are aimed at assisting with diagnosis, monitoring patient progress, and selecting appropriate treatments. These tools, in turn, require careful consideration of their ethical and legal dimensions.

It is important to mention that medical prediction accuracy of AI is proportional to the quantity, quality, and accuracy of the data provided by healthcare personnel, as well as the stored experience on a specific topic. That is, it directly depends on the quality of the data used to train the algorithm, as well as the data supplied for the development of the requested function. It should not be forgotten that the possibility of error will always be present to a greater or lesser extent. This highlights the importance of human intervention. AI predictions depend on the data and the algorithms with which the system is trained. Predictions can be wrong due to incorrect or imprecise data provided, or the use of unfounded or flawed assumptions (Romeo, 2020).

It is important to highlight that due to the high speed at which algorithms analyze large amounts of data, generating new information and learning from it, it becomes inevitable to reach a point where the human capacity of health professionals to verify how AI arrives at certain conclusions, diagnoses, or treatments is surpassed, given the complexity of the algorithmic process. Furthermore, this limitation in following the entire process is compounded by the fact that it is sometimes subject to trade or manufacturing secrecy. Hence, it is necessary to invest in the training of health professionals to correctly operate the available AI systems. Likewise, it is essential to provide adequate training to future health professionals, ensuring that the bioethical approach takes a more prominent place in their education, to promote patient beneficence rather than the system's success rate.

Regarding the resistance to the use of AI by health professionals, it is mostly due to a lack of awareness of the potential of digital medicine, the digitalization of health processes, the growing fear of AI replacing doctors, and the current global shortage of a legal framework defining the concept of liability in the case of acquiring or rejecting algorithm recommendations or opinions.

The essential point is that health professionals must be aware of the seriousness, scope, and responsibility of AI within the healthcare field. It is important to mention that healthcare cannot be conditioned by the use of AI, as major decisions could become overly robotic, creating mechanical processes without any professional being held accountable at the end of the day. Therefore, fostering shared social responsibility, that is, the human capacity to be accountable, demand accountability, and provide accountability for professional decisions where any AI-enabled device is used, must be the central focus of each of these decisions within the healthcare field (Moratalla, 2024).

Relationship between AI and regulatory authorities

Regulatory authorities have focused on three challenges with respect to the update in international AI regulatory standards, the first is algorithmic degradation over time, which is a significant challenge since such algorithms perform better when constantly updated. The second is transparency, as regulatory authorities seek to ensure that regulated products meet standards of quality, safety, and efficacy, in order to foster, an environment for this new technology to be adopted in the best possible way within the healthcare field. The final point is post-marketing surveillance.

The monitoring of AI devices applied to the health field is crucial. Algorithms are currently being designed to help monitor changes in the input data used, in this way, the reliability of the output data could be verified (FDA, 2024). This is expected to be an iterative process that allows the adjustment of AI when used with real clinical data. Therefore, for this process there must be regulatory monitoring to ensure that the initial algorithm with regulatory authorization is maintained over time despite the use of data from the real clinical field (FDA, 2024). This is the point of convergence between algorithmic degradation and post-marketing surveillance.

On the other hand, in terms of regulations and laws, the European Union (EU) recently approved the EU AI Law, the objective of which is "...promote the adoption of human-centered artificial intelligence, while ensuring a high level of protection of health, safety, fundamental rights, including democracy, the rule of law and supporting innovation..." (Parlamento Europeo, 2024).

This law will undoubtedly set a precedent for the generation of a regulatory framework on AI, starting with the risk classification detailed therein: unacceptable risk, when "they are considered a threat to people and will be prohibited," according to Guillot (2024). Within this classification, those AIs that could manipulate the behavior of vulnerable people or groups, those that classify people according to their socioeconomic status or personal characteristics, and biometric identification systems are mentioned (Guillot, 2024).

The following classification is those "High Risk" AI, Guillot (2024) defines it as those that "negatively affect security or fundamental rights will be considered high risk" and it is divided into two categories:

1. AI used in products that are already regulated by the European Union, such as toys, cars, medical devices, among others (Guillot, 2024).
2. Those belonging to the specific areas detailed in Figure 1 must be registered in a European Union database (Guillot, 2024).

Figure 1. AI requiring registration in the European Union database



Source: Adapted from: EU AI Law: First Regulation on Artificial Intelligence, Guillot, J. (2024)

An important point highlighted by Guillot (2024) is that all AI that belongs to “High Risk” must be evaluated before being commercialized and throughout its life cycle, in the same way citizens will be able to report their complaints to the respective national authorities. This risk classification for AI is a good starting point and definitely a challenge in its implementation for each health system.

It is worth recommending that each country should define its own path to use AI in health, being aware of the values, resources and challenges concerning its health system, prioritizing the development and implementation of these tools, which promote health care in an ethical, equitable and inclusive manner, which respects and involves everyone without discrimination. In this way, the potential of AI can be developed in a transparent and reliable way.

Conclusion

In an increasingly digital and technological world, artificial intelligence (AI) has established itself as a powerful tool to transform various areas related to health. The relevance of AI in health decision-making by health professionals and centers raises many questions and ethical challenges that require adequate regulation.

It is indisputable that AI has the potential to improve medical care, diagnosis, personalization of treatment and, above all, improve the efficiency of health systems; however, implementing it within these could generate concerns among health professionals or cause them to feel aggrieved when facing difficulties in adapting to technological changes, so constant training of said personnel regarding AI could be key within care centers, not only for adaptation, but also for feeding the AI database, thus strengthening joint decision-making.

The current challenge is to take advantage of artificial intelligence to advance in the field of health, without losing sight of ethical principles and the protection of the fundamental rights of patients and, above all, to have adequate regulation by the corresponding authorities, which will ensure that AI becomes a proactive complement that promotes the health and well-being of society as a whole with health professionals.

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