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Artificial Intelligence in Healthcare: A Critical Moment for Responsible Transformation

Seray Öney Doğanyiğit[1], Elgiz Yılmaz Altuntaş[2]

[1]İstanbul Bilgi University, Faculty of Communication, Department of Public Relations and Publicity, İstanbul, Türkiye
[2]Galatasaray University Faculty of Communication, Department of Interpersonal Communication, İstanbul, Türkiye

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INTRODUCTION

Artificial intelligence (AI) is rapidly reshaping the global healthcare landscape. As rising costs, aging populations, chronic disease burden, and workforce shortages intensify pressure on health systems, AI has emerged as a powerful catalyst for innovation. From clinical applications—such as diagnostic imaging, pathology, and robotic surgery—to administrative automation and predictive analytics, AI is now embedded across multiple layers of healthcare.

However, its accelerated adoption also raises urgent questions regarding ethics, regulation, liability, data security, and workforce implications. This editorial synthesizes current evidence on AI's transformative potential while highlighting critical risks that must be addressed to ensure safe, equitable, and sustainable integration—an imperative especially relevant for healthcare systems across Europe and the Balkans.

The recent emergence of specialized generative AI frameworks, such as OpenAI's healthcare-focused initiatives, represents a pivotal shift from analytical tools to interactive clinical intelligence. While these large language models (LLMs) offer unprecedented support in reducing administrative burnout and enhancing clinical decision-making, they also amplify the necessity for rigorous "human-in-the-loop" governance—particularly in linguistically and structurally diverse regions like the Balkans.

AI's Expanding Role in Healthcare Administration

Administrative complexity contributes significantly to inefficiency, delays, and clinician burnout. AI-supported tools offer powerful opportunities to reduce this burden by automating routine tasks, flagging errors, and improving patient flow.

Streamlining Documentation and EHR Processes

Natural language processing systems now transcribe clinical encounters, generate documentation, and organize electronic health record (EHR) data with increasing accuracy, reducing manual workload (1). Predictive analytics integrated into EHRs can identify high-risk patients, enabling proactive intervention and improved resource allocation.

Improving Patient Flow and Emergency Response

AI-driven patient flow models have demonstrated improved bed utilization and reduced hospital congestion (2). In emergency settings, Internet of Things-enabled monitoring and AI-based triage algorithms can shorten ambulance response times and accelerate critical interventions (3).

Such applications are particularly relevant in low-resource or geographically dispersed health systems where staff shortages remain acute.

AI-supported Remote and Preventive Care

Virtual health assistants and remote monitoring systems represent a major shift toward decentralized care. AI-enabled platforms assist patients with medication adherence, symptom tracking, appointment reminders, and chronic disease monitoring (4).

Examples such as "Florence", a virtual nursing assistant, illustrate how AI can extend clinical support beyond traditional settings (5). These tools promote treatment adherence, reduce unnecessary hospital visits, and enhance preventive care—outcomes especially valuable in chronic disease management and elderly populations.

ORCID IDs of the authors: S.Ö.D. 0000-0002-8175-0764; E.Y.A. 0000-0002-3486-1701

Corresponding Author: Elgiz Yılmaz Altuntaş, Prof. Dr.;
E-mail: elyilmaz@gsu.edu.tr

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Clinical Applications with Significant Impact

Early Diagnosis and Cancer Detection

Early detection remains one of AI's most successful domains. Deep learning models have matched dermatologist-level accuracy in classifying skin lesions (6) and achieved high performance in interpreting mammography images (7). Machine learning algorithms have also shown promise in predicting tumor recurrence using large-scale pathological datasets (8).

These tools offer substantial benefits in countries facing limited specialist availability or uneven distribution of diagnostic services.

Radiology and Imaging

Radiology has become a central testing ground for AI innovation. AI-enhanced ultrasound systems now identify anatomical structures in real time and provide differential diagnosis support, improving accuracy and efficiency in lung and obstetric imaging.

Machine learning algorithms have also been successfully applied to maternal health, predicting postpartum depression and fetal anomalies using EHR data (9). These innovations highlight AI's potential to support maternal and perinatal care, which remains an ongoing challenge in many regions.

OpenAI's next-generation models appear capable of analyzing text, audio, and images simultaneously (for example, audio clinical notes alongside radiology images). These features, which support the concept of interactive clinical intelligence, exemplify how AI is no longer a passive tool but an active "clinical partner".

Robotic Surgery and Clinical Robotics

Surgical robotics continues to expand rapidly. Systems such as the da Vinci Surgical System offer reduced complications, shorter hospital stays, and improved surgeon ergonomics (10). AI-powered robotic platforms also assist with routine tasks, medication delivery, and early sepsis detection, increasing safety in intensive care settings (11).

Drug Discovery and Precision Medicine

AI accelerates drug discovery through rapid target identification, molecular modeling, and drug repurposing. Partnerships between industry and AI firms—such as GlaxoSmithKline and Exscientia—have reduced development timelines by up to 75% (12).

AI-supported pharmacogenomics enables personalized medicine by predicting individual responses to medications, including psychopharmacological treatments (13). These advances promise to reduce trial-and-error prescribing and improve treatment outcomes.

Challenges and Risks of Accelerated AI Adoption

Despite its potential, AI introduces substantial risks that must be managed through careful oversight.

Workforce Displacement and Skill Shifts

While AI reduces clinician workload, it also automates tasks previously performed by healthcare professionals. This shift may result in job displacement or require reskilling, potentially creating anxiety and resistance within the workforce (7).

Loss of Humanistic Care

AI cannot replicate empathy, emotional intelligence, or relational communication. Overreliance on automation risks weakening the doctor-patient relationship, especially in communities where trust in healthcare providers is culturally significant (14).

Bias, Inequity, and Fairness

AI models trained on biased datasets may perpetuate or exacerbate inequalities in diagnosis, treatment recommendations, and recruitment (4). Ensuring diverse and representative data is essential for equitable AI performance.

High Implementation Costs and Security Risks

Deployment of AI systems requires significant investment in infrastructure, workforce training, and cybersecurity. Data breaches remain a major concern, particularly as health systems across the Balkans modernize digital platforms (7).

Beyond traditional data security, the rise of specialized generative AI—exemplified by OpenAI's healthcare frameworks—introduces the challenge of epistemic security. As LLMs transition from analytical tools to interactive clinical partners, the risk of "hallucinations"—the generation of plausible but medically inaccurate information—poses a direct threat to the integrity of medical knowledge. In regions with diverse linguistic landscapes, such as the Balkans, ensuring that AI-driven health communication maintains cognitive cybersecurity and prevents the spread of algorithmic disinformation is paramount. Therefore, responsible transformation must prioritize not only the technical accuracy of AI but also the protection of the information ecosystem in which clinicians and patients interact. It may be argued that the risk of AI-generated medical disinformation (hallucinations) infiltrating clinical decision-making processes is not only a data security issue but also an information security issue.

Legal and Ethical Uncertainty

Perhaps the most pressing challenge is liability. When AI-generated recommendations or robotic procedures cause harm, it is unclear whether responsibility lies with developers, healthcare providers, or institutions. This ambiguity underscores the need for standardized regulatory frameworks. For example, the European Union AI Law, which has been frequently cited, addresses not only the "mistakes" that AI makes but also the possibility of presenting misinformation as "correct", thus highlighting the risk of AI tools disrupting the medical information ecosystem (15).

Toward Responsible and Equitable AI Integration

AI's future in healthcare depends not on technological capability alone, but on governance, transparency, and ethical stewardship.

J Acad Res Med 2026;16(1):1-3

Regulation and Governance

Countries must implement regulatory frameworks that address:

- Algorithmic transparency
- Data protection and privacy
- Clinical validation requirements
- Accountability and liability
- Safety monitoring throughout the system lifecycle

Without these safeguards, AI risks undermining public trust and exacerbating inequities.

Human Oversight and Clinical Expertise

AI should augment—not replace—clinicians. Human-in-the-loop models ensure contextual judgment, empathy, and moral reasoning remain central to healthcare delivery. Although AI is known to be incapable of empathy, simulations of "scalable empathy" suggest it could play a supportive role in patient communication (for example, in triage or chronic disease monitoring) (16). According to Schneiders and van der Graaf (17), traditional empathy is a process where one person senses another's feelings, but it is resource-limited (requiring time and energy) and can be tiring (burnout). Scalable empathy, on the other hand, is the simulation of this process at a behavioral level through AI, enabling it to be delivered to millions of patients simultaneously and seamlessly.

Inclusive and Representative Data

Developers must prioritize datasets reflecting diverse populations, ensuring AI systems perform equitably across gender, ethnicity, age, and socioeconomic groups.

Workforce Training and System Preparedness

Healthcare professionals need training in digital literacy, AI interpretation, and ethical use. Health systems must also assess their readiness for technological integration, considering financial, infrastructural, and cultural factors.

CONCLUSION

AI offers extraordinary promise. It can reduce errors, accelerate diagnosis, automate administrative tasks, support overextended workforces, and promote personalized care. Yet without ethical safeguards, regulatory clarity, and equitable implementation, it risks amplifying disparities and creating new vulnerabilities.

Healthcare stands at a pivotal moment. The goal is not merely to adopt AI technologies but to ensure they strengthen the foundations of care—safety, equity, empathy, and trust. A future where AI enhances healthcare for all will require deliberate, responsible, and collaborative action across the global health community.

Footnotes

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