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ECONOMIC AND SOCIAL PERSPECTIVES ON THE USE OF ARTIFICIAL INTELLIGENCE IN MEDICINE − BENEFITS, RISKS, AND CHALLENGES

PERSPEKTYWY EKONOMICZNE I SPOŁECZNE STOSOWANIA SZTUCZNEJ INTELIGENCJI W MEDYCYNIE − KORZYŚCI, ZAGROŻENIA I WYZWANIA

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Abstract: The aim of the article is to present the social and economic perspectives of implementing artificial intelligence in healthcare and to identify the key challenges related to its broader application. Improvements in diagnostic quality, increased accessibility of healthcare, economic efficiency, as well as regulatory and ethical issues were identified.
Materials and methods: The article is based on an analysis of the available literature and a review of issues related to the use of artificial intelligence in medicine, with particular emphasis on social, economic, ethical and regulatory aspects.
Results: It has been shown that the application of artificial intelligence in medicine contributes to improving the quality of diagnostics, increasing access to healthcare, and enhancing the economic efficiency of healthcare systems.
Conclusions: Artificial intelligence AI has significant transformative potential in healthcare; however, its widespread implementation requires addressing regulatory, as well as considering social and economic challenges.

Keywords: artificial intelligence in medicine, societal implications of AI, artificial intelligence risks, AI ethics in healthcare

Streszczenie: Celem artykułu jest przedstawienie społecznych i ekonomicznych perspektyw wdrożenia sztucznej inteligencji w ochronie zdrowia oraz identyfikacja kluczowych wyzwań związanych z jej szerszym stosowaniem. Wskazano na poprawę jakości diagnostyki, zwiększenie dostępności opieki, efektywność ekonomiczną, ale też aspekty etyczne.
Materiał i metody: Artykuł opiera się na analizie dostępnej literatury oraz przeglądzie zagadnień dotyczących zastosowania sztucznej inteligencji w medycynie, ze szczególnym uwzględnieniem aspektów społecznych, ekonomicznych, etycznych i regulacyjnych.
Wyniki: Wykazano, że zastosowanie sztucznej inteligencji w medycynie przyczynia się do poprawy jakości diagnostyki, zwiększenia dostępności opieki zdrowotnej oraz podniesienia efektywności ekonomicznej systemów ochrony zdrowia.
Wnioski: Sztuczna inteligencja AI ma istotny potencjał transformacyjny w ochronie zdrowia, jednak jej szerokie wdrożenie wiąże się z koniecznością rozwiązania problemów regulacyjnych oraz uwzględnienia wyzwań społecznych i ekonomicznych.

Słowa kluczowe: sztuczna inteligencja w medycynie, społeczne implikacje AI, zagrożenia związane z AI, etyka sztucznej inteligencji w opiece zdrowotnej

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Introduction

Artificial intelligence (AI) plays a key role in the analysis of medical data, such as CT scans, MRIs, and X-rays. In dentistry, it helps detect tooth decay and plan orthodontic treatment. AI algorithms can detect subtle changes and anomalies that may be overlooked by the human eye, leading to earlier detection of diseases, including cancer and cardiovascular disease (Aerts et al., 2014; Huang et al., 2025; Song et al., 2025).

AI also enables the development of personalized treatment plans by analysing individual patient data such as genetics, lifestyle, and medical history. This allows doctors to tailor therapies to the needs of a specific patient, increasing the effectiveness of treatment (Collins, Varmus, 2015; Mesko, 2017; Al Marouf et al., 2025; Buess et al., 2025). AI supports specific doctors in processing and analysing large data sets, enabling better clinical decision-making. AI-based systems can identify health patterns and predict treatment outcomes, contributing to improved healthcare quality. It is also used in robotic surgery, where precise algorithms help perform complex operations with greater accuracy and less risk of complications.

Generative AI can be used in patient monitoring systems that analyse data in real time, allowing for faster response to changes in patients' health (Moulaei et al., 2024; Mahajan et al., 2025; Raza et al., 2024). It is worth looking at which areas are already developed and what the main challenges are, which technologies are on the verge of entering routine medical practice, and what social implications their use may have.

AI has the potential to improve healthcare efficiency, reduce administrative costs, and enhance diagnostic accuracy, offering significant economic benefits for healthcare systems. However, excessive reliance on AI may increase system fragility, contribute to physician de-skilling, and require substantial investment in oversight, transparency, and ethical governance to ensure sustainable and cost-effective implementation (Buess et al., 2025; Jalilian et al., 2024; El Arab, Al Moosa, 2025; Sparrow, Hatherley, 2025; WHO, 2021).

Materials and Methods

The analysis was based on a review of scientific literature from last 12 years, including clinical trials, systematic reviews, and publications on AI implementations in medical practice. Social, economic, and regulatory aspects were considered. The study was based on a narrative and partially systematic review of scientific literature published between 2014 and 2026. Literature searches were conducted using PubMed, Scopus, Web of Science, and Google Scholar databases.

Results and Discussion

Artificial intelligence (AI) is finding increasingly widespread application in medicine, from diagnostic imaging and risk prediction to personalized therapy and hospital process optimization (Topol, 2019; Jiang et al., 2022). Currently, AI is no longer just an experimental tool, but is finding clinical applications in medical imaging, personalized medicine, clinical decision support, and risk prediction, as well as in surgical operations and robotics (Topol, 2019; Jiang et al., 2022; Esteva et al., 2019). As AI technologies transition from experimental prototypes to widely adopted clinical tools, evaluating their economic viability becomes increasingly important. Despite well-documented clinical benefits, it remains essential to determine whether the substantial costs of AI implementation translate into long-term cost-effectiveness and sustainable value for healthcare systems facing rising expenditures driven by aging populations and chronic diseases (El-Arab, Al Moossa, 2025).

In contemporary healthcare researchers indicate, the widespread use of AI in medicine may pose perils such as:

- privacy and surveillance risks – AI increases large-scale collection and analysis of sensitive patient data, raising concerns about data breaches, monitoring, and misuse of personal health information;
- bias and inequality – AI systems trained on biased or unrepresentative datasets may reinforce existing healthcare disparities and produce unequal outcomes across patient groups;
- lack of explainability – many AI models function as "black boxes", making clinical decisions difficult to interpret, justify, or communicate to patients;
- reduced trust and physician de-skilling – overreliance on AI may weaken clinicians' diagnostic skills and reduce patient trust in medical decision-making;
- system fragility and single points of failure – dependence on a limited number of AI systems may increase vulnerability to technical failures and cyberattacks, potentially affecting large patient populations;
- power concentration and economic dependence – AI may strengthen the influence of technology companies and increase healthcare systems' dependence on costly proprietary platforms;
- ethical and responsibility challenges – determining accountability for AI-assisted medical errors remains complex, particularly when decisions rely heavily on automated systems;
- threats to patient-centred care – greater automation may reduce empathy, human interaction, and value-based deliberation in medicine, despite gains in efficiency and productivity (Sparrow, Hatherley, 2025).

Main areas of AI application in medical practice

Medical imaging

I. Detection of pathological changes in images: MRI, CT, X-ray, ultrasound, histopathological imaging, where AI enables automatic segmentation of anatomical structures, tumours detection, disease progression assessment, and classification of changes (Eisemann et al., 2025; Raza et al., 2024; Mesko et al., 2017).
II. Generative models used to improve image quality, reconstruct images, translate between modalities (e.g., CT → MRI), and fill in missing data (Goh et al., 2025; Yi et al., 2019).
III. Radiomics – extraction of many features from medical images that can be correlated with disease progression, treatment response, or prognosis (Aerts et al., 2014; Jiang et al., 2022).

Nowadays surgical scene understanding (SSU) applies artificial intelligence to interpret intraoperative visual data, such as laparoscopic videos. Despite its potential, clinical integration has remained limited, highlighting the need for diverse multicentre datasets, robust validation, and clinically driven development to enable broader implementation in surgical practice (Carstens et al., 2025).

Practical implementation, certification, regulations

Diagnostic tools are approved by regulatory authorities (e.g., FDA, EMA) for use in clinical trials or practice (Eisemann et al., 2025). However, their implementation in clinical settings is necessary – there is a need for interoperability with hospital systems, integration with workflow, and user training (Mesko et al., 2017).

In the case of detecting pathological changes in imaging: MRI, CT, X-ray, ultrasound, histopathological imaging, artificial intelligence (AI) enables automatic segmentation of anatomical structures, tumours detection, disease progression assessment, and lesion classification (Eisemann et al., 2025; Raza et al., 2024; Mesko et al., 2017).

Generative models are used to improve image quality, reconstruct images, translate between modalities (e.g., CT → MRI), and fill in missing data (Goh et al., 2025; Yi et al., 2019). The use of radiomics seems valuable here - the extraction of many features from medical images that can be correlated with disease progression, response to treatment, or prognosis (Aerts et al., 2014; Carstens et al.; 2025, Jiang et al., 2022;).

Recent studies have shown that the implementation of AI-enabled stethoscopes in primary care may improve the early detection of cardiovascular diseases, including heart failure and arrhythmias. Although overall detection rates remained similar between groups, patients examined with AI-assisted devices showed significantly higher rates of newly identified heart failure and abnormal heart rhythms (Kelshiker et al., 2026).

Precision / Personalized Medicine

Analysis of the patient's genome, clinical data, and lifestyle enables the selection of the most optimal therapies (Topol, 2019; Collins, Varmus, 2015). Artificial intelligence (AI) helps predict responses to drugs, monitor drug concentrations in the blood, and predict adverse effects (Mesko et al., 2017; Obermeyer, Emanuel, 2016).

Generative AI models are used to synthesize data or augment datasets to overcome problems with small data sets and privacy concerns (Goh et al., 2025; Choi et al., 2017).

Clinical decision support and Explainable AI (XAI) systems

AI systems are used to support physicians in diagnosing, suggesting treatment plans, and analysing test results (Esteva et al., 2019; Jiang et al., 2022). In the development of medical AI systems, increasing emphasis is being placed on the explainability of models – so that doctors and patients can trust the results, understand the logic behind them, and identify possible diagnostic errors (Doshi-Velez, Kim, 2017; Goh et al., 2025).

Prospects for the use of AI in healthcare – advantages and disadvantages

Economic aspects

Artificial intelligence in medicine offers significant economic benefits at many levels of the healthcare system. First and foremost, it enables cost reduction through early detection of diseases – rapid and accurate diagnosis reduces the need for costly interventions in later stages of the disease, reduces hospitalizations, and shortens treatment time (Mesko et al., 2017; Obermeyer, Emanuel, 2016; El-Arab, Al Moossa, 2025).

Automating routine tasks – such as analysing medical images, processing documentation, and monitoring patient status – increases staff efficiency, allows doctors and nurses to focus their efforts on more complex clinical tasks, and reduces the risk of human error (Jiang et al., 2022; Topol, 2019).

Personalization of therapy and screening improves the cost-effectiveness ratio by better tailoring treatment to individual patient needs. By analysing the patient's genome, clinical data, and lifestyle, it is possible to avoid ineffective therapies and reduce spending on unnecessary diagnostic procedures (Collins, Varmus, 2015; Esteva et al., 2019).

In addition, AI supports the optimization of administrative and logistical processes in hospitals – staff scheduling, bed management, and ordering of medicines and medical supplies – leading to better resource utilization and reduced operating costs (Mesko et al., 2017). In the long term, AI can contribute to modelling and predicting the health needs of entire populations, allowing for more effective allocation of public funds and reducing inefficiencies in healthcare systems (Obermeyer, Emanuel, 2016; Topol, 2019).

Social perspectives

The use of artificial intelligence (AI) in medicine could promote greater equality in access to healthcare, as AI can support facilities in regions with limited access to specialists, reducing social inequalities (Mesko et al., 2017; Esteva et al., 2019). This is also associated with an improvement in patients' quality of life, as earlier diagnosis and personalized treatment can reduce the burden of disease and improve social well-being (Topol, 2019; Collins, Varmus, 2015).

In the field of education and preventive medicine, artificial intelligence, when used skilfully and professionally, improves social trust, and promoting public awareness of AI in medicine fosters acceptance and cooperation among patients and staff (Goh et al., 2025). AI can also help monitor the health of vulnerable groups, the elderly, and patients with chronic diseases, allowing for more effective allocation of social care resources and supporting entire social systems (Obermeyer, Emanuel, 2016).

Social threats and challenges

A social challenge to the wider use of AI in the country may be limited access to modern AI tools exclusively for wealthier regions and institutions, which is associated with a deepening of inequality (Obermeyer et al., 2019). Another threat is the ethical responsibility for AI to make decisions on which human lives depend, which may raise social concerns, especially in the context of diagnostic errors (Doshi-Velez, Kim, 2017). The use of a range of medical data in AI-based treatment processes requires strict regulations to protect patient privacy and data security (Topol, 2019; Choi et al., 2017). Often, a lack of proper understanding of how AI systems work can lead to a decline in public trust or complete rejection of AI technology by the public and medical staff (Goh et al., 2025). Table 1 shows the collected and detailed technical, ethical, and social challenges of expanding the use of AI in the medical market.

Table 1. Challenges for the widespread use of artificial intelligence in medicine

Category	Challenges and Risks	Examples / Implications	Citations
Technical	Data quality	necessity of large, well-annotated datasets; lack of high-quality data may lead to incorrect diagnoses;	Jiang et al., 2022; Raza et al., 2024
Technical	Generalization / domain shift	models trained on one population or equipment may perform worse under different conditions;	Goh et al., 2025
Technical	Overfitting	a model may learn specific features of the training dataset instead of general patterns;	Mesko et al., 2017
Ethical and social	Bias and discrimination	algorithms may favor or discriminate against certain patient groups;	Obermeyer et al., 2019
Ethical and social	Lack of transparency (black box)	difficulty in understanding model decisions; problem with trust among doctors and patients;	Doshi-Velez, Kim, 2017; Goh et al., 2025
Ethical and social	Legal responsibility	issue of who bears the consequences of incorrect diagnoses or AI-suggested decisions;	Topol, 2019
Data privacy and security	Protection of personal data	risk of leakage or unauthorized use of sensitive medical information;	Choi et al., 2017
Data privacy and security	Regulatory compliance	necessity to meet legal requirements and quality standards, e.g., GDPR, HIPAA;	Topol, 2019
Social and societal	Deepening inequalities	access to modern technologies may be limited to wealthier regions or institutions;	Obermeyer, Emanuel, 2016
Social and societal	Lack of trust and social acceptance	patients and medical staff may reject AI if they do not understand how it works;	Goh et al., 2025
Social and societal	Changing professional roles	automation may affect the work of medical staff and require new competencies.	Topol, 2019; Mesko et al., 2017

Source: own study.

Problems and challenges for the future

Large language models and generative AI systems introduce additional clinical and ethical risks, including hallucinations, misinformation, insufficient explainability, and unclear legal responsibility. From infectious disease monitoring to AI-powered surgical assistance, these technologies enable proactive, personalized care while addressing critical safety gaps. However, successful implementation requires careful consideration of technical, operational, and ethical challenges (Mahajan et al., 2025).

Autonomous AI systems offer advantages in resource-limited healthcare settings, primarily by improving efficiency where skilled medical personnel are scarce. Although telemedicine platforms have been introduced in some contexts, they often do not enable immediate point-of-care diagnosis, as results are typically available only after the patient has left the clinic, which may contribute to incomplete follow-up and reduced diagnostic effectiveness. The main limitations of the study include its implementation within a single healthcare system in a low-income country, the small number of participating specialists, and the narrow scope of the AI system focused solely on detecting diabetic eye disease in largely asymptomatic patients. While the findings suggest potential scalability and high user satisfaction, the generalizability of the results to other clinical settings and healthcare systems should be interpreted with caution, and further multicentre validation studies are required (Abramoff et al., 2023).

The biggest challenges for the future in terms of wider dissemination of AI methods in medicine are the quality and availability of data and the high costs of labelled data sets (Jiang et al., 2022; Raza et al., 2024). Other problems may include generalization and domain shift, where models trained on one population / type of equipment may perform worse in other conditions (Goh et al., 2025). In the area of privacy and ethics, the use of AI methodology carries the risk of patient discrimination, unauthorized use of data, and a lack of transparency in the operation of the AI models used (Topol, 2019; Obermeyer et al., 2019).

Other researchers in this field raise issues of difficulty in explaining and interpreting data from medical databases, and thus a decline in public trust in AI systems (Doshi-Velez, Kim, 2017; Goh et al., 2025). Looking ahead, it is important to refine their regulatory compliance, which would provide greater security and legal accountability for the wider use of AI in medicine (Eisemann et al., 2025).

Artificial intelligence in healthcare – Summary: benefits versus risks

As shown in Table 2, artificial intelligence (AI) in medicine offers significant benefits for patients, physicians, and the healthcare system, but it also carries ethical, social, and economic risks. Responsible implementation of AI into medical systems, accompanied by appropriate regulations and transparency, will be crucial to maximizing the benefits and minimizing the associated risks.

Table 2. Social and economic balance sheet of AI application

Medical Aspects	Benefits	Risks
Diagnostics	- higher accuracy and speed of diagnoses (Topol, 2019) - early disease detection improving prognosis (Jiang et al., 2022)	- risk of overdiagnosis (Eisemann et al., 2025) - errors due to poor data quality or so-called domain shift (Goh et al., 2025)
Patient care	- more time for doctors to interact with patients (Mesko et al., 2017) - reduced patient stress thanks to faster results (Topol, 2019)	- patient concerns that AI may "replace" doctors (Jiang et al., 2022) - decline in public trust if the role of AI is unclear (Goh et al., 2025)
Health economics	- lower treatment costs due to earlier diagnosis (Mesko et al., 2017) - greater work efficiency (Topol, 2019)	- high initial costs of implementing AI systems (Goh et al., 2025) - risk of deepening inequalities between countries depending on wealth (Jiang et al., 2022)
Society	- equality in access to healthcare, including in regions with fewer specialists (Mesko et al., 2017) - more lives saved (Topol, 2019)	- data privacy and security concerns (Jiang et al., 2022) - need for regulation and oversight of algorithms (Goh et al., 2025)
Future	- personalized treatment and screening (Topol, 2019) - potential for epidemic forecasting (Mesko et al., 2017)	- uncertainty about the long-term effects of AI (Goh et al., 2025) - risk of systemic dependency on technology (Jiang et al., 2022)

Source: own study.

The economic prospects of using AI in medicine globally

Artificial intelligence in medicine offers significant economic benefits at many levels of the healthcare system. It enables cost reduction through early detection of diseases-rapid and accurate diagnosis reduces the need for costly interventions in later stages, reduces hospitalizations, and shortens treatment time (Mesko et al., 2017; Obermeyer, Emanuel, 2016). The automation of routine tasks increases staff efficiency and allows them to focus their efforts on tasks requiring expert knowledge (Jiang et al., 2022; Topol, 2019). Personalization of therapy improves the cost-effectiveness ratio by avoiding ineffective therapies and procedures (Collins, Varmus, 2015; Esteva et al., 2019).

On a single hospital scale, the costs of implementing an AI solution (licenses, integration, training, certification) can vary in practice from tens of thousands of euros (for simple administrative / triage tools) to hundreds of thousands of euros (for advanced diagnostic systems or proprietary solutions).

In Poland, the implementation of AI in healthcare has accelerated mainly in radiology, cardiology, and telemedicine. Pilot projects involving AI-assisted mammography screening, electrocardiogram analysis, and digital pathology have been introduced in selected oncology and university centres. The pace of benefits depends on financing policies, data standardization, and staff education. According to reports by International Trade Administration (2023), the AI market in the Polish medical sector is growing rapidly, but financial constraints are slowing down its full utilization. This development is characterized by smaller direct financial savings, but high relative potential (reduction of inefficiencies). In Poland, we are seeing a growing number of pilot projects and implementations (national platforms, solutions in oncology and radiology), but the scale and funding are significantly smaller than in Western countries, which affects the pace of economic benefits.

Western Europe is seeing strong growth in the medical market that uses AI, significant regulatory and investment initiatives (EU) – the benefits are unevenly distributed among individual countries. AI is more widely used here in image analysis and clinical decision support systems, which translates into real cost savings (Chatzikou et al., 2025).

The greatest absolute economic benefits (due to the scale of expenditure), rapid commercialization, and high corporate implementation are seen in connection with the widespread use of AI in medicine in the United States. It is estimated that the widespread implementation of AI could result in savings of 5-10% of healthcare spending in the US – hundreds of billions of dollars annually. This gives an approximate framework for the scale of economic benefits, mainly due to better management of chronic diseases and process optimization (Sahni et al., 2023; McKinsey, 2025).

Summary

AI can increase equality in access to healthcare, support less experienced physicians, minimize diagnostic errors, and improve patients' quality of life through early disease detection (Mesko et al., 2017; Topol, 2019). Transparent implementations increase public trust and educating patients about how AI systems work is key to the acceptance of the technology (Goh et al., 2025). AI reduces healthcare costs through early disease detection and process optimization (Mesko et al., 2017). Automation of routine tasks increases staff efficiency, while personalized treatment and screening improve cost-effectiveness (Jiang et al., 2022; Topol, 2019).

These include the risk of overdiagnosis, diagnostic errors due to data limitations, loss of effectiveness in other populations (domain shift), as well as regulatory, privacy, and ethical issues (Goh et al., 2025; Jiang et al., 2022). Recent study found that clinicians using AI for medical decision-making were perceived by peers as having lower clinical competence, although this effect was reduced when AI was used primarily for verification rather than as the main decision-making tool. These findings suggest that while AI is recognized as beneficial for improving diagnostic accuracy, its use may still negatively influence professional peer evaluations (Yang et al., 2025). However, in non-clinical settings, AI enhances medical education, public relations, revenue cycle management, and healthcare marketing. Its ability to continuously learn and adapt enables ongoing improvements in clinical and operational efficiency, making healthcare delivery more proactive, predictive, and precise (Bhuyan et al., 2025).

Conclusions

Artificial intelligence (AI) in medicine offers significant benefits: improved diagnostic quality, increased access to care, economic efficiency of the system, and better resource management. However, responsible implementation that considers social, economic, regulatory, and ethical aspects is crucial.

The social and economic prospects of AI in medicine are promising, but their realization requires responsible implementation, legal regulation, and education of both medical staff and patients. Combining technological innovation with ethics can ensure that benefits are maximized and risks are minimized.

Although AI systems have demonstrated diagnostic performance comparable to specialists in radiology, dermatology, and ophthalmology, many studies report reduced effectiveness in real-world settings due to domain shift, heterogeneous data quality, and limited external validation.

Future implementation strategies should focus on multicentre validation studies, explainable AI systems, ethical governance, and equal access to advanced technologies.

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