Impact of artificial intelligence (AI) on plastic surgery: A systematic review

Impacto de la inteligencia artificial (IA) en la cirugía plástica: una revisión sistemática

Ariana Karolina Guevara Alvarez
https://orcid.org/0009-0005-7441-6134
dra.arianaguevaraa@gmail.com
Investigador Independiente
Porto Alegre, Brazil.

Daniel Andrés Reyes Bailón
https://orcid.org/0009-0004-1717-5488
danielreyes@uees.edu.ec
Investigador Independiente
Guayaquil-Ecuador.

Juan Carlos Lema Balla
https://orcid.org/0000-0002-2573-7426
juan.lema@hial.mspz7.gob.ec
Hospital General Isidro Ayora, Loja, Ecuador
Riobamba, Ecuador.

Carla Emilia Parra Moran
https://orcid.org/0009-0005-0485-6206
carla.parra1008@gmail.com
Universidad de las Américas
Quito, Ecuador.

José Roberto Lema Balla
https://orcid.org/0000-0002-1401-7503
jose.lema@hgl.mspz3.gob.ec
Hospital Fibuspam Ecuador
Riobamba, Ecuador.

Abstract

Artificial intelligence (AI) has established itself as a revolutionary tool in the field of plastic surgery, providing significant improvements in the precision of procedures and therapeutic approaches. The aim of this article is to analyze the impact of AI on plastic surgery, highlighting its role in the optimization of surgical procedures, as well as the technical, ethical and legal challenges that its implementation entails, in addition to examining the current statistical situation. To this end, a systematic review was carried out using recognized scientific databases such as PubMed, Scopus and Google Scholar, following the guidelines of the PRISMA protocol. Priority was given to articles published in high-impact journals, integrative reviews, and clinical studies focused on plastic surgery and AI applications. The results of the analysis show that artificial intelligence is increasingly used in cosmetic surgery, transforming the methods of diagnosis and treatment of patients. The implementation of this technology has been shown to improve surgical outcomes and increase patient satisfaction. However, their integration also poses technical, ethical and legal challenges that must be addressed to ensure safe, effective and ethical implementation.

Keywords: plastic surgery, artificial intelligence, medical ethics.

Resumen

La inteligencia artificial (IA) se ha consolidado como una herramienta revolucionaria en el ámbito de la cirugía plástica, proporcionando mejoras significativas en la precisión de los procedimientos y en los enfoques terapéuticos. El objetivo de este artículo es analizar el impacto de la IA en la cirugía plástica, resaltando su papel en la optimización de los procedimientos quirúrgicos, así como los desafíos técnicos, éticos y legales que su implementación conlleva, además de examinar la situación estadística actual. Para ello, se realizó una revisión sistemática utilizando bases de datos científicas reconocidas como PubMed, Scopus y Google Scholar, siguiendo las directrices del protocolo PRISMA. Se dio prioridad a artículos publicados en revistas de alto impacto, revisiones integradoras y estudios clínicos enfocados en cirugía plástica y aplicaciones de IA. Los resultados del análisis evidencian que la inteligencia artificial tiene un uso creciente en la cirugía estética, transformando los métodos de diagnóstico y tratamiento de los pacientes. La implementación de esta tecnología ha demostrado mejorar los resultados quirúrgicos y aumentar la satisfacción de los pacientes. No obstante, su integración también plantea desafíos técnicos, éticos y legales que deben ser abordados para garantizar una aplicación segura, efectiva y ética.

Palabras clave: cirugía plástica, inteligencia artificial, ética médica.

Introduction

Medicine has always sought to improve the quality of life and human health. However, a traditional approach based on standard treatments for all is not always the most effective. The emergence of artificial intelligence (AI) and personalized medicine represents a significant advancement in the medical field, allowing for more precise interventions tailored to the individual characteristics of each patient.

AI is rapidly advancing across various fields, including medicine, where it has proven to be a valuable tool in supporting healthcare professionals in diagnosis, treatment, and clinical follow-up. One of its emerging applications is in plastic surgery, a specialty that encompasses both functional reconstruction and aesthetic enhancement of the human body (Madriz et al., 2024).

The applications of AI in medicine range from the analysis of images and clinical data to optimizing therapeutic decisions. These tools enhance the efficiency, accuracy, and speed of medical care, significantly contributing to the prevention, early diagnosis, and personalized treatment of diseases (Guachichulca et al., 2024).

In recent years, plastic surgery has evolved significantly to meet the demands of modern society. With the development of new technologies, AI has established itself as a strategic ally in this field. As noted by Barrios-Tao & Díaz-Pérez (2024), the integration of AI in plastic surgery has transformed surgical methods and clinical outcomes, opening new opportunities to increase precision, safety, and patient satisfaction.

However, this integration also brings technical, ethical, and legal challenges that must be carefully addressed to ensure safe and responsible implementation. Therefore, the objective of this article is to analyze the impact of artificial intelligence on plastic surgery, highlighting its role in optimizing surgical procedures, the challenges posed by its use, and the current statistics reflecting its application. Additionally, it aims to provide a comprehensive view of its advantages, limitations, and future projections, based on recent scientific evidence.
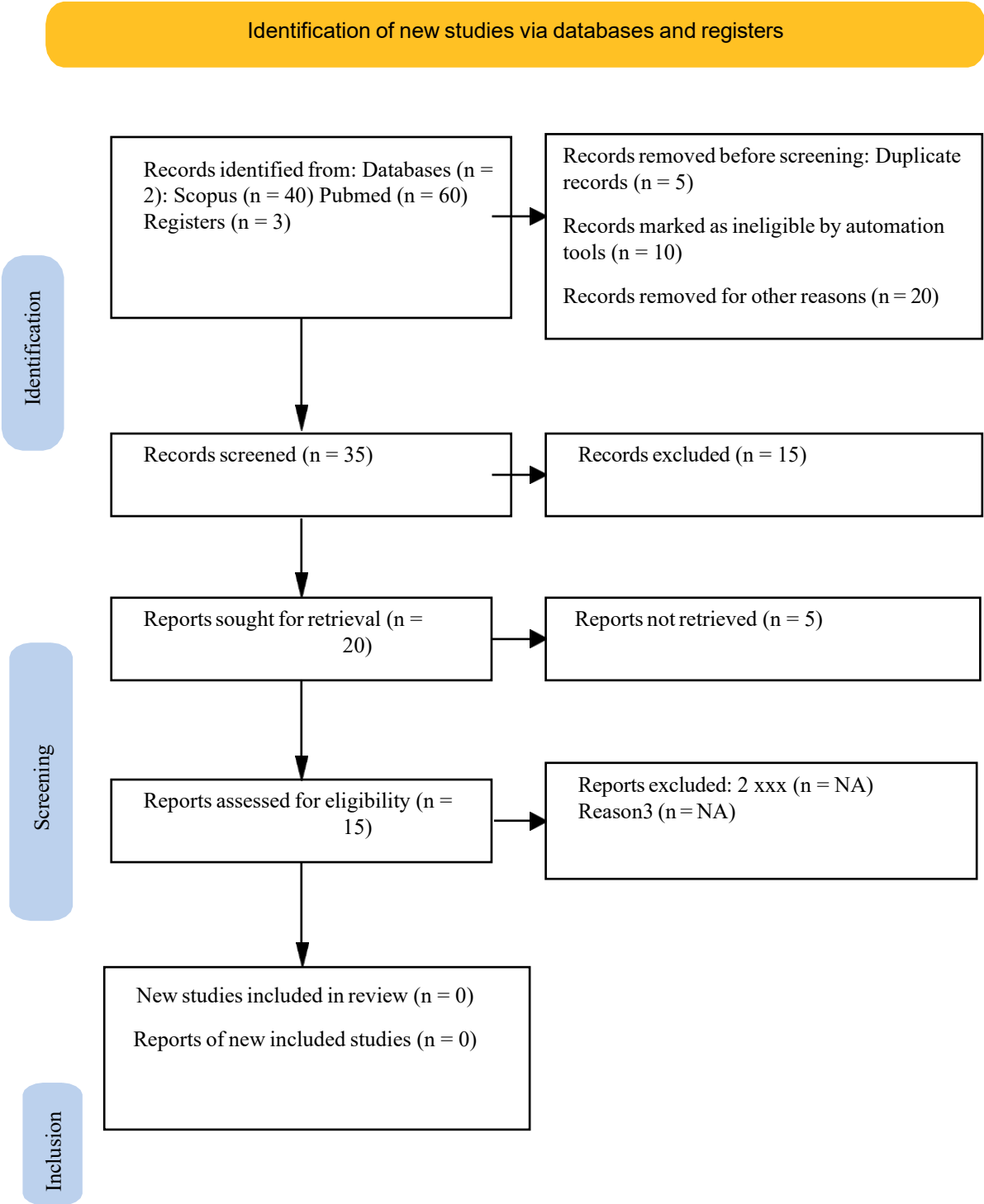
Methodology

For the preparation of this study, a thorough review of the scientific literature related to the use of artificial intelligence in plastic surgery was conducted. Articles from specialized medical journals, clinical studies, and statistical data published in the last five years were analyzed. The methodology followed the PRISMA protocol guidelines for systematic reviews.

The sources of information included recognized scientific databases such as PubMed, Scopus, and Google Scholar. Articles published in high-impact journals, as well as systematic reviews and clinical studies specifically focused on the intersection of plastic surgery and artificial intelligence, were prioritized. Inclusion criteria encompassed research addressing the implementation of AI in various phases of the surgical process, such as preoperative diagnosis, surgical planning, preoperative simulation, and the use of robotic technologies during procedures. Studies analyzing the benefits, challenges, and limitations inherent in the use of AI in this field were also included.

A mixed-methods analysis, both quantitative and qualitative, was conducted on the collected information. This involved comparing results obtained through AI technology with those reported via conventional surgical methods, evaluating aspects such as diagnostic accuracy, procedural efficiency, and patient perceptions regarding

the outcomes achieved. Finally, the data were systematized and presented in a structured manner, highlighting the main trends, relevant findings, and future projections of the use of artificial intelligence in plastic surgery.

Identification of new studies via databases and registers

Identification

Records identified from: Databases (n = 2): Scopus (n = 40) Pubmed (n = 60) Registers (n = 3)	Records removed before screening: Duplicate records (n = 5) Records marked as ineligible by automation tools (n = 10) Records removed for other reasons (n = 20)

Screening

Records screened (n = 35)	Records excluded (n = 15)
Reports sought for retrieval (n = 20)	Reports not retrieved (n = 5)
Reports assessed for eligibility (n = 15)	Reports excluded: 2 xxx (n = NA) Reason3 (n = NA)

Inclusion

New studies included in review (n = 0)

Reports of new included studies (n = 0)

Guevara, A., Reyes, D., Lema, J., Parra, C., & Lema, J. (2026). Impact of artificial intelligence (AI) on plastic surgery: A systematic review. *Revista InveCom, 6* (1). 1-7. https://zenodo.org/records/15381608

Results and discussion

The results of the analysis indicate that artificial intelligence has seen significant use in aesthetic surgery, transforming diagnostic and treatment methods for patients. The influence of AI on surgical intervention is extensive, contributing to greater precision, efficiency, and safety in procedures. One of its main advantages lies in improving surgical outcomes, as its precision allows surgeons to reduce operational risks (Sampaio et al., 2024).

Besides, AI has been shown to enhance the effectiveness of surgical processes by automating repetitive tasks, allowing specialists to focus on more complex aspects of surgery. In this context, AI significantly improves both diagnosis and planning of interventions, thanks to the use of advanced algorithms capable of analyzing medical images with a level of detail superior to that of the human eye. This facilitates the early identification of patterns and anomalies.

In aesthetic surgery, the implementation of intelligent systems allows for the optimization of medical practices and enriches the patient experience, achieving greater precision and better aesthetic results. Additionally, by analyzing prior data, AI enables the anticipation of potential complications, facilitating the adoption of preventive measures that strengthen the safety of the procedure and the patient (de la Fuente Marín, 2024).

AI has also revolutionized the surgical education field. Through virtual reality environments, trainee surgeons can practice procedures with highly realistic simulations, enhancing the quality of their learning. In this context, AI facilitates the creation of 3D models, preoperative simulations, and surgical guidance systems, benefiting not only healthcare professionals but also patients, who can access personalized information, specific recommendations, and previews of expected outcomes.

From a clinical research perspective, AI allows for the analysis of large volumes of data, generating innovative hypotheses and validating them in virtual or real environments, thus contributing to new discoveries in the field. Concurrently, this technology impacts the business development of plastic surgery, creating opportunities for innovation, reducing risks and costs, and improving customer satisfaction (de Lara González, 2024).

Among the most notable applications of AI in aesthetic surgery is the detailed analysis of facial and bodily features, enabling the evaluation of symmetry, proportions, signs of aging, and other relevant anatomical variables. This capability allows surgeons to provide more accurate diagnoses and individualized treatment suggestions. Additionally, AI systems facilitate the comparison of "before and after" images, aging simulations, facial recognition, and emotional analysis, contributing to a more comprehensive surgical planning process (Aguirre et al., 2024).

AI also enables the analysis of skin conditions such as wrinkles, scars, pigmentation, or damage, proposing personalized treatments like laser therapy, dermal fillers, or botulinum toxin. It aids in analyzing breast structures and suggesting specific interventions, as well as assessing the distribution of fat and muscle mass in the body, which is useful for procedures such as liposuction or abdominoplasty. Another important application is the monitoring of wounds and scars, which improves postoperative treatment and accelerates recovery.

Furthermore, the use of AI-assisted robotic surgery has allowed for the execution of minimally invasive procedures with high precision, such as laparoscopic and endoscopic surgeries. The integration of data during consultations has also enabled surgeons to identify patterns of seasonal demand or demographic preferences, allowing them to tailor their services to market trends (Martín Portero, 2024).

Recent data reflect a significant increase in the incorporation of AI in cosmetic surgery. In the United States, more than 50% of healthcare organizations have implemented AI technologies in their surgical activities (Cerero, 2024). Comparative studies have demonstrated that AI-assisted surgeries, such as breast reconstructions, have 30% lower complication rates compared to traditional procedures, and greater satisfaction among patients undergoing facial surgeries (de Francisco, 2023). Additionally, the creation of three-dimensional models from patient data has allowed for the early visualization of potential complications, aiding in the definition of safer and more effective surgical strategies (Aceituno et al., 2024).

AI has significantly transformed surgical activities through the implementation of deep learning algorithms and neural networks that enable machines to predict and detect anomalies with a level of precision that, in some cases, exceeds human diagnosis. One of the most relevant advancements in this context is the development of autonomous surgical robots. These AI-guided systems can perform complex tasks, such as suturing, with millimeter precision, minimizing human intervention and increasing patient safety (Melgar Barcelona, 2024).

In the field of plastic surgery, robotic surgery has contributed to improving precision and stability during interventions. Equipped with highly sensitive sensors, these systems can detect subtle changes in real-time during surgical procedures, allowing surgeons to adjust their techniques instantly, thereby optimizing aesthetic results. For instance, in interventions such as liposuction or rhinoplasty, the enhanced precision of robotic devices minimizes damage to surrounding tissues.

AI also facilitates preoperative planning by generating personalized 3D anatomical models, enabling both the surgeon and the patient to visualize the possible outcomes of different surgical options. This tool helps improve physician-patient communication, increases satisfaction, reduces the need for revision surgeries, and optimizes clinical decisions. Additionally, it enhances intraoperative navigation via computer vision and augmented reality systems that guide the surgeon in real-time during the procedure.

On the other hand, AI allows for monitoring the postoperative healing process, detecting infections early, analyzing wounds, and predicting potential complications such as hypertrophic scarring. It can also evaluate aesthetic and functional outcomes through facial and body image analyses, providing patients with personalized feedback via chatbots, virtual assistants, and remote digital platforms.

The integration of AI in surgical planning and execution has also proven effective in reducing intervention times and increasing precision, thanks to its ability to process large volumes of data in real-time and generate evidence-based recommendations.

Among the modern applications of AI in plastic surgery, technologies for facial analysis and image modification stand out, allowing for the simulation of surgical results, prediction of aging, and optimization of facial features. These tools are useful not only in clinical contexts but also in counseling, education, and personalization. However, they also pose important ethical challenges, such as the risk of identity manipulation, generation of unrealistic expectations, algorithmic discrimination, and privacy violations.

Moreover, AI systems for surgical planning help evaluate the feasibility and risks of procedures, facilitating the prediction of complications and the customization of surgical strategies. Nonetheless, ethical dilemmas arise regarding the distribution of responsibility in case of failures, the need for human oversight, trust in automated systems, and transparency in decision-making.

Additionally, these technologies allow for a comprehensive assessment of potential surgical outcomes, considering patient satisfaction, quality of life, psychological well-being, and the social impact of interventions. While these advancements enhance informed decision-making, it is also necessary to address associated risks, such as biases in algorithms, inequities in access to technology, and opacity in evaluation criteria (Aguirre et al., 2024; Martín Portero, 2024).

Finally, despite the achievements made, there are still technical limitations in the use of AI in aesthetic surgery. The accuracy of algorithms largely depends on the quality of input data, and the ability of AI to adapt to complex clinical contexts in real-time is still under development. Additionally, the advancement of AI raises new ethical and social concerns that must be managed carefully. While its application may revolutionize surgical practice and outcomes, it also increases risks related to patient autonomy, privacy, equity, and legal responsibility.

This section analyzes some of the main ethical, social, and practical implications of using AI in plastic surgery. Key aspects include patient autonomy, professional responsibility, social beauty standards, equity in access to care, and emerging legal challenges.

One of the primary issues addressed is the impact of AI on patient autonomy and informed consent. The use of algorithms and predictive systems raises questions about patients' ability to make free and informed decisions regarding aesthetic procedures. There is a risk that AI tools, used without proper supervision or explanation, may manipulate expectations, induce hasty decisions, or generate misinformation. Furthermore, patients must be protected from system errors, unforeseen surgical complications, or unsatisfactory outcomes resulting from automated recommendations.

Another critical point is the role of the surgeon in an increasingly automated environment. Delegating tasks to AI systems requires professionals to maintain and enhance their technical and ethical competencies. Surgeons must ensure that the technologies used are safe, reliable, and properly certified. Moreover, the use of AI does not exempt surgeons from their legal responsibilities in cases of malpractice or negligence.

From a social perspective, the widespread implementation of AI in aesthetic surgery could alter beauty standards and perceptions of the human body. These tools can intensify aesthetic pressure, reinforce stereotypes, and create unrealistic models of physical perfection, negatively impacting self-esteem and personal identity. Such influence should be critically evaluated by professionals, institutions, and health authorities (Yáñez Krüger, 2024).

The incorporation of AI in plastic surgery also requires attention to legal issues. It is essential to protect patient data privacy and security, as well as to clearly define shared responsibilities among healthcare professionals, software developers, and medical device manufacturers. Several strategies are proposed to address these concerns:

1. Development of ethical frameworks: It is suggested to establish specific regulations for the use of AI in aesthetic surgery, inspired by traditional bioethical principles (autonomy, beneficence, non-maleficence, justice) and current technological guidelines.

Guevara, A., Reyes, D., Lema, J., Parra, C., & Lema, J. (2026). Impact of artificial intelligence (AI) on plastic surgery: A systematic review. *Revista InveCom, 6* (1). 1-7. https://zenodo.org/records/15381608

2. Technical and auditing measures: Implementing verification, certification, and continuous monitoring procedures for the systems in use is recommended, ensuring their transparency and traceability.
3. Continuous education: Educating both patients and healthcare professionals about the capabilities, limitations, and risks of AI is fundamental. Informational campaigns and training can help promote more informed and safer decisions.

Despite the benefits, AI also poses challenges related to equity in access to healthcare. There are concerns that its implementation may primarily benefit patients with greater resources or in urban areas, exacerbating existing health disparities. It is crucial to ensure that the development of these technologies is inclusive, guaranteeing that their benefits reach all social sectors, regardless of geographic location or socioeconomic status.

Looking ahead, greater autonomy of surgical robots and the development of systems capable of predicting and managing complications in real-time are expected. However, these advancements must be accompanied by sustainable ethical solutions that prioritize patient dignity, safety, and well-being. While AI represents a revolution in surgery, its implementation should be guided by humanistic principles and a firm commitment to quality care.

Additionally, integrating AI with demographic and behavioral analysis allows for the customization of services offered. Analyzing variables such as age, gender, income level, and geographic location can help identify demand patterns. For example, if a high rate of women around 30 years old seeking body procedures post-pregnancy is detected, clinics can tailor their communication campaigns to reach this segment through specific media.

Psychological segmentation, which considers patients' values, attitudes, and aspirations, enables the design of ethical marketing strategies focused on safety, privacy, and responsible counseling. Seasonal trends, such as an increase in requests for rhinoplasty in summer, can also be anticipated, facilitating strategic planning of resources and personnel.

Finally, analyzing interactions on digital platforms provides valuable insights into the interests and priorities of potential patients, allowing for the development of more relevant content and building stronger trust-based relationships (Abrante Rodríguez, 2024).

Conclusions

Artificial intelligence has revolutionized cosmetic surgery, providing new opportunities to enhance precision, personalize treatments, and improve the efficiency of surgical procedures. The collected evidence demonstrates that the application of AI-based technologies significantly contributes to better clinical outcomes and higher levels of patient satisfaction.

However, this advancement also brings important challenges. The implementation of AI systems in aesthetic surgery introduces technical complexities, ethical dilemmas, and legal issues that must be rigorously addressed to ensure responsible, safe, and effective use. It is imperative that these developments are accompanied by updated regulatory frameworks, control protocols, and specialized training for the professionals involved.

In this context, it is essential to continue promoting research and the development of artificial intelligence technologies in the surgical field, while also ensuring the protection of patient rights, transparency in algorithm functioning, and equity in access to these advancements. With an ethical, sustainable approach centered on patient well-being, AI has the potential to positively transform the practice of cosmetic surgery and significantly improve the quality of life for those accessing these services.

References

Abrante Rodríguez, D. (2024). Imagen corporal y uso de redes sociales en jóvenes: Variables psicológicas asociadas. (Doctoral dissertation, Universidad de La Laguna). https://dialnet.unirioja.es/servlet/tesis?codigo=347616

Aceituno, C. M., & Jiménez, Ó. E. G. (Eds.). (2024). Telemedicina de la Red Iberoamericana de Salud Digital. CANOPUS EDITORIAL DIGITAL SA. https://books.google.com/books?hl=es&lr=&id=yRv7EAAAQBAJ&oi=fnd&pg=PA7&dq=Aceituno,+C.+M.,+%26+Jim%C3%A9nez,+%C3%93.+E.+G.+(Eds.).+(2024).+Telemedicina+de+la+Red+Iberoamericana+de+Salud+Digital.+CANOPUS+EDITORIAL+DIGITAL+SA.&ots=gYFFSx3i5v&sig=ckoiumSjnNerSBaKoQViSFj8pFQ

Aguirre, L. M. C. A., Ochoa, E. C. A., Barranzuela, L. M. F., & Alcalde, S. D. C. (2024). Business Consulting para Andrade Cirugía Plástica SAS (Master's thesis, Pontificia Universidad Católica del Perú, Perú). https://search.proquest.com/openview/bb67d86637f80c9b222cb04d8552aa40/1?pq-origsite=gscholar&cbl=2026366&diss=y

Barrios-Tao, H., & Díaz-Pérez, V. (2024). De cuerpos a perfiles: implicaciones psicopolíticas de la inteligencia artificial. Arbor, 200(811), 2569-2569. https://arbor.revistas.csic.es/index.php/arbor/article/view/2569

Cerero, D. F. (2024). Inteligencia artificial para la formación docente sanitaria (Vol. 42). ESIC. https://www.torrossa.com/it/resources/an/5831120

De Francisco Ángel Luis Martín, ARTIFICIAL: La Nueva Inteligencia y su Aplicación en Nefrología. En: Lorenzo V., López Gómez JM (Eds). Nefrología al día. ISSN: 2659-2606. Disponible en: https://www.nefrologiaaldia.org/609

De la Fuente Marín, A. (2024). La revolución de la inteligencia artificial: explorando su impacto en la sociedad. Palencia IES Alonso Berrugu, 155. https://iesalonsoberruguete.com/wp-content/uploads/2024/05/PROYECTOS-BIE-2024.pdf#page=155

De Lara González, A. (2024). Redacción periodística con herramientas de IA: para qué sí y para qué no. Revista de Innovación en Periodismo, (2024), 31. http://dspace.umh.es/handle/11000/36167

Guachichulca, J. S. A., Aguilar, D. J., & Becerra, A. X. L. (2024). Aplicaciones, oportunidades y desafíos de implementar la inteligencia artificial en medicina: una revisión narrativa de la literatura. In Anales de la Facultad de Ciencias Médicas (Vol. 57, No. 2, pp. 90-104). https://revistascientificas.una.py/index.php/RP/article/download/4707/3759

Haddaway, N. R., Page, M. J., Pritchard, C. C., & McGuinness, L. A. (2022). PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and open synthesis. Campbell Systematic Reviews, 18, e1230. https://doi.org/10.1002/cl2.1230

Madriz, L. J. S., Benavides, D. C. S., Pérez, J. F. S., González, L. D. P., & Arias, N. P. C. (2024). Inteligencia artificial aplicada al diagnóstico médico: una revisión actual. Revista Científica de Salud y Desarrollo Humano, 5(2), 274-288. http://revistavitalia.org/index.php/vitalia/article/view/183

Martín Portero, R. (2024). Impacto de las nuevas tecnologías en las empresas y en los consumidores. (Trabajo Fin de Grado en Administración y Dirección de Empresas, Universidad de Valladolid). https://uvadoc.uva.es/handle/10324/71593

Melgar Barcelona, P. (2024). El sistema Da Vinci: tecnología y cirugía asistida por robot (CAR). (Trabajo Fin Grado en ENFERMERÍA, Universidad Europea Valencia). http://titula.universidadeuropea.com/handle/20.500.12880/9049

Rueda Martín, M. A. (2025). La concreción del deber objetivo de cuidado en el desarrollo de la actividad médico-quirúrgica curativa a la luz de los avances de los sistemas de inteligencia artificial. (No. ART-2025-142468). https://www.raco.cat/index.php/InDret/article/download/141388/192899

Sampaio, R. C., Chagas, V., Sanchez, C. S., Gonçalves, J., Borges, T., Alison, M. B., & Paz, F. S. (2024). Uma revisão de escopo assistida por inteligência artificial (IA) sobre usos emergentes de IA na pesquisa qualitativa e suas considerações éticas. Revista Pesquisa Qualitativa, 12(30), 01-28. https://editora.sepq.org.br/rpq/article/view/729

Yáñez Krüger, F. P. (2024). La responsabilidad civil del médico cirujano estético o cosmético ante la jurisprudencia: obligación de resultado y responsabilidad objetiva. (Tesis de grado en Ciencias Sociales y Jurídicas, Universidad de Chile). https://repositorio.uchile.cl/handle/2250/202370