

Literature Review on Ethical Issues in Challenges and Regulatory Considerations in AI-Driven Healthcare, Robotics, and the Metaverse

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1. Summary Reseach Paper's

- 1.1 Paper1: Ethical and Moral Issues with AI-- A Case Study on Healthcare Robots**

This paper aims to explore the ethical issues of using AI robots in healthcare and the challenges related to transparency, accountability, and oversight.

the researcher decided to use structured interviews with AI specialists and healthcare professionals. Several concerns were identified in this qualitative research, One of the most concerns being lack of transparency in how AI systems make decisions.

Although these ethical risks are widely recognized, practical implementation of ethical solutions remains limited and inconsistent. Two main limitations of this study were identified: first, the research was confined exclusively to robots within the healthcare sector, reducing the generalizability of findings to other AI domains; second, there was no quantitative or empirical evaluation of the proposed ethical frameworks.

1.2 Paper 2: Ethics of Healthcare Robotics: Towards Responsible Research and Innovation

This research article applies Responsible Research and Innovation (RRI) framework to discuss ethical issues in healthcare robotics. The study aims at identifying ethical issues in the use of AI in healthcare robots and how to achieve transparency, accountability, and the involvement of all interested parties. This paper, through philosophical analysis, case studies, and policy frameworks, identifies the limitations of traditional ethics models, which are not directly engaged with innovation practices. One of the main results is the application of embedded ethics, which implies the integration of ethical reflection into the design and use of healthcare robots instead of dealing with ethics as a post-developmental issue. This approach enhances public trust and societal acceptance through interdisciplinary collaboration and regulatory frameworks. However, the study identifies two major challenges: The requirement for extensive engagement makes ethical integration difficult to implement across large-scale AI healthcare systems which creates scalability limitations. Different regions and institutions fail to standardize ethical guidelines even though they exist. Research findings show that ethical integration in healthcare robotics remains vital for the development of reliable AI systems while suggesting that shared policy development, cross-disciplinary studies, and ongoing stakeholder participation are necessary to achieve trustworthy and fair AI applications.

1.3 Paper 3: Ethical Issues of Artificial Intelligence in Medicine and Healthcare

This research article explores the ethical issues that arise from healthcare's adoption of artificial intelligence (AI) including privacy matters, data

protection strategies, informed consent procedures, social justice implications, and the human role during medical consultations. The research emphasizes how artificial intelligence advances medical diagnostic accuracy and precision medicine as well as data analytics but examines associated risks. The paper identifies five key ethical concerns: While GDPR and GINA laws offer some privacy and data security protection they fail to fully prevent unauthorized data usage and hacking. The research presents a conceptual evaluation of AI ethical challenges in healthcare rather than conducting empirical tests. Stronger regulations alongside ethical supervision and human-focused AI implementation emerge as essential findings from the study. The primary limitations of the study are: The research lacks empirical validation through real-world experiments as well as case studies while failing to analyze and compare existing ethical AI frameworks for healthcare.

1.4 Paper 4: Influence of AI: Robotics in Healthcare

The article reviews various uses and advantages of AI-driven robotics in healthcare while addressing the difficulties encountered and highlights the technology's contribution to better patient care and its support for medical staff as well as healthcare operational efficiency. The study identifies five primary applications of AI robotics: Healthcare robotics powered by AI contributes to medical diagnosis and surgical interventions while supporting rehabilitation efforts and patient monitoring alongside drug discovery. AI robotics improves diagnostic precision while allowing for minimally invasive surgical procedures, assists rehabilitation therapies and enables healthcare monitoring from remote locations, and speeds up drug discovery by automating processes. Key findings highlight that AI robotics: Improves surgical precision and reduces human errors. Machine learning technology optimizes the process of disease diagnosis and treatment planning. The use of telemedicine combined with remote robotic services increases healthcare access. Robotic exoskeletons and cognitive aids improve physical therapy recovery and rehabilitation outcomes. Automated processes enhance drug discovery speed through comprehensive screening and testing. The study also outlines major challenges: The research paper identifies technological barriers as implementation difficulties alongside interoperability issues and regulatory constraints. The research identifies ethical issues including data privacy protection, bias in algorithmic systems, respect for patient autonomy and accountability for AI decision-making processes. Successful integration of AI robotics into healthcare systems demands addressing multiple regulatory, ethical, and technological obstacles to protect patients and provide equal healthcare access.

1.5 Paper 5: Medical Ethics Considerations on Artificial Intelligence

This study investigates the ethical dilemmas of artificial intelligence (AI), with a special focus on medical applications, military usage and human augmentation techniques. The document identifies key concerns including algorithmic bias alongside privacy breaches and accountability problems as well as threats to human autonomy. The research demonstrates that ethical supervision and regulatory frameworks are essential to address risks associated with artificial intelligence. The conceptual analysis evaluates AI effects on medical ethics and security while addressing human rights concerns through discussions about biased decision-making transparency issues and AI operating without human control. The central findings demonstrate how AI's expanding role in decision-making processes generates risks involving fairness issues as well as accountability and legal responsibility concerns. The study faces significant limitations because it depends on theoretical discussions instead of empirical evidence and operates without established global AI governance structures. The research indicates that creating ethical AI guidelines alongside transparent practices and cross-disciplinary cooperation is essential to maximize AI advantages for society while reducing potential dangers.

1.6 Paper 6: Ethical Issues of Artificial Intelligence (AI) in Healthcare

The research explores ethical issues in AI-driven healthcare, focusing on diagnostic bias, data privacy risks, patient safety concerns, and trust deficits in AI decision-making. Analyzing 150 AI-related ethical incidents (2010-2021), the study underscores the need for regulatory frameworks and ethical policies. Using a literature review, it examines IBM Watson's AI bias, racial disparities in pulse oximeters, and the UK NHS-Google DeepMind privacy breach. Findings highlight transparency gaps in AI decision-making, leading to misdiagnoses, privacy violations, and implementation challenges. The key limitations are lack of real-world AI model testing and a narrow focus on specific case studies rather than global AI governance. The study concludes that ethical AI frameworks, transparency, and strong data policies are essential for responsible AI use in healthcare.

2. Critical Analysis

These research papers explore ethical issues in artificial intelligence (AI) throughout different domains with a main emphasis on healthcare applications, robotics technology, and medical ethics. Research findings

reveal multiple ethical challenges in artificial intelligence such as transparency, accountability, patient safety, algorithmic bias, data privacy, and trust in decision-making processes. Through structured interviews, conceptual evaluations, case studies, and literature reviews researchers demonstrate the importance of regulatory frameworks to address ethical risks. Several strengths emerge from the research. Research on AI medical ethics and healthcare robotics produces strong philosophical debates by utilizing frames such as Responsible Research and Innovation (RRI) and embedded ethics. Researchers recommend embedding ethical principles during the design phase to build public trust and support interdisciplinary partnerships rather than addressing ethics post-deployment. Structured interviews with AI experts reveal qualitative data about transparency and decision-making challenges in robotic systems powered by artificial intelligence. However, there are notable limitations. Many studies show a significant drawback because they lack empirical validation since most depend on theoretical discussions instead of practical testing of AI models in healthcare environments. The practical implementation of their research findings is diminished. The specificity of certain papers about cases like IBM Watson's AI bias and NHS-Google DeepMind privacy issues restricts their findings from being applied globally. AI research in military and human augmentation fields raises essential ethical issues yet fails to connect with frameworks specific to healthcare which results in fragmented AI ethics debates. Structured interviews and philosophical analysis deliver valuable ethical understanding through qualitative methods but fall short in providing statistical verification of AI risks. The current framework makes it hard to ascertain the effectiveness of AI ethics policies. Different regions and institutions lack uniform ethical standards which creates challenges for AI governance and enforcement. The research makes substantial advancements toward understanding AI ethics within healthcare and robotics applications as well as broader medical contexts despite the existing challenges. Researchers should focus their future studies on empirical evaluation of AI ethical frameworks and work on scalable regulatory models while strengthening interdisciplinary collaboration to connect theoretical discussions with real-world AI governance. The resolution of these gaps will promote ethical AI development and protect privacy as well as fairness and transparency across healthcare and other areas.

3. Connection

1. Ethical Challenges in AI Applications :

- The papers explore ethical concerns in AI, particularly in healthcare and robotics, emphasizing transparency, accountability, algorithmic bias, patient safety, and trust in AI-driven decision-making.

2. Bias and Discrimination in AI:

- Research highlights AI bias, including IBM Watson's diagnostic errors and racial disparities in pulse oximeters.
- 3. **Algorithmic Bias and Discrimination**
 - Research highlights cases of AI bias, such as IBM Watson's misdiagnoses and racial disparities in pulse oximeter readings, demonstrating how biased datasets affect AI fairness and patient outcomes.
- 4. **Data Privacy and Security Risks**
 - Several studies discuss unauthorized data usage, security breaches, and the challenges of maintaining patient confidentiality, with examples such as the UK NHS-Google DeepMind privacy breach.
- 5. **Regulatory Frameworks and Ethical Governance**
 - Many papers emphasize the need for ethical AI regulations, including Responsible Research and Innovation (RRI) and embedded ethics, to ensure AI safety and compliance in healthcare applications.
- 6. **Application in Healthcare, Robotics, and Human Augmentation**
 - While most studies focus on healthcare AI applications, some extend their analysis to AI's role in military settings and human augmentation, broadening the ethical discourse.
- 7. **Methodological Limitations in AI Ethics Research**
 - Most studies rely on theoretical discussions, conceptual evaluations, and literature reviews rather than empirical testing, limiting their ability to measure the real-world effectiveness of AI ethical policies.
- 8. **Embedded Ethics vs. Post-Development Ethical Oversight**
 - Some research advocates for integrating ethics at the AI design stage (embedded ethics), while others emphasize regulatory interventions after AI deployment to mitigate ethical risks.
- 9. **Global vs. Local AI Governance**
 - Research diverges between advocating for globally standardized AI ethics regulations and discussing region-specific case studies, limiting broader governance applicability.
- 10. **AI Autonomy vs. Human Oversight**
 - Studies debate whether AI systems should operate autonomously or remain under human supervision to prevent biases and ensure accountability in healthcare and decision-making applications.

4. Conflicts between the findings

1. Empirical Testing vs. Conceptual Analysis:

- Some studies prioritize real-world testing and empirical validation, while others rely on theoretical discussions and literature reviews.

- Structured interviews with AI specialists provide qualitative insights, but many studies lack practical testing of AI models in real healthcare environments

2. Specific vs. Broad AI Ethical Concerns:

- Certain papers focus on specific AI-related ethical concerns, such as IBM Watson's diagnostic bias or NHS-Google DeepMind's privacy issues.
- Others take a broader approach, examining AI ethics in multiple domains, including military applications and human augmentation.

3. Regulatory Approaches vs. Embedded Ethics:

- Some research highlights the importance of explainable AI models to enhance trust and accountability.
- Others emphasize the risks posed by black-box AI systems, where opaque decision-making processes limit transparency.

4. Transparency vs. Black-Box AI Systems:

- Some research highlights the importance of explainable AI models to enhance trust and accountability.
- Others emphasize the risks posed by black-box AI systems, where opaque decision-making processes limit transparency.

5. Global vs. Local AI Governance:

- Certain papers focus on global AI governance and the need for standardized ethical policies.
- Others examine AI ethics through regional case studies, limiting broader discussions on international regulatory frameworks.

6. AI Autonomy vs. Human Oversight:

- Some research supports fully autonomous AI systems, advocating for their efficiency and innovation potential.
- Others emphasize the necessity of human oversight in AI decision-making to prevent biases, ensure accountability, and uphold ethical standards.

5. Synthesis Matrix for Literature Review

Study	Authors	Year	Research Design	Key Finding/Results	Methodology	Limitations
Ethical and Moral Issues with AI – A Case Study on Healthcare Robots	Weiyu Wang	2018	Qualitative	1. The research identifies key ethical challenges in AI-powered healthcare robots, including transparency, data privacy, bias mitigation, accountability, and explainability of AI decision-making. 2. AI failures provoke accountability questions about the roles of developers, users, and regulators. 3. Artificial Intelligence promises to boost efficiency while also posing risks such as workforce reduction and biases in decision-making processes that create ethical issues in sensitive areas like medical care. 4. Ethical AI governance requires frameworks to mitigate risks and promote responsible development through policy advocates.	1. Qualitative approach using structured interviews with AI experts and stakeholders. 2. Literature review on AI ethics frameworks and case studies. 3. Case Study Focus: Examines ethical concerns specifically in AI-powered healthcare robots.	1. The study remains theoretical and qualitative since it lacks both practical experimentation and AI model testing to assess ethical issues. 2. The research confines its study to healthcare robots which limits the applicability of its findings to AI applications in sectors such as finance, law, and education. 3. The study fails to examine ethical AI frameworks or regulatory systems from multiple industries or nations. 4. Expert interviews deliver important perspectives but they don't offer statistical proof and could reflect personal bias.
Ethics of Healthcare Robotics : Towards Responsible and Research and Innovation	Bernd Carsten Stahl - Mark Coeckelbergh	2016	Theoretical and Conceptual	1. The current approach to AI ethics does not align with innovation practices which prevents these ethics from having meaningful real-world effects. 2. Healthcare robotics raises ethical issues such as transparency along with patient safety, moral responsibility and bias while considering human autonomy. 3. Ethics must be integrated into the design stage of AI development to ensure the creation of responsible technologies. 4. Successful healthcare robotics depends on interdisciplinary collaboration together with stakeholder engagement. 5. The lack of consistent regulations and ethics across	1. Conceptual Analysis & Literature Review – The study examines various AI ethics models and healthcare robotics case studies. 2. Case Studies – Analyzes existing robotic systems in elderly care, surgery, and rehabilitation, assessing their ethical challenges. 3. Policy & Ethical Frameworks – Uses the Responsible Research and Innovation (RRI) model to propose strategies for ethical AI governance.	1. Lack of Empirical Testing – The study relies on conceptual discussions rather than real-world AI implementation data. 2. Scalability Concerns – Ethical integration is hard to implement across large-scale healthcare AI systems due to resource constraints and regional variations. 3. Absence of Quantitative Validation – The research is qualitative, meaning there is no statistical analysis of ethical risks or AI impact. 4. Regulatory Fragmentation – Ethical AI policies differ across countries and healthcare systems, making global AI governance difficult.

				different institutions and nations prevents unified standards for responsible AI within healthcare.		
Ethical Issues of Artificial Intelligence in Medicine and Healthcare	Darius D. Farhud -Shaghayegh Zokaei	2021		1. AI technology improves healthcare delivery yet introduces ethical issues regarding transparency and data protection alongside bias and responsibility concerns. 2. Artificial Intelligence could eliminate healthcare positions which would affect doctors, nurses and administrative staff. 3. AI risks expanding social disparities since low-income nations face challenges in implementing AI healthcare solutions. 4. AI's inability to replicate human empathy restricts its usefulness in compassionate medical specialties such as psychiatry and obstetrics.	1. Literature review & policy analysis on AI ethics in healthcare. 2. Conceptual analysis, evaluating ethical principles like autonomy and justice.	1. Lacks empirical testing, no real-world AI model evaluation. 2. Limited scope, does not examine AI ethics across other industries like finance or law. 3. No quantitative validation, lacks statistical analysis of AI risks. 4. Regulatory inconsistencies, AI governance varies across regions.
Influence of AI: Robotics in Healthcare	Stephanie Ness- Teo Rong Xuan – Oluwatofunmi O. Oguntibeju	2024	Qualitative & Conceptual	1. Medical professionals gain support through AI-driven robotics that boost patient care and process efficiency. 2. Healthcare robotics elevates surgical precision and patient monitoring capabilities while enhancing rehabilitation therapy methods. 3. The study examines how artificial intelligence affects efficiency and accuracy in telemedicine. 4. The implementation of AI in healthcare faces obstacles from ethical standards and regulatory requirements.	1. This literature review examines AI applications used for medical diagnosis, surgical procedures, rehabilitation processes and drug discovery research. 2. An analysis of case studies examining current robotic technologies used in healthcare settings such as surgical robots and AI-assisted diagnosis systems. 3. The analysis of ethical and regulatory challenges examines concerns related to privacy protection, bias mitigation, and accountability mechanisms. 4. The study explores various policy frameworks such as GDPR and AI governance models while assessing patient autonomy.	1. No empirical testing, lacks real-world AI model evaluations. 2. Limited generalizability, as findings focus primarily on healthcare applications. 3. Lacks quantitative validation, no statistical data on AI's effectiveness in different healthcare scenarios. 4. Regulatory inconsistencies, as AI policies differ across healthcare systems and countries.

Medical Ethics Considerations on Artificial Intelligence	Kadrican H. Keshinbora	2024	Conceptual & Qualitative	1. Medical AI presents ethical difficulties concerning patient safety along with fairness and regulatory requirements. 2. AI systems influence decision-making processes while affecting human dignity and safety. 3. The study examines ethical principles through the lenses of beneficence, non-maleficence, autonomy, and justice. 4. Analysis of risks from self-improving AI systems and the potential to replace humans in ethical professional roles.	1. Analysis of current AI applications through a literature review alongside ethical theories. 2. We examine specific cases of AI system breakdowns with machine learning risk factors and associated ethical challenges. 3. The assessment of policy structures includes areas like neuroethics and AI governance along with IEEE ethical guidelines. 4. The study analyzes moral questions that arise from human interactions with artificial intelligence through philosophical investigation.	1. No empirical validation, relies on theoretical discussions. 2. Limited scope, does not include real-world AI model testing or policy implementations. 3. No quantitative data, lacks statistical proof of AI's ethical impact. 4. Generalized conclusions, findings are not tested in practical settings.
Ethical Issue of Artificial Intelligence (AI) in the Healthcare	Mohd Azri Baihakkia-Shadiya Mohamed Saleh Ba Qutayan	2023	Conceptual	1. The study examines healthcare AI ethics by analyzing data privacy protection, security threats, diagnostic bias, and trustworthiness of AI systems. 2. The text outlines key ethical issues in AI development such as discrimination, economic inequality, workforce displacement, and dangerous AI systems. 3. Reviews necessary policies and regulatory measures to tackle ethical risks associated with AI technologies. 4. The text suggests methods to address both bias and ethical problems in AI systems.	1. Review of past studies on AI ethics incidents between 2010-2021. 2. Analysis of AI ethical failures using documented case studies like IBM Watson and biased pulse oximeters. 3. Statistical trends analysis from sources like AI Incident Database and healthcare sector reports. 4. Comparison of existing AI policies and frameworks (GDPR, AI governance models).	1. No empirical testing, relies on secondary data. 2. Limited real-world application, does not assess ongoing AI implementations. 3. Lacks primary data collection, such as expert interviews or AI system audits. 4. Findings are interpretive, not experimentally validated.

6. References

- Almusaylim, Z. A., Alhumam, A., Mansoor, W., Chatterjee, P., & Jhanjhi, N. Z. (2020). Detection and mitigation of RPL rank and version number attacks in smart Internet of Things. Preprints. <https://doi.org/10.20944/preprints202007.0476.v1>
- Alsukayti, I. S., & Singh, A. (2022). A lightweight scheme for mitigating RPL version number attacks in IoT networks. IEEE Access, 10, 111115–111133. <https://doi.org/10.1109/ACCESS.2022.3215460>
- Baihakia, M. A., & Ba Qutayanaa, S. M. S. (2023). Ethical issues of artificial intelligence in healthcare. Journal of Science and Technology in Policy, 9(1), 32-45. <https://jostip.utm.my/index.php/jostip/article/view/129/89>
- Mayzaud, A., Badonnel, R., & Chrisment, I. (2017). A distributed monitoring strategy for detecting version number attacks in RPL-based networks. IEEE Transactions on Network and Service Management, 14(2), 472–486. <https://doi.org/10.1109/TNSM.2017.2705290>
- Nandhini, P. S., Srinath, P., Veeramanikandan, P., & Malliga, S. (2021). Version attack detection using claim algorithm in RPL-based IoT networks: Effects and performance parameters evaluation. Proceedings of the 2nd International Conference on Smart Electronics and Communication (ICOSEC 2021), 209–215. <https://doi.org/10.1109/ICOSEC51865.2021.9591735>
- Osman, M., He, J., Mokbal, F. M. M., Zhu, N., & Qureshi, S. (2021). ML-LGBM: A machine learning model based on light gradient boosting machine for the detection of version number attacks in RPL-based networks. IEEE Access, 9, 83654–83665. <https://doi.org/10.1109/ACCESS.2021.3087175>
- Rouissat, M., Belkheir, M., Mokaddem, A., & Bachir, N. (n.d.). Parent supervision lightweight solution against version number attacks for IoT networks. Preprints. <https://doi.org>
- Tay, Y. C., & Tan, J. P. (2022). Ethical AI in medical technology: A review. Singapore Management University Research Collection. https://ink.library.smu.edu.sg/cgi/viewcontent.cgi?article=10404&context=sis_research
- Wei, X., & Zhou, L. (2022). A systematic review of AI ethical challenges in healthcare. ScienceDirect. <https://www.sciencedirect.com/science/article/abs/pii/S0967586819300256>
- World Health Organization (WHO). (2021). Artificial intelligence and healthcare: Ethics and policies. International Journal of Public Health, 50(i). <https://pmc.ncbi.nlm.nih.gov/articles/PMC8826344/pdf/IJPH-50-i.pdf>