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REFLECTION ARTICLE

Artificial intelligence applied to healthcare: innovation, ethics, and humanization of care

Inteligencia artificial aplicada a la atención sanitaria: innovación, ética y humanización de la atención

Inteligência artificial aplicada à saúde: inovação, ética e humanização do cuidado

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Abstract

The aim was to analyze the impact of AI on healthcare, highlighting innovations, ethical challenges, and the humanization of care. This is a reflective study guided by Grant and Booth's typology. A search was conducted in the Medline/PubMed, LILACS, and SciELO databases using controlled terms and Boolean operators. After screening and applying inclusion and exclusion criteria, the final corpus was submitted to Bardin's Content Analysis, structured in the phases of pre-analysis, material exploration, and results treatment. Two analytical categories emerged: "The transformative potential of AI in reorienting healthcare practices" and "Ethical dilemmas and humanization as a pillar of care in the digital age." The potential of AI in precision diagnoses, personalized therapies, and optimized management was verified, but significant ethical dilemmas were revealed, such as data privacy, algorithmic biases, and accountability issues, which threaten equity and the centrality of human care. AI is revolutionary when used as a support tool, amplifying empathy and active listening. The incorporation of models such as IAC (Information, Evaluation, Consent) and explainability frameworks (XAI) translates ethical principles into implementable steps, ensuring fair, efficient, and human-centered systems.

Descriptors: Artificial Intelligence; Innovation in Healthcare; Humanization of Care; Ethics in Nursing; Patient Safety.

Resumén

El objetivo fue analizar el impacto de la IA en la atención sanitaria, destacando las innovaciones, los desafíos éticos y la humanización de la atención. Este es un estudio reflexivo guiado por la tipología de Grant y Booth. Se realizó una búsqueda en las bases de datos Medline/PubMed, LILACS y SciELO utilizando términos controlados y operadores booleanos. Tras la selección y la aplicación de los criterios de inclusión y exclusión, el corpus final se sometió al análisis de contenido de Bardin, estructurado en las fases de preanálisis, exploración del material y tratamiento de los resultados. Surgieron dos categorías analíticas: "El potencial transformador de la IA en la reorientación de las prácticas sanitarias" y "Dilemas éticos y humanización como pilar de la atención en la era digital". Se verificó el potencial de la IA en diagnósticos de precisión, terapias personalizadas y gestión optimizada, pero se revelaron importantes dilemas éticos, como la privacidad de los datos, los sesgos algorítmicos y los problemas de responsabilidad, que amenazan la equidad y la centralidad de la atención humana. La IA es revolucionaria cuando se utiliza como herramienta de apoyo, amplificando la empatía y la escucha activa. La incorporación de modelos como IAC (Información, Evaluación, Consentimiento) y marcos de explicabilidad (XAI) traduce los principios éticos en pasos implementables, lo que garantiza sistemas justos, eficientes y centrados en el ser humano.

Descriptores: Inteligencia Artificial; Innovación en la Atención Sanitaria; Humanización de la Atención; Ética en Enfermería; Seguridad del Paciente.

Resumo

Objetivou-se analisar o impacto da IA na saúde, destacando inovações, desafios éticos e a humanização do cuidado. Trata-se de um estudo de reflexão orientado pela tipologia de Grant e Booth. Realizou-se busca nas bases Medline/PubMed, LILACS e SciELO utilizando termos controlados e operadores booleanos. Após triagem e aplicação de critérios de inclusão e exclusão, o corpus final foi submetido à Análise de Conteúdo de Bardin, estruturada nas fases de pré-análise, exploração do material e tratamento dos resultados. Emergiram duas categorias analíticas: "O potencial transformador da IA na reorientação das práticas de saúde" e "Dilemas éticos e a humanização como pilar da assistência na era digital". Verificou-se o potencial da IA em diagnósticos de precisão, terapias personalizadas e gestão otimizada, mas revela dilemas éticos significativos, como a privacidade de dados, vieses algorítmicos e questões de responsabilização, que ameaçam a equidade e a centralidade do cuidado humano. A IA é revolucionária quando utilizada como ferramenta de apoio, amplificando a empatia e a escuta ativa. A incorporação de modelos como IAC (Informação, Avaliação, Consentimento) e de estruturas de explicabilidade (XAI) traduz princípios éticos em etapas implementáveis, assegurando sistemas justos, eficientes e centrados no ser humano.

Descritores: Inteligência Artificial; Inovação em Saúde; Humanização da Assistência; Ética em Enfermagem; Segurança do Paciente.

Introduction

Artificial Intelligence (AI) is emerging as a transformative force in the field of healthcare, promising to revolutionize everything from disease diagnosis and treatment to the management of healthcare systems. The ability of machine learning algorithms to analyze vast datasets at superhuman speeds offers unprecedented potential for more precise, predictive, and personalized medicine. In the face of healthcare systems that still struggle with efficiency and equity, AI presents itself as a promising path for optimizing resources and improving clinical outcomes[1,2].

In this context, discussions about reorienting healthcare practices are becoming increasingly common. The First International Conference on Health Promotion, in Ottawa in 1986, already signaled the need to reorient healthcare systems. Today, AI emerges as a tool to catalyze this change, shifting the focus from a purely curative model to a more proactive and preventative approach[2].

Conversely, the integration of AI into clinical practice reveals a number of challenges. Understanding the ethical issues related to patient data privacy and security, the possibility of discriminatory biases embedded in algorithms, and defining responsibilities in case of failures are pressing concerns[3].

Furthermore, the impact of automation on the healthcare professional-patient relationship and the risk of dehumanizing care require careful analysis to ensure that technology serves as a complement, and not a substitute, for the human touch, empathy, and sensitivity that are essential in healthcare[4].

This article proposes a reflection on the application of AI in healthcare, exploring its most promising innovations, the ethical dilemmas that accompany its advancement, and the implications for the humanization of care, seeking a balanced understanding of how this technology can be shaped to build a healthier and more equitable future for all. Therefore, the objective of this research is to analyze the impact of AI on healthcare, highlighting innovations, ethical challenges, and the humanization of care.

Methodology

This study was designed as a critical reflection study, a qualitative approach that allows for critical analysis and in-depth interpretation of a body of knowledge on a given topic. Unlike a systematic review, the focus is not on exhausting the literature, but rather on selecting relevant works that allow for the construction of an argument and reflection on the advances, challenges, and nuances of the topic. The methodological focus is less on systematic synthesis and more on critical, interpretative, and integrative analysis of concepts and debates, which differentiates it from other reviews. A reflective literature study, also called a critical review in some contexts, was chosen because this type of synthesis goes beyond the simple description of studies and emphasizes critical evaluation, interpretative analysis, and conceptual innovation. It differs from traditional narrative reviews by incorporating a reflective stance of the researcher towards scientific production, recognizing both the relevance and limitations of the works analyzed. This approach allows for the identification of gaps, discussion of theoretical convergences and divergences, and, in some cases, the proposal of explanatory hypotheses or conceptual models that contribute to the advancement of knowledge in the investigated field[5].

For initial exploratory purposes, data were obtained from searches conducted in the Medline/PubMed, LILACS, and SciELO databases in January and February 2026, without applying any pre-established selection criteria at this stage. This approach allowed for a broad and preliminary understanding of the topic, with a view to constructing a more refined research strategy in subsequent phases of the study.

The analysis process was methodologically guided by Content Analysis from the perspective of Laurence Bardin, organized into three chronological phases, namely[6]:

- Preliminary analysis: this initial phase involved organizing and systematizing the material to be analyzed. It began with a "floating reading" of pre-selected articles in the databases to gain familiarity with the content. Next, criteria were defined for selecting the final corpus, including articles published in the last five years that directly addressed the intersection between artificial intelligence, health, ethics, and humanization, and excluding articles that superficially dealt with the topic.

The material was then organized into preliminary themes that guided the next phase.

- Exploration of the material: In this central stage, the data coding process was carried out. The articles in the corpus were read exhaustively to identify the recording units (key terms, phrases, or concepts, such as "algorithmic bias," "data privacy," "doctor-patient relationship") and the context units (the paragraph or section in which the recording unit was inserted, essential for understanding its full meaning). From the grouping of these units by similarity of meaning and thematic relevance, codes were created which, when aggregated, gave rise to the categories.
- Treatment of results, inference, and interpretation: In the final phase, the raw data were processed to become meaningful and valid. The information was condensed, and the empirical categories ("The transformative potential of AI in reorienting health practices" and "Ethical dilemmas and humanization as a pillar of care in the digital age") were consolidated, as shown in the Figure 1.

Based on this framework, inferences and interpretations were made, connecting the findings from the literature with the study's objective and allowing for a reflective discussion on the current landscape of AI in healthcare.

Figure 1. Analytical categorization. Rio de Janeiro, RJ, Brazil, 2026

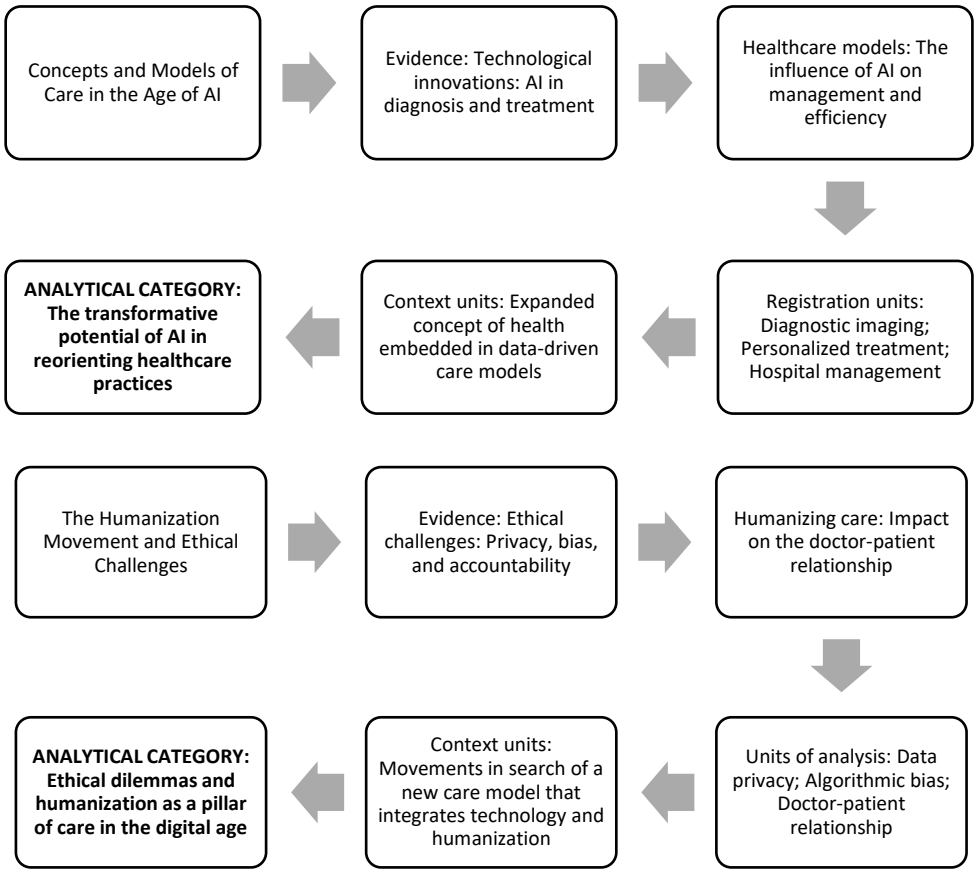
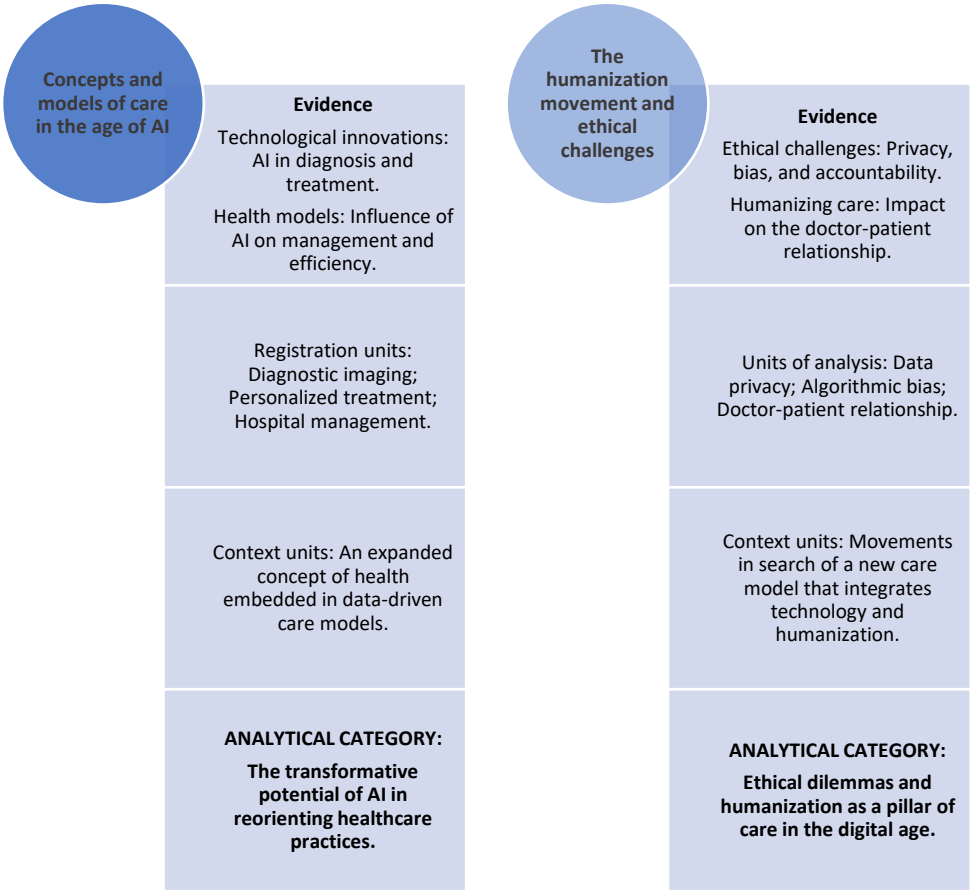


Figure 2. Analysis of analytical categories. Rio de Janeiro, RJ, Brazil, 2026



Results and Discussion

From the categorization process, two categories of analysis emerged: "The transformative potential of AI in reorienting healthcare practices" and "Ethical dilemmas and humanization as a pillar of care in the digital age." The results show that, although the vast potential of AI to improve care and optimize processes is recognized, its effective implementation remains a challenge, especially regarding ethical issues and the preservation of humanized care.

Chart 1. Development of thematic categories. Rio de Janeiro, RJ, Brazil, 2026

Conceptions and models of care in the age of AI	**The humanization movement and ethical challenges**
Evidence	**Evidence**
Technological innovations: AI in diagnosis and treatment.	Ethical challenges: Privacy, bias, and responsibility.
Health models: Influence of AI on management and efficiency.	Humanization of care: Impact on the doctor-patient relationship.
Registration Units	**Registration Units**
Diagnostic imaging; Personalized treatment; Hospital management.	Data privacy; Algorithmic bias; Doctor-patient relationship.
Context Units	**Context Units**
Expanded concept of health embedded in data-driven care models.	Movements in search of a new care model that integrates technology and humanization.
Analytical Category	**Analytical Category**
The transformative potential of AI in reorienting healthcare practices.	Ethical dilemmas and humanization as a pillar of care in the digital age.

The first analytical category demonstrated, based on registration units such as "precision diagnosis," "personalized therapies," and "optimized management," that AI has the power to reorient the healthcare model. Innovative practices, in this context, reveal themselves as a reflection of a new concept of health, which transcends the simple absence of disease to become a dynamic, predictive, and personalized process, influenced by multiple factors analyzable by algorithms.

The second category, however, reveals the predominance of challenges that act as barriers. The registration units, such as "data privacy," "algorithmic biases," and "depersonalization of care", point to a latent conflict. Just as curative and individualistic practices still persist despite knowledge about health promotion, ethical dilemmas, and the risk of dehumanization represent a hegemonic challenge to the full adoption of AI. This highlights that actions in the field of digital health are marked by a duality: on the one hand, the pursuit of technological optimization and, on the other, the imperative need to ensure that technology does not override, but serves, human care.

The analysis of the results deepens the understanding of the complex interaction between innovation, ethics, and humanization in digital health.

The transformative potential of AI in reshaping healthcare practices

AI-driven transformations in healthcare represent a paradigm shift, moving practice from a reactive model to a more proactive, predictive, personalized, and participatory approach to medicine[7]. The ability to process large volumes of health data (Big Data) at high speed is at the forefront of innovation. One of the most established applications is in assisting with image diagnosis, where deep learning algorithms, especially convolutional neural networks (CNNs), have already demonstrated performance comparable to, or in some cases superior to, that of human radiologists in detecting pathologies such as diabetic retinopathy, dermatological lesions, and pulmonary nodules suggestive of cancer[8,9].

Beyond diagnosis, AI personalizes treatments in ways previously unimaginable. In precision oncology, for example, intelligent systems analyze tumor genomic data, clinical history, and scientific evidence to help choose the most effective targeted therapies with fewer side effects for each patient. AI-assisted surgical robotics transcends automation and offers enhanced precision, with algorithms that perform tremor filtering, real-time recognition of anatomical structures, and intraoperative guidance, which tends to minimize invasiveness and accelerate patient recovery[8,9].

In hospital management, AI optimizes everything from patient flow and real-time bed allocation to predicting epidemic outbreaks, enabling more informed and efficient decision-making. The use of predictive models was crucial during the COVID-19 pandemic to anticipate resource demand and guide public health policies, directly contributing to the sustainability and resilience of healthcare systems[10].

In addition to the applications mentioned, recent studies highlight that the performance of algorithms, while promising, depends on the quality and diversity of the data used for training. Despite the high accuracy in image-based diagnoses, challenges remain in external validation and applicability in different clinical contexts. This suggests that the effectiveness observed in controlled environments does not always translate immediately to everyday clinical practice[11,12].

Another issue raised is the need to combine the computational power of AI with clinical expertise, so that the technology acts as an extension of human judgment and not as a replacement[8,13].

A study analyzed sarcopenia in cancer patients at a center in Japan, aiming to overcome the limitations of conventional methods for measuring skeletal muscle mass in the diagnosis of sarcopenia by introducing an artificial intelligence (AI) system applied to computed tomography (CT) images. A total of 3,096 cases with images up to the L3

lumbar level (2011–2021) were analyzed, divided into cohorts for pre-processing, training, and validation. The AI, based on the DeepLabv3 and EfficientNetV2-XL models, was trained to detect the body region and diagnose sarcopenia via the Skeletal Muscle Index (SMI). The reproducibility of conventional methods was low (κ = 0.478 in the test cohort and 0.236 in the validation cohort), with diagnostic alterations in 43% of cases. In contrast, AI demonstrated high consistency, accuracy, and speed, with an IoU of 0.93 for body region detection, a sensitivity of 82.3%, a specificity of 98.1%, and a positive predictive value of 89.5% for sarcopenia diagnosis[14].

Ethical dilemmas and humanization as a pillar of care in the digital age

The increasing implementation of AI in healthcare brings with it complex ethical challenges that need to be addressed to ensure a fair and safe transition. The privacy and security of patient data are paramount concerns. AI systems, especially machine learning systems, rely on vast datasets of health information, such as electronic health records, genomic images, and even information from wearable devices, for their training and operation. The use of this data, often without the explicit and informed consent of the patient for each specific use, raises serious questions about autonomy and confidentiality. Regulation of the use, sharing, and, above all, anonymization of this data is fundamental not only for individual protection but also for building public trust, without which the widespread adoption of these technologies becomes unfeasible[1,2].

Another significant and well-documented challenge is algorithmic bias. If the data used to train the algorithms reflects existing social and health inequalities, whether racial, gender, or socioeconomic, AI can perpetuate or even amplify these disparities. A notorious example is algorithms that, trained predominantly with data from white populations, show lower accuracy in diagnosing skin diseases in dark-skinned patients. This can result in less accurate diagnoses or inadequate treatments for historically underrepresented groups, transforming the technology into a vector of health inequity[3,15].

The issue of accountability in the event of an AI system error is an area that still demands regulatory clarity. If an algorithm fails in a diagnosis, leading to an adverse outcome, is it the responsibility of the physician who followed the recommendation, the hospital that acquired the software, or the company that developed it? This "accountability gap" is one of the biggest obstacles to safe clinical adoption. The transparency of algorithms, often protected as trade secrets and seen as "black boxes," exacerbates the problem. It is crucial that physicians can understand the logic behind AI recommendations to trust them and integrate them into their clinical judgment[2,16].

In this context, the humanization of care emerges as an essential counterpoint. On the one hand, AI can strengthen the doctor-patient relationship. By automating administrative, bureaucratic, and repetitive tasks that currently consume a considerable portion of professionals' time, technology can free them to dedicate themselves to active listening, detailed clinical examination, and empathy. On the other hand, there is a risk that technology will create distance, leading to a depersonalization of care if the interaction is excessively mediated by screens and systems. Trust can be eroded if the patient feels that decisions about their health are made by an impersonal machine. Therefore, AI must be implemented as a decision support tool, and not as a substitute for clinical judgment, sensitivity, empathy, and attentive listening, which remain irreplaceable[3,10].

Given the current landscape of technological advancements in healthcare, a promising scenario emerges, albeit one permeated by potential biases that could compromise the centrality of human care. In this context, it becomes imperative to critically reflect on the balance between innovation and ethics: while innovation devoid of ethical principles can lead to the dehumanization of care practices, ethics dissociated from innovation tends to limit the development and effectiveness of healthcare services. Thus, consolidating the innovation-ethics-humanization triad represents a contemporary challenge for healthcare systems, requiring interdisciplinary approaches and institutional policies that promote technological practices committed to human well-being.

Ethical dilemmas related to privacy and the secondary use of data reinforce the need for robust governance structures. AI governance should include not only technical regulations, but also transparent accountability processes and independent audit mechanisms[10,17]. Algorithmic biases have direct practical effects, considering that racial and socioeconomic inequalities can be reproduced and amplified by AI systems if there is no continuous correction and monitoring. In this sense, equity and social justice should be mandatory criteria in all phases of the development of AI applied to healthcare[16,18].

Therefore, critical reflection on the humanization of care must also consider the patient's perspective. The perception of depersonalization is associated with reduced trust and adherence to treatment. Thus, the integration of AI must be accompanied by strategies that reinforce the relational role of professionals, preventing technology from becoming a barrier to communication[4].

Conclusion

The transformative journey of the concept of health, which evolved from a biomedical vision to a broad understanding of its social determinants, finds a new and powerful catalyst in Artificial Intelligence. AI offers the promise of reorienting care models, moving them from a curative perspective to a more predictive, personalized, and participatory approach, reflecting a new formulation of healthcare thinking and practice. Thus, although the new healthcare model is structured from a perspective of technological innovation, characteristics of hegemonic models that imply technocratic practices still exist. The implementation of AI, therefore, requires constant vigilance to ensure that it does not become a modern version of an impersonal model, but rather a tool that amplifies the capacity to care.

A critical analysis of the reviewed studies highlights both the transformative potential of AI and its methodological and contextual limitations. Convergences were observed in the recognition of diagnostic efficiency and support for health management; however, divergences emerge regarding applicability in different realities and the robustness of the available evidence. Overcoming ethical challenges, such as algorithmic bias and data privacy, is fundamental to ensuring equity and trust in the system. More importantly, the pursuit of humanized care should be the central axis in the adoption of any technology. Artificial Intelligence will be truly revolutionary in healthcare if it is able to enhance human intelligence, empathy, and care, allowing healthcare professionals to focus on what will always be the core of medicine: the integral well-being of the human being. To achieve this, building this future depends on continuous dialogue between developers, healthcare professionals, patients, and regulators, so that new proposals for changes in healthcare models result in a fairer, more efficient, and, above all, more humane system. Furthermore, the review highlights gaps that need to be explored in future research, such as deepening the analysis of equity, testing algorithms in diverse local contexts, and longitudinally evaluating the impact of AI on the professional-patient relationship. Only through this continuous critical-reflective process will it be possible to ensure that technological innovation progresses inextricably with the promotion of human dignity.

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