Systematic Review

Ethical Issues of Artificial Intelligence in Healthcare in Developing Countries: A Systematic Review of Empirical Studies

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Abstract

Significant improvements in diagnosis, treatment, and patient outcomes are possible with the use of artificial intelligence (AI) in healthcare. However, there is still a lack of research on ethical issues, especially in developing nations. This systematic review, conducted following PRISMA 2020 guidelines, identified 22 studies from a comprehensive search of 2977 records published between January 2019 and May 2024. Ethical themes were categorised using Jobin et al.'s framework and the European Commission's Ethics Guidelines for Trustworthy AI (EGTAI), while studies were evaluated using Kitchenham and Charters' quality checklist. Nine main ethical issues were identified by thematic analysis; the most often discussed issues were data privacy and justice, followed by patient safety, autonomy, and cyber-security. Benevolence received the least attention, while notable ethical conundrums included bias, fairness, discrimination, algorithmic transparency, and data protection. This systematic review highlights the need for stronger regulatory frameworks, ethical guidelines, and governance structures to ensure responsible AI integration in healthcare, particularly in developing countries, and calls for further research to address existing gaps.

Received: 31-08-2024 | **Revision:** 26-01-2025 | **Accepted:** 04-04-2025

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Keywords | Artificial Intelligence; Healthcare; Ethics issues; Developing Countries; Systematic Review

How to cite: Junaid K, Nasir M, Rafique S, Arshad A, Siddiqui M, Junaid MA. Ethical Issues of Artificial Intelligence in Healthcare in Developing Countries: A Systematic Review of Empirical Studies. Ann King Edw Med Univ.2025;31(spi2):111-118

Introduction

Artificial intelligence (AI) has changed healthcare vastly from diagnosis, treatment and patient care. Machine learning algorithms are used to analyse medical images, which aids in diagnosis. It facilitates early detection of cancers and cardiovascular diseases. In management, robotic-assisted surgeries, which analyze AI analytics which is reducing the time and improving the outcomes. Personalized medicine uses lifestyle, environmental and genetic factors to make treatment plans for the patients.[1] Telemedicine using AI analytics has the potential to improve healthcare access and services. Natural language processing effectively analyses medical data to support clinical decisions. These developments have a lot of promise, especially in developing countries where healthcare systems struggle with issues like a lack of workers, inadequate infrastructure, and accessibility issues. Low and middle-income countries face challenges of health workforce shortage and service delivery. Artificial intelligence can be used to address the shortage,

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https://doi.org/10.21649/akemu.v31iSpl2.5827

2079-7192/

accessibility and service delivery challenges.[2]

Artificial has the potential to improve the quality of care. However its implementation requires careful analysis of the ethical concers. The absence of strong regulatory frameworks, data governance policies, and sufficient digital infrastructure is among the major ethical issues in low- and middle-income countries (LMICs). In tackling these issues, the four core tenets of medical ethics—autonomy, beneficence, non-maleficence, and justice are especially pertinent.[3] Important concerns include patient autonomy, bias in AI algorithms, data privacy and security, decision-making transparency, and the moral obligations of medical personnel.[4] Additionally, AI systems developed on high-income country datasets might not be clinically or culturally appropriate for healthcare systems in developing nations, which could exacerbate already-existing health disparities.[5]

According to recent studies, medical professionals' time constraints frequently result in less than ideal doctor-patient communication, which has a detrimental effect on treatment adherence and patient satisfaction. AI driven solutions can be promising to address these. Virtual assistants can provide on demand information about the condition, management and outcome.[6,7] While AI-driven solutions like virtual assistants, predictive analytics, and automated patient communication tools present potential solutions, they also bring with them new ethical challenges like algorithmic fairness, informed consent, and trust.[8] Moreover it relies on data that is fed in it. If there are underrepresented groups in the population AI might fail to provide accurate predictions about them.

Limited data accessibility, insufficient AI training for healthcare workers, mistrust of AI-driven decisions, and doubts about cost-effectiveness are some of the obstacles to successful AI deployment in developing nations.[9] Despite these obstacles, AI offers healthcare systems that are dealing with a lack of human resources, ineffective diagnostics, and healthcare disparities in rural areas a revolutionary opportunity.[10] By identifying important ethical conundrums and suggesting solutions to address the responsible and equitable deployment of AI, this study seeks to assess the ethical implications of AI in healthcare, especially in developing countries. Preventing AI-driven healthcare disparities and advancing a patient-centered, morally sound AI framework in medical practice require addressing these issues.

Methods

The systematic review was conducted from January 2019 to May 2024, adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The authors systematically searched multiple databases (PubMed, Scopus, Web of Science, and regional journals) to identify relevant studies.[11] Studies were included if they were observational research, systematic reviews, or meta-analyses, qualitative study, commentary, perspective focusing on AI and ethics in underdeveloped healthcare systems. Only peer-reviewed English-language publications were considered to maintain consistency in interpretation and methodological rigor. Studies were excluded if they were non-peer-reviewed, duplicate publications, or lacked substantial discussion on ethical considerations, thereby mitigating publication bias.

Two independent researchers conducted the database search using synonymic keywords, Boolean operators, truncation, and Medical Subject Headings (MeSH) terms related to AI and ethics. A third researcher systematically reviewed the selected studies to verify relevance and resolve discrepancies. The search terms included: “Artificial Intelligence” OR “Machine Learning” OR “Deep Learning” OR “Healthcare” OR “Medical Ethics” OR “Fairness” OR “Autonomy” OR “Bias” OR “Developing Countries. “Countries were classified as developed or developing based on the Human Development Index (HDI), with an HDI score of ≤0.80 indicating a developing country. However, HDI has inherent limitations, as it does not comprehensively capture disparities in healthcare infrastructure, regulatory frameworks, or socio-economic constraints affecting AI adoption.[12]

To ensure methodological rigor and mitigate bias, the Kitchenham and Charters' checklist was applied for quality assessment. Each study was systematically evaluated using predefined quality criteria (Table 1).[13] Instead of relying on statistical reliability measures, a consensus-based evaluation process was adopted, where discrepancies in quality assessments were thoroughly examined and resolved through expert deliberation. This approach was deemed appropriate given the qualitative nature of the study, which required nuanced interpretation rather than purely statistical agreement.[13]

Table 1: *Quality assessment questions*

No	Quality Questions	Score
1	Is the chosen research method relevant to the research questions?	1/0.5/0
2	Is the study's objective clear?	1/0.5/0
3	Is each ethical concern described specifically in the study?	1/0.5/0
4	Does the study include a detailed overview of ethical strategies?	1/0.5/0
5	Do the study's findings contribute to the field of research?	1/0.5/0

Results

The literature search identified 2,977 studies across multiple databases (Figure 1). After removing 2,113 duplicates and screening 798 studies based on titles and abstracts, 94 full-text papers were assessed for quality and eligibility. Ultimately, 22 studies met the inclusion criteria and were included in the final systematic review. Table 1 outlines the key characteristics of the selected studies, published between January 2019 and May 2024.

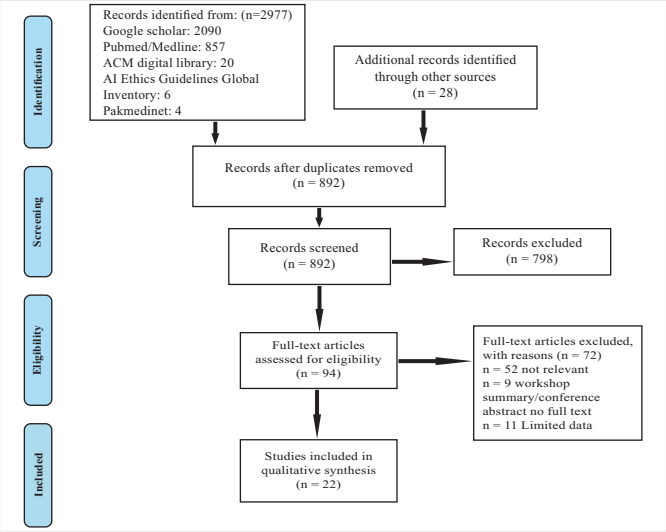

Figure-1: *PRISMA Flowchart*

Geographically, the reviewed studies originated from diverse regions, including four studies from African countries, five from India, and others from China, Turkey, Pakistan, Malaysia, Iran, Romania, and Belarus. The majority of these studies has been conducted in recent years and primarily comprises of review articles, including systematic and scoping reviews, as well as qualitative research methodologies such as case analyses, surveys, interviews, and document analysis. The quality assessment scores of these studies are presented in Table 2.

Table 2: *List of eligible studies and the study characteristics*

Study	Country	Research type	Discipline	Ethical Considerations	Quality
Guan J (2019) [14]	China	Perspective	Medicine	Fairness, benevolence, non-malevolence and respect for autonomy, informed consent, safety, privacy, data transparency, non-discrimination	3.5
Ma et al. (2019) [15]	China	Disease model training and prediction	Medicine	Privacy	3
Keskinbora KH (2019) [16]	Turkey	Review article	Medicine	Honesty, truthfulness, transparency, benevolence, non-malevolence and respect for autonomy	4.5
Buruk et al. (2020) [17]	Turkey	Scientific contribution	Medicine	Privacy and confidentiality of data, transparency, security, utility, and equality; human autonomy, security Privacy, transparency, trust,	3
Jeyaraman et al. (2023) [18]	India	Review article	Surgery	responsibility, bias in healthcare data collection, and data quality, cyber security	4

Study	Country	Research type	Discipline	Ethical Considerations	Quality
Nichol et al. (2021)[19]	Sub-Saharan Africa	Qualitative study	Medicine	Privacy, power disparities, alignment and conflicts of interests, benefit-sharing, stigma, and bias	5
Thenral et al. (2020)[20]	India	Qualitative study	Medicine	Privacy/confidentiality, security/ hacking, and data ownership	5
Straw and Wu (2022)[21]	India	Review article	Informatics	Fairness, biases	3
Astărăstoae et al. (2024)[22]	Romania	Review article	Medicine	Informed consent, confidentiality, protection of personal data, accuracy of the information	4.5
Pitel et al. (2024)[23]	Romania	Review article	Medicine	Transparency, patient autonomy, and potential biases	4
Sokolchik VN & Razuvanov AI (2023)[24]	Belarus	Qualitative study	Medicine	Patient confidentiality, and non-discrimination, informed consent, and trust between developers and users	4.5
Farhud DD & Zokaei S (2021)[25]	Iran	Editorial	Medicine	Privacy and Data Protection, Informed Consent and Autonomy, Social Gaps and Justice, Empathy, and Sympathy	3
Sharma N & Gupta D (2023)[26]	India	Commentary	Medicine	Biases, Fairness, Transparency Explainability, Informed Consent and Autonomy	4
Ray PP (2023) [27]	India	Perspective	Surgery	Beneficence, Non-maleficence, Autonomy, Justice, Respect for person, Honesty and integrity	4
Zhang J & Zhang ZM (2023)[28]	China	Multidisciplinary approach (Qualitative Research)	Medicine	Data quality, algorithmic bias, opacity, safety and security, responsibility attribution, Patient privacy and autonomy	4.5
Naik et al.(2022)[29]	India	Review article	Medicine	Informed consent, safety and transparency, algorithmic fairness and biases, data privacy, Relevance	4
Sihlahla et al. (2023)[30]	South Africa	Qualitative research	Medicine	Transparency, Informed consent, Data protection, non-maleficence	4.5
Obasa AE & Palk AC (2023)[31]	South Africa	Correspondence	Medicine	Data security, privacy and appropriate consent, Algorithm biases and health equity, trust and responsibility	3
Jogi AA (2021)[32]	South Africa	Thesis	Medicine	Bias, Data inequity, data privacy, reliability, safety, transparency, accountability	4
Umer et al. (2023)[33]	Pakistan	Review article	Medicine	Liability, accountability, Beneficence, autonomy, and justice, bias mitigation, privacy, transparency	4.5

Study	Country	Research type	Discipline	Ethical Considerations	Quality
Majeed S & Qadir A (2024)[34]	Pakistan	Systematic review	Medicine	Transparency, data safety, biases, fairness, privacy, accountability	5
Baihakki MA & Qutayan SM (2023)[35]	Malaysia	Review article	Medicine	Data privacy and security risks, safety concerns, bias diagnosis, trust	4

In terms of disciplinary distribution, medical journals accounted for most publications (n=19), followed by surgery (n=2) and health informatics (n=1). The study systematically identified nine primary ethical themes related to AI in healthcare: autonomy, privacy, beneficence, justice, non-maleficence, transparency, trust, patient safety, cyber-security, and accountability. A thematic code mapping approach was employed to further categorize 16 sub-ethical issues, which were subsequently analyzed using full-text thematic analysis (Table 3).Privacy and justice emerged as the most frequently discussed ethical challenges across the reviewed literature, with recurring concerns regarding data security, algorithmic biases, and fairness. Furthermore, autonomy, patient safety, and cyber-security were consistently addressed, highlighting their significance in AI-driven healthcare. In contrast, beneficence was the least explored ethical principle in the included studies (Figure 2, Table 3).

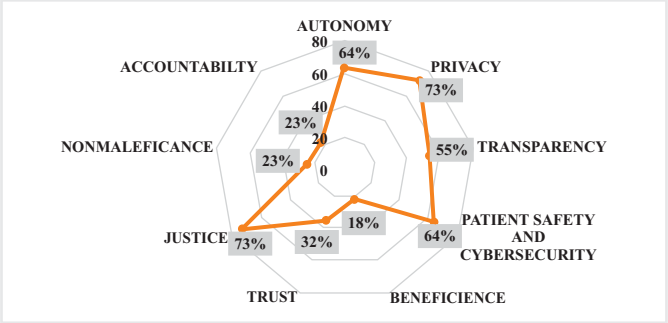

Figure-2: *The ethical principles in the systematic review are determined by the number of studies involved*

Discussion

Robotics and artificial intelligence (AI) in healthcare have the potential to enhance patient care, improve diagnostic accuracy, and support clinical decision-making. However, their integration raises significant ethical concerns, including privacy, trust,

Table 3: *Overview and description of identified Main ethical issues and sub-issues related to AI*

No.	Main Ethical Issues	No	Ethical Sub-Issues	References
1	**Autonomy**	14/22	Informed consent	14,22,24,25,26,29,30,31
			Respecting human autonomy	14,16,17,23,25,26,27,28,33
2	**Privacy**	16/22	Data privacy	14,15,17,18,19,20,25,28,29,31,32,33,34,35
			Confidentiality	17,20,22,24
3	**Beneficence**	4/22	Benevolence	14,16,27,33
4	**Justice**	16/22	Bias	18,19,21,23,26,28,29,31,32,33,34,35
			Fairness	14,21,26,29,34
			Discrimination	14,19,24,25
			Equality	17,19,31,32
5	**Non-maleficence**	5/22	Non- malevolence	14,16,25,27,30
6	**Transparency**	12/22	Transparency	14,16,17,18,23,26,28,29,30,32,33,34
			Explainability	26
7	**Trust**	7/22	Trust	16,18,24,27,31,32,35
8	**Patient safety and cyber security**	14/22	Patient safety	14,28,29,32,34,35
			Cyber security	17,18,19,20,22,25,28,29,39,31,35
9	**Accountability**	5/22	Accountability	28,31,32,33,34

accountability, and bias in AI-driven health technologies.[36] Accountability is a critical issue, particularly in cases where AI systems contribute to diagnostic errors, raising questions about liability and responsibility. Similarly, privacy concerns in AI-driven healthcare systems, especially in data-sharing partnerships, necessitate robust governance frameworks trust in AI technology hinges on the confidentiality of patient data and the assurance that AI systems operate fairly and transparently.[37] To mitigate biases in algorithm development and ensure ethical AI deployment, inclusive development approaches are recommended, focusing on transparency and equity throughout the AI lifecycle.

This study systematically examines ethical concerns surrounding AI in healthcare, identifies key gaps, and proposes evidence-based strategies to address these challenges, particularly in low- and middle-income countries (LMICs). A regional analysis of the reviewed literature revealed that most studies focused on Africa and South Asia, with India being a primary contributor.[38] Notably, ethical AI discussions in LMICs differ from those in high-income nations, as wealthier countries have already established ethical guidelines and regulatory mechanisms to govern AI in healthcare.[38] In contrast, AI adoption in resource-limited settings is often constrained by inadequate infrastructure, limited digital literacy, and challenges in data governance and regulatory compliance.[39]

A key finding of this systematic review is that justice and data privacy emerged as the most frequently discussed ethical concerns in AI-based healthcare technologies. This aligns with prior research indicating that equitable access to AI-driven healthcare and protection against algorithmic discrimination are among the most pressing ethical considerations.[40] Data Privacy is a global concern, especially in low- and middle-income countries (LMICs) due to weak regulatory mechanisms and limited cyber-security infrastructure. Standardized data governance practices, including secure data storage, ethical AI model training, and bias mitigation techniques, are needed to prevent healthcare decision-making disparities.[41]

Ethical concerns in AI-based healthcare include privacy, justice, autonomy, patient safety, and cyber-security. Autonomy in clinical decision-making is crucial for healthcare professionals and patients, reducing burnout, improving job satisfaction, and fostering collaborative decision-making. It ensures AI remains a supportive tool. [42] Similarly, cyber-security risks associated with AI-driven healthcare applications—such as data breaches, unauthorized data access, and AI model manipulation—underscore the importance of secure AI deployment strategies.[43] Addressing these issues will require stronger regulatory oversight, enhanced AI accountability measures, and comprehensive cyber-security protocols to safeguard patient data and healthcare systems.[44]

The integration of AI in healthcare is growing, but a globally recognized framework for ethical AI development and implementation is lacking. Initiatives like the Ethics Guidelines for Trustworthy AI provide conceptual recommendations but lack concrete methodologies for evaluating AI's ethical performance in real-world healthcare applications.[45] Ensuring human agency, technical robustness, security, transparency, fairness, and non-discrimination are crucial for maintaining AI's role as an assistive tool, preserving clinical expertise, and promoting fairness and non-discrimination. Addressing these ethical concerns will support responsible AI integration, fostering trust, protecting patient rights, and enhancing the effectiveness and fairness of AI applications in medical practice.[46]

While this review offers a comprehensive analysis of ethical concerns in AI-driven healthcare, it acknowledges several limitations, including publication bias, language constraints, and insufficient exploration of grey literature. To facilitate ethical AI adoption, future research should focus on in-depth regional analyses to address context-specific ethical challenges in AI implementation. Additionally, inclusive ethical frameworks must be developed, prioritizing engagement from patients, healthcare professionals, policymakers, and AI developers to ensure equitable and ethical AI integration. Strengthening AI governance through international collaborations is essential for maintaining ethical AI deployment across high-income and low-resource settings. Furthermore, expanding the scope of literature reviews by incorporating non-English sources and grey literature will provide a broader, more diverse perspective on ethical AI concerns. Addressing these aspects will contribute to responsible, transparent, and fair AI-driven healthcare systems globally.

Conclusion

Artificial intelligence presents ethical issues related

to data privacy, justice, autonomy, patient safety, and cyber-security, it also has the potential to enhance healthcare outcomes and access. Because of its quick growth, proactive ethical governance is required to keep marginalised populations from being excluded. In order to guarantee transparency and accountability, future research should concentrate on region-specific ethical standards, public-private partnerships for data security, and inclusive stakeholder engagement. In healthcare applications, bolstering AI governance frameworks will help reduce risks and advance equity.

Ethical Approval: Not applicable

Conflict of Interest: None

Funding Source: None

Authors' Contribution:

KJ: Conception and design, final approval of version to be published

MN: Acquisition of data, or analysis & interpretation of data

SR: Drafting of article, final approval of version to be published

AA: Acquisition of data

MS: Drafting of article

MAJ: Acquisition of data

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