GIJLSS
Greenation International Journal of Law and Social Sciences
+62 81210467572 https://research.e-greenation.org/GIJLSS greenation.info@gmail.com
GREENATION RESEARCH
DOI: https://doi.org/10.38035/gijlss.v3i2

Bridging Innovation and Governance: A Systematic Literature Review of Artificial Intelligence, Electronic Medical Records, and Legal Protection in Healthcare

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Abstract: The rapid digital transformation in healthcare has resulted in the extensive implementation of artificial intelligence (AI) and electronic medical records (EMR), providing significant enhancements in data-driven clinical decision-making and operational efficiency. The objective is to discern prevailing research trends, delineate significant difficulties, and offer strategic insights that harmonize innovation with governance. A systematic literature review, 20 peer-reviewed journal papers published from 2017 to 2024 were chosen based on relevance, methodological rigor, and contribution to the discourse. The data indicate that although AI substantially improves healthcare delivery, its incorporation into EMRs exceeds the establishment of cohesive legal protections. Principal themes encompass data security, liability uncertainty, algorithmic bias, and institutional preparedness. The study indicates that addressing this gap necessitates a multidisciplinary strategy that integrates legal, technical, and ethical factors. Regulatory change, patient-centric policies, and stakeholder collaboration are crucial for the responsible implementation of AI in healthcare.

Keywords: Artificial Intelligent, Electronic Medical Records, Legal Protection, Systematic Literature Review

INTRODUCTION

One of the most revolutionary developments in contemporary medicine is the incorporation of artificial intelligence (AI) into healthcare systems [1], [2]. In addition, the extensive use of electronic medical records (EMRs) has transformed the way that patient data is captured, saved, and accessed [3]. Together, AI and EMR technologies offer the promise of advanced analytics, improved diagnostic accuracy, personalized treatment, and more efficient healthcare delivery [4]. For many countries striving to modernize their health systems, the digital transformation driven by AI-EMR integration is not only beneficial but inevitable. However, while technological capabilities are advancing rapidly, there remains significant concern regarding the legal, ethical, and institutional readiness to manage such innovations responsibly [1], [5], [6], [7].

Recent evidence underscores a critical phenomenon that the pace of AI-EMR adoption is far outstripping the development of legal and governance structures. A study by Hossain et al. found that although over 70% of hospitals in Indonesia's major cities had adopted EMR systems, fewer than 20% implemented data governance protocols that meet international benchmarks [8]. The Indonesian Data Protection Bill (UU PDP) [9], passed only in 2022, came long after the deployment of cloud-based EMR platforms, leaving a legal vacuum for several years. This scenario is echoed in WHO's 2021 Global Strategy on Digital Health [10], which emphasized that in low- and middle-income countries, the growth of digital technologies often exceeds the pace of their regulation. Furthermore, inconsistencies in privacy enforcement contribute to increasing patient mistrust [11] regarding how personal data is handled within AI-driven systems [12]. These developments reveal a clear phenomenon gap: the technological transformation of healthcare is not being matched by coherent, enforceable, and context-sensitive legal frameworks.

While much has been written about the technological benefits of AI and the efficiency of EMRs, relatively few studies examine the legal and ethical dimensions of their integration, particularly in emerging economies. Mandl and Kohane (2017) emphasized that existing privacy models are insufficient in addressing the unique data flows generated by AI-enhanced EMRs. Mehta et al. (2020) reinforced this point, showing how the speed of AI evolution in healthcare systems often leaves behind questions of legal liability and patient rights. In Southeast Asia, Handayani et al. (2021) observed that while Indonesia's digital health systems are technically progressive, institutional and legal infrastructures are poorly aligned. Furthermore, Prastyanti and Sharma (2024) highlighted the fragmentation of discourse, noting the separation between legal scholarship and the practical realities of AI implementation. These studies affirm the need for integrative, interdisciplinary research that bridges technology, law, and ethics in the context of AI-EMR ecosystems.

Given this backdrop, the primary research problem addressed in this study is the absence of comprehensive frameworks that guide the ethical, legal, and effective use of AI in electronic health record systems. This lack of integration exposes patients to privacy risks, healthcare providers to legal ambiguity, and developers to accountability voids. There is an urgent need to understand how healthcare systems—especially those in developing countries—can foster innovation while upholding principles of justice, transparency, and patient autonomy.

This review is guided by the following research question: How are the legal and ethical implications of Artificial Intelligence (AI) implementation in Electronic Medical Records (EMRs) addressed in contemporary academic literature, particularly in relation to data protection, professional accountability, and regulatory frameworks? This question aims to identify critical themes in existing studies and to explore whether current scholarship sufficiently informs safe, ethical, and legally sound adoption of AI in healthcare documentation systems.

The contribution of this study lies in its ability to consolidate fragmented discussions from law, informatics, and health policy into a unified analytical lens. It offers both theoretical and practical value. On the theoretical level, it deepens the understanding of how governance mechanisms can evolve alongside technology. On the practical level, it provides actionable recommendations for health system administrators, legal reformers, and AI developers who aim to build sustainable and ethically sound digital health infrastructures. Particularly in contexts like Indonesia, the study offers grounded insights that can support national policy efforts.

The novelty of this research rests in its comprehensive and context-aware approach. While prior literature has tended to examine AI, EMR, or legal issues in isolation, this study integrates these domains within a single systematic framework. Additionally, it advances a localized understanding of global challenges by situating its analysis within the institutional

realities of a developing country. In doing so, it contributes original value to the continuing discussion on how legal protection, public trust in healthcare, and digital innovation can coexist.

METHOD

This study adopted a systematic literature review (SLR) methodology. The initial dataset was generated using the Publish or Perish tool with Google Scholar as the database. Keywords included "Artificial Intelligence," "Electronic Medical Records," and "Legal Protection."

Inclusion criteria were as follows: (1) peer-reviewed journal articles published between 2017 and 2024; (2) focus on AI implementation in EMR systems; (3) clear discussion of legal, ethical, or regulatory aspects. After removing duplicates and non-relevant literature, 20 top-cited articles were finalized for review.

The selected articles were then analyzed using thematic content analysis. Data extraction and coding were performed to identify recurring concepts, challenges, and proposed solutions. Themes were synthesized to reflect the intersection of technological capability, ethical concerns, and legal governance in the implementation of AI in EMRs.

RESULT AND DISCUSSION

This section presents the findings of the systematic literature review, which were analyzed using thematic content analysis. Based on the synthesis of the 20 most cited articles retrieved four major themes were identified that frame the current academic discourse on the legal and ethical dimensions of AI implementation in EMRs. These themes not only reflect the dominant concerns in global scholarship but also highlight critical gaps in policy, professional capacity, and regulatory readiness, particularly in emerging economies. The discussion below elaborates each theme in depth, providing an integrative perspective that links academic insight with practical governance implications

Table 1. The Most Cited Article

No	Authors	Title	Year	Source
1	S Maleki Varnosfaderani, M Forouzanfar [13]	The role of AI in hospitals and clinics: transforming healthcare in the 21st century	2024	Bioengineering
2	N Naik, BM Hameed, DK Shetty, D Swain, M Shah [14]	Legal and ethical consideration in artificial intelligence in healthcare: who takes responsibility?	2022	Frontiers in Surgery
3	GA Kaissis, MR Makowski, D Rückert [15]	Secure, privacy-preserving and federated machine learning in medical imaging	2020	Nature Machine Intelligence
4	Z Ahmed, K Mohamed, S Zeeshan, XQ Dong [16]	Artificial intelligence with multi-functional machine learning platform development for better healthcare and precision medicine	2020	Database
5	C Wang, S Liu, H Yang, J Guo, Y Wu, J Liu [17]	Ethical considerations of using ChatGPT in health care	2023	Journal of Medical

				Internet Research
6	CY Hsieh, CC Su, SC Shao, SF Sung, SJ Lin	Taiwan's national health insurance research database: past and future	2019	Clinical Epidemiology
7	H Roberts, J Cowls, J Morley, M Taddeo, V Wang [18]	The Chinese approach to artificial intelligence: an analysis of policy, ethics, and regulation	2021	Springer
8	N Khalid, A Qayyum, M Bilal, A Al-Fuqaha [19]	Privacy-preserving artificial intelligence in healthcare: Techniques and applications	2023	Computers in Biology and Medicine
9	RJ Chen, JJ Wang, DFK Williamson, TY Chen [20]	Algorithmic fairness in artificial intelligence for medicine and healthcare	2023	Nature biomedical Engineering
10	CE Haupt, M Marks [21]	AI-generated medical advice—GPT and beyond	2023	Jama
11	AS Ahuja [22]	The impact of artificial intelligence in medicine on the future role of the physician	2019	PeerJ
12	S Harrer, P Shah, B Antony, J Hu [23]	Artificial intelligence for clinical trial design	2019	Trends in pharmacological sciences
13	G Nittari, R Khuman, S Baldoni, G Pallotta [24]	Telemedicine practice: review of the current ethical and legal challenges	2020	Telemedicine and e Helath
14	C Cath [25]	Governing artificial intelligence: ethical, legal and technical opportunities and challenges	2018	Philosophical Transactions of the Royal Society …
15	B Singh [26]	Blockchain technology in renovating healthcare: Legal and future perspectives	2023	Revolutioning Healthcare Through Artificial Intelligence and Internet of Things Appications
16	V Bilgram, F Laarmann [27]	Accelerating innovation with generative AI: AI-augmented digital prototyping and innovation methods	2023	IEEE Engineering Management
17	T Panch, H Mattie, LA Celi [28]	The “inconvenient truth” about AI in healthcare	2019	NPJ digital medicine

18	DD Farhud, S Zokaei [29]	Ethical issues of artificial intelligence in medicine and healthcare	2021	Iranian journal of public health
19	F Pesapane, C Volonté, M Codari, F Sardanelli [30]	Artificial intelligence as a medical device in radiology: ethical and regulatory issues in Europe and the United States	2018	Insights into imaging
20	F Doshi-Velez, M Kortz, R Budish, C Bavitz [31]	Accountability of AI under the law: The role of explanation	2017	arXiv preprint arXiv

Privacy and Data Protection in AI-Based EMRs.

A primary concern identified across the literature is safeguarding patient data in AI-powered EMR systems [13]. Researcher propose federated learning and advanced encryption methods as solutions [15], [19]. However, without robust legal mandates enforcing data sovereignty and algorithmic transparency, these technologies may still expose patients to risk. Regulatory gaps in the classification and oversight of AI as a medical device [30], as highlighted, further exacerbate these vulnerabilities.

AI systems that utilize EMRs must process large volumes of private patient information, which makes them appealing targets for attackers. The absence of uniform security standards across jurisdictions further complicates efforts to ensure data integrity. In many developing countries, including Indonesia, the lack of technical infrastructure for data encryption and auditing mechanisms adds layers of vulnerability [32]. Furthermore, questions arise regarding the ownership of EMR data—whether it lies with patients, hospitals, software vendors, or governments—which complicates the enforcement of privacy rights. An effective response requires national legislation that recognizes EMRs as protected digital assets and mandates strong data governance models, including privacy impact assessments, real-time breach alerts, and sanctions for non-compliance.

Ethical Dilemmas and Accountability in Medical AI.

Legal ambiguity around responsibility in AI-assisted decisions emerged as a critical issue. Naik et al. [14] and Chen et al. (2023) stress the need for algorithmic fairness and defined accountability structures. The use of ChatGPT-like systems in clinical settings, while efficient, raises ethical concerns around misinformation and liability. The literature suggests that ethical boards must evolve to include AI oversight mechanisms [5], [7], [33], [34], [35], [36], [37], [38].

This theme exposes deep philosophical and practical concerns. When an AI algorithm provides erroneous clinical advice, the legal system struggles to assign fault [39]. Traditional models of liability—based on human negligence—are ill-suited to account for decisions generated by machine-learning models trained on potentially biased or incomplete datasets. Additionally, black-box algorithms often lack interpretability, meaning healthcare providers may not understand how the system arrived at a given diagnosis. This undermines informed consent, clinical transparency, and due process.

Moreover, algorithmic fairness has emerged as a central ethical demand [20], [35]. AI systems trained on datasets from high-income populations may perform poorly when applied in diverse, lower-resource contexts. For example, diagnostic algorithms that fail to incorporate variations in symptoms across racial or gender lines may contribute to unequal care. Ethical

frameworks must thus incorporate notions of justice, equity, and inclusivity in AI system development and implementation.

Regulatory Readiness and Legal Governance Frameworks.

The regulatory landscape varies widely, with countries like China developing proactive AI policies [18], while others lag behind. It is needed to advocate for interoperable, enforceable legal frameworks that align AI governance with health data protection laws [25], [26]. The use of blockchain and national health databases [40] offer promising models for legal compliance and data integrity.

One key insight is that most legal frameworks are reactive rather than proactive. Legislation often trails behind innovation, creating loopholes and ambiguities that can be exploited. For example, while The GDPR establishes the framework for EU data protection, it does not address many AI-specific concerns such as automated decision-making in healthcare or explainability standards for neural networks [41], [42].

A comparative legal analysis shows that AI governance in healthcare requires more than data protection laws. It also necessitates regulations that encompass software certification, ethical review committees, and transnational data sharing protocols. Blockchain technology, as suggested [26], holds potential for strengthening legal traceability and consent management. However, its integration with national e-health strategies remains minimal.

Policymakers should consider establishing independent AI regulatory bodies to oversee AI's ethical and safe application in therapeutic situations. Such institutions should have the mandate to audit algorithms, certify vendors, and mediate disputes involving AI-generated medical harm.

Transformation of the Medical Profession and Healthcare Ecosystem.

The traditional duties of healthcare practitioners are being altered by the use of AI. AI may redefine physicians' roles from decision-makers to system auditors [22], [23]. While tools like GPT support medical consultations [21], they may erode the humanistic aspects of care. Reskilling medical staff in AI literacy and ethics is essential for sustainable integration.

There is a growing consensus that medical professionals will need to acquire new competencies to coexist with AI [43], [44]. This includes not only technical skills such as data interpretation and system calibration, but also legal knowledge regarding consent, liability, and patient rights. Medical schools and continuing education programs must evolve to prepare future practitioners for hybrid environments where clinical judgment is supported—but not replaced—by algorithmic tools.

Moreover, institutions must guard against over-dependence on AI, which may reduce critical thinking and the therapeutic relationship between doctors and patients. The rise of AI-generated advice, especially from generative models like ChatGPT, poses risks of information oversimplification and loss of empathy. These concerns are particularly acute in low-resource settings where digital solutions may be deployed as cost-cutting substitutes for human labor.

Healthcare ecosystems must therefore be restructured not only around technological efficiency but also around values of compassion, professionalism, and ethical responsibility. This includes redesigning workflows, updating institutional policies, and fostering interdisciplinary dialogue between technologists, clinicians, ethicists, and legal scholars.

CONCLUSION

This review underscores the intricate relationship that exists in healthcare between AI, EMRs, and legal-ethical governance. The findings suggest that current legal and institutional frameworks are insufficient to manage the multifaceted risks posed by AI. A coordinated approach involving data protection laws, ethical guidelines, regulatory reform, and educational

innovation is vital. Policymakers and healthcare institutions must act swiftly to build resilient legal ecosystems that safeguard patient rights while harnessing the benefits of AI.

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