Chapter 4

Artificial Intelligence (AI) and Ethics in Medicine at a Global Level: Benefits and Risks

Sadi Elasan[1]

Yusuf Ateş[2]

Abstract

Technological developments in medicine have created significant transformations in healthcare services and offered more effective diagnosis and treatment options for patients. Among these advances, artificial intelligence (AI) plays a pivotal role in a variety of medical applications, from disease diagnosis and treatment planning to clinical research and patient care optimization. However, the rapid development of artificial intelligence in medicine also raises ethical challenges and concerns, including patient privacy, data security, inequality and societal impacts. This study examines the potential benefits and risks associated with the global use of artificial intelligence in medicine. The study presents examples and features of global AI-based medical applications, including data-driven diagnosis and treatment, disease prediction and early warning systems, personalized care and treatment planning, drug development and discovery, telemedicine and remote healthcare. Discussions of confidentiality, fairness, integrity, transparency, patient autonomy, responsibility and accountability, change management, social acceptance are emphasized, emphasizing the importance of ethical rules and guidelines in the use of AI in medicine. An analysis of global publication trends in the study of AI and ethics in medicine is also presented, providing insights into the most influential countries and networks of collaboration. As a result, AI has enormous potential in medicine and offers numerous benefits, including better access to healthcare, improved diagnosis and treatment, customized care, resource efficiency, disease prevention and early detection. However, risks related to data security, privacy, inequality and ethical considerations must be addressed. Also, careful management, data security, ethical practices and protection of human factors are vital in leveraging the full potential of AI in medicine.

1 Assoc. Prof., Van Yüzüncü Yıl University, sadielasan@yyu.edu.tr, 0000-0002-3149-6462

2 Teacher, Repuclic of Türkiye Ministry of National Education, Van Fevzi Geyik Primary School, kayramyagizz@gmail.com

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1. INTRODUCTION

Technological developments in medicine and health provide the transformation of health services with more effective diagnosis and treatment options for patients. Emerging technologies such as artificial intelligence (AI) play an important role in medicine. AI can perform operations such as data analytics, learning, prediction, suggestion, and decision-making by giving computer systems human-like capabilities. In medicine, AI offers a range of applications, from disease diagnosis and treatment planning to clinical research to optimizing patient care.

However, the rapid development of AI in medicine also raises many ethical challenges and concerns. The use of AI in medicine brings with it several ethical issues such as patient privacy, data security, inequality, ethical values and societal impacts. Therefore, it is important to evaluate the benefits and risks of the use of AI in medicine at a global level.

This section will examine the potential benefits and risks of the use of AI in medicine at the global level. First, an overview of the concepts of AI and medicine will be presented, and the potential and limitations of AI in medicine will be discussed. Then, the relationship between ethics and AI will be addressed, and ethical issues arising from the use of AI in medicine will be discussed.

1.1. Artificial Intelligence and Medicine: Definitions and Concepts

Today, artificial intelligence (AI) technology in the field of medicine creates revolutionary changes in the diagnosis, treatment and care processes of patients. AI is a discipline that gives computer systems human-like abilities and is used in many medical applications, thanks to its ability to perform complex operations such as data analytics, learning, prediction, and decision-making.

The concepts of Artificial Intelligence and medicine provide a fundamental basis for understanding the use of Artificial Intelligence in medicine. Artificial Intelligence refers to a general description of artificial intelligence technology and enables computer systems to have human-like capabilities. Medicine, on the other hand, is a science and application field that covers diagnosis, treatment and care processes related to human health. The use of Artificial Intelligence in medicine interacts with many different aspects of the medical field.

However, the use of Artificial Intelligence in medicine also involves some risks. Risks such as data security and privacy, ethical and legal issues, reliance on

technology, and human factors can affect the use of AI in medicine. Risks such as completely relying on AI's decisions, ignoring the human factor, violating ethical rules and compromising patients' privacy must be carefully considered.

In conclusion, Artificial Intelligence holds great potential in the medical field. However, risks such as ethical, legal, safety and human factors must also be considered. In the future, the use of Artificial Intelligence in medicine is expected to increase and more research and regulations are required in this area. Artificial Intelligence can enable patients to benefit from healthcare services in a more effective and optimized way in the medical field, but it needs to be carefully managed and used correctly.

1.2. The Potential and Limitations of Artificial Intelligence in Medicine

The potential and limitations of AI in medicine include:

Potentials:

• Can use big data analytics and machine learning for disease diagnosis and prediction.

• In treatment planning, it can offer optimized treatment recommendations based on patients' genetic profiles and clinical data.

• It can help make more effective decisions by analysing medical data in data analytics and research.

Limitations:

• Data security and privacy is an important issue and medical data must be stored securely.

• Decision-making processes and outcomes of AI are controversial and should be used in conjunction with clinical assessments by human physicians.

• Issues such as ethical issues, patient confidentiality, data use and liability should be considered.

1.3. The Relationship Between Ethics and Artificial Intelligence

The relationship between ethics and artificial intelligence is extremely important in terms of the impact of artificial intelligence technologies on people's lives, social structure and cultural values. This relationship stems from the fact that AI technologies should be used by ethical principles. Ethical values, human rights, social norms and societal expectations are important factors to consider in the use of AI technologies.

The observance of fundamental principles such as fairness, transparency, reliability, confidentiality, responsibility and human-centeredness ensures the ethical compliance of artificial intelligence systems. However, there are also challenges and controversies with artificial intelligence systems. For example, issues such as data bias, algorithm errors, discrimination, security risks, and unemployment concerns make the ethical relevance of AI systems questionable.

However, the relationship between ethics and artificial intelligence also presents several challenges and controversies. For example, issues such as the risks of discrimination and inequality related to the use of AI systems, privacy violations during data collection and use, and the interference of AI systems in human decisions can trigger ethical discussions.

Therefore, it is important to develop standards and guidelines for the ethical use of AI technologies and to implement these standards in an ethically acceptable manner. It is also important to raise public awareness of the ethically correct use of AI technologies and to involve various stakeholders in the development of AI technologies.

1.4. Global AI-Based Medical Data Collection and Use Practices: Examples and Features

• Data-Driven Diagnosis and Treatment: AI can help diagnose and treat diseases by analysing medical data using big data analytics and machine learning techniques. For example, in image-based diagnostic methods (e.g., radiology, pathology), artificial intelligence can automatically analyse images to detect medical conditions such as cancer, brain damage, and fractures, helping doctors make quick and accurate diagnoses.

• Disease Prediction and Early Warning: AI can use patients' health data to predict disease risk and develop early warning systems. For example, by analysing a patient's electronic health records and clinical data, AI can predict the risk of diseases such as diabetes, hypertension and heart disease and alert doctors to monitor patients at an early stage and take appropriate action.

• Treatment Planning and Personalized Care: AI can plan treatments and provide personalized treatment options using patients' genetic, clinical and other health data. For example, in cancer treatment, AI can analyse a patient's genetic profile, tumour characteristics, and other factors to determine the most effective treatment plan and guide doctors.

• Drug Development and Discovery: AI can accelerate drug development processes and identify potential new drug candidates in drug discovery.

Using big data analytics and AI algorithm methods, AI can select the most promising candidates from thousands of potential drug molecules and identify them for laboratory testing, thereby accelerating drug development processes.

• Telemedicine and Remote Healthcare: AI can help diagnose and treat patients in telemedicine and remote healthcare. Artificial intelligence can play an important role in remote patient monitoring, diagnosis and treatment processes, especially in remote areas, places with transportation difficulties or in emergencies. For example, AI-powered telemedicine systems can assist healthcare professionals in remote diagnosis, treatment planning and patient monitoring by analysing patients' symptoms, medical data, and test results.

1.5. Features of AI-based medical applications are as follows:

• Speed and Accuracy: AI can produce fast and accurate results using big data analytics and machine learning techniques. Especially in image-based diagnostic methods, artificial intelligence can obtain faster and more accurate results than humans.

• Learning and Development: AI can perform better over time. Machine learning algorithms can continuously analyse data and improve themselves to produce more accurate results.

• Objectivity: AI can produce objective results without being affected by human factors. Medical decisions can be based on objective data rather than emotions and prejudices.

• Big Data Analytics: AI can analyse large amounts of data that are difficult for humans to analyse, which can lead to new insights and discoveries.

• Limitations and Challenges: AI-based medical applications also have limitations and challenges. For example, the lack of transparency and interpretability in AI models can lead to trust issues between healthcare professionals and patients. Potential biases in AI models can also lead to ethical and legal issues. Therefore, the development of transparent, interpretable and unbiased AI models is crucial for the successful adoption of AI-based medical practices.

1.6. Ethical Rules and Guidelines: The Use of Artificial Intelligence in Medicine

The use of artificial intelligence (AI) in medicine is regulated by ethical rules and guidelines. Below are some ethical rules and guidelines:

• Confidentiality and privacy policy: Confidentiality and privacy of data are important in the use of AI. Data must be protected and processed by legal regulations.

• Fair use: AI models should not discriminate and their results should be used fairly and equally for all patients.

• Accuracy and reliability: AI models should produce accurate and reliable results.

• Transparency and explain ability: The decision-making processes and results of AI models should be explainable.

• Patient autonomy: Patient preferences and consent are important.

• Training and certification: Health professionals who will use AI should have appropriate training and certification.

• Responsibility and accountability: The use of AI should be documented and evaluated.

• Change management: Change management strategies should be used for the use of AI.

• Social acceptance and ethical discussion: There should be social acceptance and ethical discussions about the use of AI.

2. MATERIAL

A systematic data collection method, search strategy and network analysis software were used to ensure the reliability of our study and the accuracy of the results. Global publication trends in artificial intelligence and ethics in medicine were identified by examining the most influential countries.

In this study, global post-pandemic heart disease studies conducted between 1999-2023 (last access date: 25 April 2023) using the "Web of Science Core Collection (WOS, Clarivate Analytics, Philadelphia, PA, USA)" database were examined. As a result of searches made using the keywords "Artificial Intelligence, Ethics, Medicine" in the database, 602 suitable studies were found.

3. RESULTS

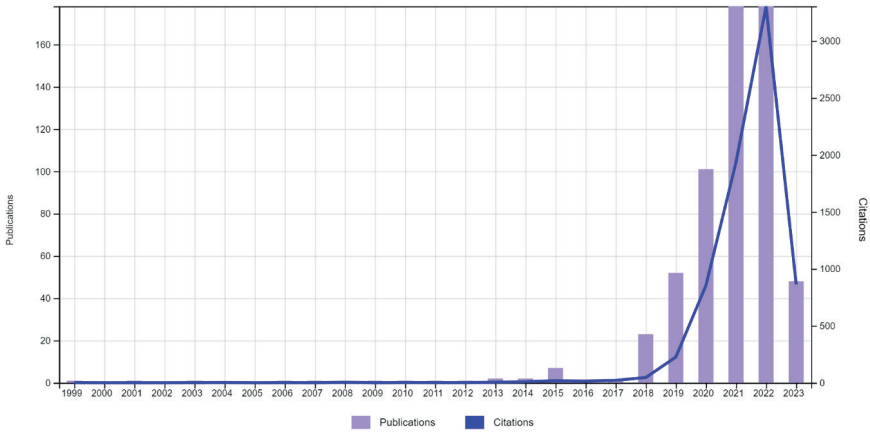

Figure 1. Frequency of publications and citations by year

In this study, 602 published articles were taken from the WOS database. Articles were cited 5786 times (without self-citations). The average number of citations per article is 12. H index is 41. Especially since 2018, both the number of citations and the number of articles showed an increasing trend. In 2023, it is estimated that the number of broadcasts will peak. The distribution of publications and citations is shown in Figure 1.

The USA ranks first in the number of articles published (n=200; 33%), followed by the UK (n=93; 16%); Germany (n=84; 14%) and Canada (n=80; 13%) followed. There were broadcasts from a total of 72 countries around the world, including these first 4 countries, and Turkey ranked 11th. Countries with 12 or more publications are listed in Table 1.

Table 1. Countries with at least 10 publications.

Research Areas	Record Count	% of 602
USA	200	33.223
England	93	15.449
Germany	84	13.953
Canada	80	13.289
Netherlands	57	9.468
China	54	8.970
Australia	50	8.306
France	36	5.980
Switzerland	35	5.814
Italy	33	5.482
Turkey	24	3.987
Spain	19	3.156
Belgium	17	2.824
Singapore	17	2.824
India	16	2.658
Sweden	16	2.658
Austria	13	2.159
Ireland	12	1.993
Showing 18 out of 72 entries (least 12 publications)		

Network analysis

In this study, the "collaboration network" was analyzed using VOSviewer (version 1.6.19, Leiden University, The Netherlands) to identify global trends in "Artificial Intelligence and Ethics in Medicine" studies and important topics of research in this field. These analyzes were performed using text mining and data visualization (bubbles maps and other graphical) methods to ensure the accuracy and reliability of the study.

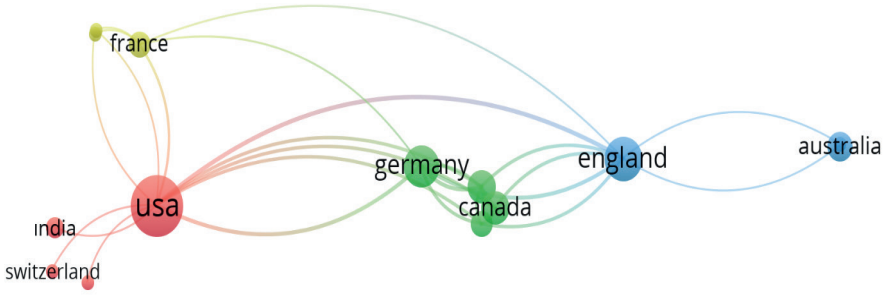

Figure 2. International collaboration network map. (Collaboration between countries is shown by lines, with thickness indicating strength, and circle/text size indicating the level of int. collaboration)

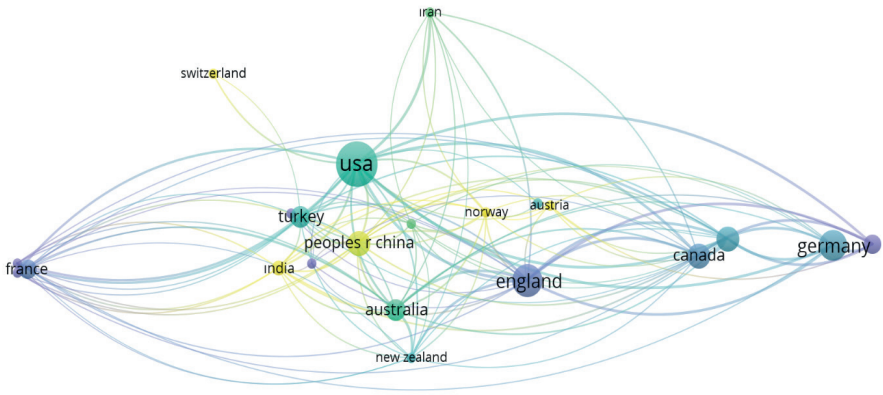

Figure 3. Bibliographic coupling analysis for country. (The relatedness of items was determined based on the number of references the share)

In this study, he examined the worldwide trends and publication trends on the subject of "Artificial Intelligence (AI) and Ethics in Medicine at a Global Level: Benefits and Risks".

The results can be used to guide research in this area and provide a roadmap for research in Artificial Intelligence and Ethics in Medicine at a Global Level. In conclusion, the findings reveal global trends in "Artificial Intelligence and Ethics in Medicine at the Global Level".

4. CONCLUSION

4.1. Potential Benefits of Artificial Intelligence in Medicine: Implications for Patients, Healthcare and Society

Artificial intelligence offers many benefits in the medical field. These are better access to patient's health, higher sensitivity in diagnosis and treatment, customized treatment and care, efficiency and rational use of resources, disease prevention and early diagnosis, health care planning and resource allocation, training and improvement in practice. While these benefits enable patients to receive better health care, they increase the efficiency of health services and provide a more rational use of resources. AI could also potentially be instrumental in disease prevention and early detection and assist in healthcare planning and resource allocation processes. Artificial intelligence, which also offers potential benefits in medical education and practice, can help medical students and professionals improve their skills.

4.2. Potential Risks of Artificial Intelligence in Medicine: Data Security, Privacy, Inequality and Ethical Issues

The use of AI in medicine can lead to potential risks such as data security, privacy, inequality and ethical issues. It emphasizes the need for data security and privacy, protection of health data, and precautions against unauthorized access risks. Inequality indicates that the use of artificial intelligence may increase health inequalities in some regions or population groups. Finally, ethical issues point out that the use of artificial intelligence affects issues such as transparency, accountability, fairness and responsibility. Therefore, it is important that the use of artificial intelligence in medicine is carried out correctly and ethically.

4.3. Trends and Future Prospects in Artificial Intelligence and Medicine at a Global Level

Artificial intelligence is developing rapidly in medicine and has the potential to provide many benefits. Artificial intelligence will be used more widely in processes such as image analysis, diagnosis, treatment planning and disease follow-up. Artificial intelligence, which will enable patients to take an active role, can help them predict disease risks and make informed health decisions. There is also the potential to provide more effective and accessible healthcare to people living in low-income and rural areas. However, it is important to pay attention to data security, ethics and accountability issues. Artificial intelligence can be used in surgical robots, health consultants, personalized treatment plans and drug discovery processes. However, it is also important to protect the human factor and ethical values. As a result, artificial intelligence in medicine can enable patients to receive faster and more accurate diagnoses and treatment, increase the efficiency of healthcare services and improve public health. However, it is important not to ignore data security, ethical problems and the human factor in this process.

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