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Artificial Intelligence and Digital Health Technologies in Medical Practice

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Artificial Intelligence and Digital Health Technologies in Medical Practice

ABSTRACT

The integration of Artificial Intelligence (AI) into digital health applications is transforming contemporary medical practice by enhancing diagnostic accuracy, predictive capabilities, and healthcare delivery. While AI offers significant potential to improve healthcare outcomes, it also raises complex ethical, legal, and regulatory concerns that must be carefully addressed. This paper examines the central research problem of balancing technological innovation with patient rights and safety within the framework of medical jurisprudence. The primary objectives of the study are to analyse the role of AI in clinical decision-making, identify liability issues arising from errors in AI-assisted medical care, and evaluate the adequacy of existing legal frameworks in addressing these challenges. The study adopts a doctrinal and analytical methodology, relying on statutory provisions, policy guidelines, judicial precedents, and relevant secondary sources including reports and scholarly literature. The paper argues that the increasing reliance on AI-driven systems challenges traditional concepts of medical negligence and professional responsibility, particularly where algorithmic decision-making is involved. It further highlights concerns relating to data protection, informed consent, and algorithmic bias, which may adversely affect patient autonomy and trust. In the Indian context, the study evaluates emerging digital health regulations and identifies significant gaps in ensuring accountability and transparency. The paper concludes that while AI-powered digital health technologies have the potential to revolutionize healthcare, a comprehensive legal framework is essential to ensure ethical compliance, protect patient rights, and establish clear standards of liability for stakeholders including medical professionals, developers, and healthcare institutions in evolving digital ecosystems worldwide and future governance frameworks.

KEYWORDS

Artificial Intelligence; Digital Health; Medical Liability; Data Protection; Medical Jurisprudence

INTRODUCTION

The rapid growth of technological innovations has significantly

transformed the delivery of healthcare services.¹ The world is currently experiencing a revolutionary phase characterized by the integration of Artificial Intelligence (AI) and digital health technologies into medical practice.² These innovations have reshaped traditional healthcare systems by enabling precise diagnosis, improving patient outcomes, and enhancing operational efficiency.³ Technologies such as machine learning, natural language processing, and predictive analytics allow healthcare professionals to analyse vast volumes of medical data with speed and accuracy.⁴ Digital health technologies, including telemedicine, wearable devices, mobile health applications, and electronic health records, further enhance the capabilities of AI by enabling continuous patient monitoring, virtual consultations, and data-driven decision-making.⁵

Together, these technologies address persistent challenges within the healthcare sector, such as high costs, limited access to medical services, and inconsistencies in clinical practices.⁶ The adoption of digital health technologies accelerated significantly during the pandemic, highlighting their importance in ensuring continuity of care and strengthening healthcare infrastructure.⁷ Despite their transformative potential, the integration of AI and digital health technologies presents several challenges, including concerns related to data privacy, ethics, regulatory frameworks, and validation of AI systems.⁸ Additionally, disparities in access to technology may exacerbate existing inequalities in healthcare delivery.⁹ This paper aims to critically examine the role of Artificial Intelligence and digital health technologies in modern medicine by exploring their applications, benefits, limitations, and associated legal and ethical implications.¹⁰ It also seeks to analyse how these technologies can be effectively integrated into healthcare systems.

¹ Eric Topol, *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again* 1–10 (Basic Books 2019).

² World Health Organization, *Global Strategy on Digital Health 2020–2025* 1–5 (2020).

³ Daron Acemoglu & Pascual Restrepo, Artificial Intelligence and Jobs: Evidence from Online Vacancies, 119 *J. Econ. Persp.* 1, 3–6 (2020).

⁴ Andre Esteva et al., A Guide to Deep Learning in Healthcare, 25 *Nature Med.* 24, 24–26 (2019).

⁵ Ashish K. Jha et al., Use of Electronic Health Records in U.S. Hospitals, 360 *N. Engl. J. Med.* 1628, 1628–1630 (2009).

⁶ Scott Kruse et al., Evaluating Barriers to Adopting Telemedicine Worldwide: A Systematic Review, 7 *J. Telemed. & Telecare* 1, 4–7 (2018).

⁷ World Health Organization, *Maintaining Essential Health Services During COVID-19 Pandemic* 2–6 (2020).

⁸ Brent Mittelstadt et al., The Ethics of Algorithms: Mapping the Debate, 3 *Big Data & Soc'y* 1, 5–10 (2016).

⁹ Jan A. G. M. van Dijk, *The Digital Divide* 45–60 (Polity Press 2020).

¹⁰ Luciano Floridi et al., AI4People – An Ethical Framework for a Good AI Society, 28 *Minds & Machs.* 689, 690–695 (2018).

Review of Literature

The integration of Artificial Intelligence into medical practice has been widely explored across interdisciplinary literature, highlighting both its transformative potential and associated challenges.¹¹ A growing body of research recognizes the significant impact of these technologies on modern healthcare systems.¹² Early research on AI in healthcare primarily focused on its diagnostic capabilities. Jiang et al. (2017) demonstrated that AI-based systems can outperform traditional statistical methods in disease diagnosis.¹³

Similarly, Topol (2019) emphasized that AI should augment rather than replace clinical decision-making, underscoring its role in analysing large datasets and supporting evidence-based practices.¹⁴ In the domain of digital health, telemedicine and mobile health (mHealth) applications have been extensively studied. According to WHO (2020), digital health technologies have significantly improved access to healthcare services, particularly in remote and underserved areas.¹⁵ Kruse et al. (2018) found that telemedicine reduces healthcare costs while increasing patient satisfaction through remote consultations.¹⁶ Additionally, wearable health technologies have proven effective in continuous health monitoring and chronic disease management.¹⁷ Recent literature highlights the convergence of AI and digital health technologies. Esteva et al. (2019) demonstrated the effectiveness of AI-powered tools in mobile applications for disease detection, particularly in dermatology and radiology.¹⁸ Similarly, Bates et al. (2021) explored the use of AI in electronic health records (EHRs) to predict patient deterioration and enhance hospital management systems.¹⁹ However, several challenges are identified in the literature.

Data privacy and security remain major concerns due to the

¹¹ Eric Topol, *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again* 21–30 (Basic Books 2019).

¹² Daron Acemoglu & Pascual Restrepo, Artificial Intelligence and Jobs: Evidence from Online Vacancies, 119 J. Econ. Persp. 1, 5–8 (2020).

¹³ Fei Jiang et al., Artificial Intelligence in Healthcare: Past, Present and Future, 2 Stroke & Vascular Neurology 230, 231–235 (2017).

¹⁴ Eric Topol, *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again* 44–67 (Basic Books 2019).

¹⁵ World Health Organization, *Global Strategy on Digital Health 2020–2025* 9–15 (2020).

¹⁶ Scott Kruse et al., Evaluating Barriers to Adopting Telemedicine Worldwide: A Systematic Review, 7 J. Telemed. Telecare 4, 4–10 (2018).

¹⁷ Daniel J. B. Smith, Wearable Technology and Its Role in Healthcare, 5 Digital Health 1, 2–6 (2019).

¹⁸ Andre Esteva et al., A Guide to Deep Learning in Healthcare, 25 Nature Med. 24, 24–29 (2019).

¹⁹ David W. Bates et al., The Potential of Artificial Intelligence to Improve Patient Safety, 172 JAMA 212, 212–218 (2021).

sensitive nature of health information.²⁰Mittelstadt et al. (2016) highlighted ethical issues such as algorithmic bias, lack of transparency, and accountability.²¹Regulatory gaps also persist, as existing legal frameworks struggle to keep pace with technological advancements.²²Furthermore, the digital divide poses a significant challenge, as unequal access to technology may widen disparities in healthcare delivery. Van Dijk (2020) notes that the benefits of digital health technologies may not be equally distributed across different populations.²³Overall, the literature suggests that while AI and digital health technologies improve efficiency, accuracy, and accessibility, their implementation must carefully address ethical, legal, and social concerns.

Objectives

1. The exploration of the relevance of Artificial Intelligence with regard to enhancing diagnosis and decision-making in the medical field.
2. The evaluation of the effects of digital health technologies on accessibility and service delivery within the healthcare sector.
3. The analysis of the legal, regulatory, and ethical issues surrounding the use of Artificial Intelligence and digital health technologies in the medical field.

Research Methodology

The present study adopts a doctrinal and analytical research methodology.²⁴ It relies primarily on secondary sources of data, including peer-reviewed journals, books, conference proceedings, reports, and credible online databases.²⁵ This research involves a comprehensive review of literature related to Artificial Intelligence and digital health technologies to examine their applications, advantages, and limitations in the medical field.²⁶An analytical approach is employed to evaluate the legal, regulatory, and ethical implications

²⁰Shoshana Zuboff, *The Age of Surveillance Capitalism* 93–110 (PublicAffairs 2019).

²¹ Brent Mittelstadt et al., *The Ethics of Algorithms: Mapping the Debate*, 3 *Big Data & Soc'y* 1, 5–15 (2016).

²² Cary Coglianese & David Lehr, *Regulating by Robot: Administrative Decision Making in the Machine-Learning Era*, 105 *Geo. L.J.* 1147, 1155–1160 (2017).

²³ Jan A. G. M. van Dijk, *The Digital Divide* 45–60 (Polity Press 2020).

²⁴ S. N. Jain, *Legal Research and Methodology* 45–52 (LexisNexis 2016).

²⁵ William H. Putman, *Legal Research, Analysis, and Writing* 12–18 (Cengage Learning 2018).

²⁶ Mark A. Hall & Ronald F. Wright, *Systematic Content Analysis of Judicial Opinions*, 96 *Cal. L. Rev.* 63, 70–75 (2008).

associated with the adoption of these technologies.²⁷

ARTIFICIAL INTELLIGENCE IN DIAGNOSIS AND DECISION-MAKING

It is apparent that the use of Artificial Intelligence brings about transformational improvements in the field of diagnostics, specifically in terms of enhancing the accuracy, efficiency, and speed of diagnosis.²⁸ Through its ability to analyse large volumes of highly complex datasets, which include but are not limited to medical images, electronic health records, genomics, and laboratory results, AI can lead to early diagnosis and treatment of illnesses, such as cancer, cardiovascular diseases, and neurodegenerative diseases.²⁹ In addition, Artificial Intelligence makes a significant contribution to clinical decision making due to the use of predictive analytics.³⁰ The use of Clinical Decision Support Systems (CDSS) that utilize Artificial Intelligence can help clinicians identify appropriate treatments for patients by combining patient-related data with known medical knowledge.³¹ With the use of such technology, clinical errors will be reduced, and clinical decisions will become more consistent. Moreover, Artificial Intelligence helps in promoting personalized medicine.³² In addition, AI contributes to enhanced efficiency within the operations of healthcare facilities through automation of various repetitive tasks in both administration and clinical practice. For instance, data collection and preliminary analysis can be automated using artificial intelligence.³³ Notwithstanding, there exist numerous limitations that need to be considered. In particular, the accuracy and effectiveness of AI tools rely greatly on data. Thus, problems related to algorithmic bias, non-transparency, and non-interpretable AI outputs should be addressed.³⁴ These problems relate to reliability, ethical considerations, and overall quality of AI-based decision making. Furthermore, AI adoption entails significant

²⁷ Cary Coglianese & David Lehr, *Regulating by Robot: Administrative Decision Making in the Machine-Learning Era*, 105 Geo. L.J. 1147, 1155–1160 (2017).

²⁸ Eric Topol, *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again* 44–50 (Basic Books 2019).

²⁹ Fei Jiang et al., *Artificial Intelligence in Healthcare: Past, Present and Future*, 2 *Stroke & Vascular Neurology* 230, 231–234 (2017).

³⁰ Andre Esteva et al., *A Guide to Deep Learning in Healthcare*, 25 *Nature Med.* 24, 25–28 (2019).

³¹ David W. Bates et al., *The Potential of Artificial Intelligence to Improve Patient Safety*, 172 *JAMA* 212, 213–216 (2021).

³² Isaac S. Kohane et al., *Machine Learning in Medicine*, 380 *N. Engl. J. Med.* 1347, 1347–1355 (2019).

³³ John D. Halamka & Micky Tripathi, *The HITECH Era in Retrospect*, 377 *N. Engl. J. Med.* 907, 907–909 (2017).

³⁴ Brent Mittelstadt et al., *The Ethics of Algorithms: Mapping the Debate*, 3 *Big Data & Soc'y* 1, 5–12 (2016).

investments in terms of infrastructure and technical expertise.³⁵ Therefore, while the use of Artificial Intelligence in clinical practice is promising, it poses certain technical, ethical, and operational challenges to be resolved first.

DIGITAL HEALTH TECHNOLOGIES AND HEALTHCARE DELIVERY

It is clear from the results that digital health technology has considerably enhanced the availability of healthcare services, as well as the delivery of these services, especially among the people residing in remote areas.³⁶ Telemedicine, mobile health applications, and online consultation software have made sure that geographical boundaries no longer present any obstacles in accessing healthcare services, which have become easier and more efficient to use.³⁷ They prove to be most useful when the requirement for continuous healthcare exists, for example, in the case of chronic diseases.³⁸ Furthermore, digital health technologies help to increase patient engagement through increased involvement in their healthcare needs. The constant monitoring of health through wearables and mobile applications allows for monitoring the various physiological factors such as heartbeat, blood pressure, and glucose levels.³⁹ In relation to service delivery, digital technology, especially EHRs and integrated health information systems, facilitates both administrative and clinical work processes. Such technologies allow effective storage, access, and sharing of data between healthcare providers, thus promoting coordination, avoiding redundancies, and eliminating medical errors.⁴⁰ Additionally, improved communication using digital platforms promotes prompt and well-informed decision-making in healthcare institutions.⁴¹ However, numerous factors hinder the application of digital health technologies. Digital illiteracy on the part of patients and healthcare providers, poor technological infrastructures, and expensive implementation processes limit the use of such technologies.⁴² In

³⁵ Cary Coglianese & David Lehr, *Regulating by Robot: Administrative Decision Making in the Machine-Learning Era*, 105 *Geo. L.J.* 1147, 1155–1160 (2017).

³⁶ World Health Organization, *Global Strategy on Digital Health 2020–2025* 9–12 (2020).

³⁷ Scott Kruse et al., *Evaluating Barriers to Adopting Telemedicine Worldwide: A Systematic Review*, 7 *J. Telemed. Telecare* 4, 4–8 (2018).

³⁸ Thomas R. Insel, *Digital Health Technology and Chronic Disease Management*, 12 *Health Affs.* 45, 45–50 (2020).

³⁹ Daniel J. B. Smith, *Wearable Technology and Its Role in Healthcare*, 5 *Digital Health* 1, 2–6 (2019).

⁴⁰ Ashish K. Jha et al., *Use of Electronic Health Records in U.S. Hospitals*, 360 *N. Engl. J. Med.* 1628, 1628–1632 (2009).

⁴¹ John D. Halamka & Micky Tripathi, *The HITECH Era in Retrospect*, 377 *N. Engl. J. Med.* 907, 907–909 (2017).

⁴² Scott Kruse et al., *supra* note 2, at 8–10.

addition, there are threats relating to data protection and cyber security because the information involved is highly sensitive.⁴³ The unequal access to digital tools and technologies is another issue that increases the digital divide, which may further increase inequities in healthcare access and delivery.⁴⁴ Hence, even though digital health technologies contribute significantly to facilitating accessibility and service delivery, other issues should be addressed.

LEGAL, REGULATORY, AND ETHICAL ISSUES

Some of the key challenges identified by the studies indicate the necessity of understanding the legal, regulatory, and ethical questions that arise as a consequence of introducing AI and digital health tools into the clinical setting.⁴⁵ Patient data privacy remains one of the main problems because of the heavy dependence of these technologies on the collection, analysis, and processing of patients' health-related information.⁴⁶ Breaches of information security could have devastating consequences for patients and their confidential medical records.⁴⁷ It is important to note that the lack of coherent regulations in the area creates an obstacle in the process of incorporating artificial intelligence into the provision of health care services.⁴⁸ The fast evolution of technology has resulted in the creation of uncertainty with respect to liability, as there are often no means to identify who should be held responsible when AI systems cause a failure in diagnoses and treatment.⁴⁹ There are ethical considerations as well, especially those concerning the issue of algorithmic bias, fairness, and transparency. When AI algorithms are based on small or unrepresentative sample sizes, there can be an outcome bias, where people who have certain characteristics like race, gender, or socioeconomic standing will receive a different treatment compared to others.⁵⁰ Moreover, when there is no transparency and explainability of the process of making a decision using the artificial intelligence algorithm, which is known as the "black box" issue, it may undermine the trust that both patients and doctors should have in these new technologies.⁵¹ Finally, the results also show the issue of patient

⁴³ Shoshana Zuboff, *The Age of Surveillance Capitalism* 93–110 (PublicAffairs 2019).

⁴⁴ Jan A. G. M. van Dijk, *The Digital Divide* 45–60 (Polity Press 2020).

⁴⁵ Cary Coglianese & David Lehr, Regulating by Robot: Administrative Decision Making in the Machine-Learning Era, 105 Geo. L.J. 1147, 1150–1155 (2017).

⁴⁶ Shoshana Zuboff, *The Age of Surveillance Capitalism* 93–105 (PublicAffairs 2019).

⁴⁷ I. Glenn Cohen et al., Big Data, Big Tech, and Protecting Patient Privacy, 372 Science 141, 141–143 (2020).

⁴⁸ Cary Coglianese & David Lehr, *supra* note 1, at 1155–1160.

⁴⁹ Ryan Calo, Artificial Intelligence Policy: A Primer and Roadmap, 51 U.C. Davis L. Rev. 399, 410–415 (2017).

⁵⁰ Sendhil Mullainathan & Ziad Obermeyer, Dissecting Racial Bias in an Algorithm Used to Manage the Health of Populations, 366 Science 447, 447–453 (2019).

⁵¹ Brent Mittelstadt et al., The Ethics of Algorithms: Mapping the Debate, 3 Big Data &

autonomy and consent. The patients might not necessarily understand how AI technologies impact medical decisions and might not have a choice concerning what kind of care they receive.⁵² In addition, depending too much on AI tools may limit the involvement of human judgment in clinical reasoning.⁵³ Overall, the results point out that despite having significant advantages, Artificial Intelligence technologies require specific legislation, regulations, and ethics guidelines.⁵⁴

CONCLUSION

Artificial Intelligence and digital health technologies have emerged as transformative tools in modern medical practice, significantly enhancing healthcare quality, accessibility, and efficiency.⁵⁵ AI has demonstrated strong potential in improving diagnosis, decision-making, and personalized treatment, while digital health technologies have expanded access to healthcare and strengthened patient engagement.⁵⁶ However, these advancements are accompanied by critical challenges, including data privacy concerns, algorithmic bias, lack of transparency, and regulatory gaps.⁵⁷ The digital divide further raises concerns about unequal access to healthcare technologies.⁵⁸ Therefore, the successful integration of these technologies requires a balanced approach that combines innovation with robust legal, ethical, and regulatory frameworks.⁵⁹ Promoting collaboration among policymakers, healthcare providers, and technology developers is essential to ensure that these technologies are used responsibly and equitably, ultimately contributing to a more efficient and patient-centered healthcare system.⁶⁰

Soc'y 1, 5–12 (2016).

⁵² Luciano Floridi et al., *AI4People – An Ethical Framework for a Good AI Society*, 28 *Minds & Machs.* 689, 695–700 (2018).

⁵³ Eric Topol, *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again* 120–130 (Basic Books 2019).

⁵⁴ World Health Organization, *Ethics and Governance of Artificial Intelligence for Health* 15–25 (2021).

⁵⁵ Eric Topol, *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again* 1–10 (Basic Books 2019).

⁵⁶ World Health Organization, *Global Strategy on Digital Health 2020–2025* 9–15 (2020).

⁵⁷ Brent Mittelstadt et al., *The Ethics of Algorithms: Mapping the Debate*, 3 *Big Data & Soc'y* 1, 5–12 (2016).

⁵⁸ Jan A. G. M. van Dijk, *The Digital Divide* 45–60 (Polity Press 2020).

⁵⁹ Cary Coglianese & David Lehr, *Regulating by Robot: Administrative Decision Making in the Machine-Learning Era*, 105 *Geo. L.J.* 1147, 1155–1160 (2017).

⁶⁰ World Health Organization, *Ethics and Governance of Artificial Intelligence for Health* 15–25 (2021).