

The role of artificial intelligence in enhancing health security in Algeria

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Abstract: Establishing a regulatory and legislative framework for the use of artificial intelligence in the healthcare sector has become an urgent necessity, given the opportunities these technologies provide for developing an integrated health system that ensures high-quality medical services and strengthens disease prevention strategies. In the face of global health challenges such as the spread of infectious and chronic diseases and the increasing risks of pandemics, Artificial intelligence emerges as a pivotal tool for supporting health and societal security. It offers wide-ranging capabilities in early diagnosis, epidemic prediction, and big data analysis, in addition to enhancing the efficiency of medical resource management and guiding public policies toward more proactive and effective decision-making. This study seeks to contribute to current debates on health and societal security by highlighting the central role of artificial intelligence in supporting the development of resilient health systems capable of addressing global health challenges.

key words:

Health Security- Artificial Intelligence- Healthcare Resource Management- Health Policies- Medical resources.

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introduction:

In a rapidly evolving world increasingly relying on technology as a trusted partner in knowledge production, numerous research questions have emerged regarding health security and the impact of artificial intelligence technologies on preventive and therapeutic measures to curb the spread of serious diseases in countries and communities, particularly amid challenges posed by the vast amounts of patient data subject to diagnosis and treatment. With the continued rise of the health security discourse in global health which has rendered health security nearly synonymous with global health a significant portion of critical studies on how health is framed in the context of security, and its implications for global governance, policies, and international relations, has primarily emerged from disciplines such as international relations, security studies, public policy, and law.

Accordingly, establishing a regulatory and legislative framework to govern the use of AI technologies in the health sector constitutes a priority within the government's agenda, which aims to develop an advanced healthcare system that ensures high quality treatment and specialized medicine. This reflective article, directed at the global health audience actively engaged in policy and practice, seeks to encourage critical engagement in studying the political significance of health security and to foster discussions on the role of AI in strengthening health security. It does so by linking theoretical debates with empirical applications, thereby critically evaluating the framing of health security policies in terms of the extent to which AI programs are managed and aligned with public health policies in Algeria. From this perspective, the following research question is posed:

How can artificial intelligence technologies contribute to supporting and developing health security policies in Algeria amid current global health challenges?

Section 1: Artificial Intelligence as a Strategic Tool to Strengthen Health Security

Health security encompasses a set of measures and procedures aimed at preserving human health, protecting individuals, and preventing threats to well-being. Human health is considered both at the individual level, which includes physical, mental, and psychological aspects, and at the public health level, which reflects the

health of individuals within the community and the enhancement of collective immunity. The World Health Organization has identified key areas of health security, including emerging and infectious diseases, malnutrition and food insecurity, international crises and humanitarian emergencies, climate change, chemical and radiation hazards, and the risk of biological terrorism¹.

Amid rapid advancements in modern technology, states and governments have sought to harness artificial intelligence in various domains, including healthcare, to improve public health, enhance the quality of healthcare services, and, consequently, support health security. Key applications of artificial intelligence in the health sector include:

A). Machine Learning in Healthcare

AI technologies have moved beyond experimental tools in laboratories to become integral to modern healthcare systems.

1. Definition of Machine Learning in Healthcare:

Machine learning is a branch of AI that allows systems to learn from data and detect patterns with minimal human intervention. It has brought a transformative impact on healthcare and, as technology continues to evolve, it is expected to significantly influence disease diagnosis and treatment².

2. Applications of Machine Learning in Healthcare:

Machine learning tools are widely used to analyse complex data and predict outcomes in scientific research. For instance, in medicine, machine learning has helped develop models to forecast disease progression based on health data. AI algorithms can also analyze a patient's medical history, laboratory results, and other data points to provide accurate diagnoses, enable early disease detection and

¹- Belkhir A, "The Challenge of Health Measures in Algeria in the Shadow of Revolutionary Crises: A Critical Reading of the Role of the National Agency for Health Security, Effective and Political Journal, Volume 7, Issue 1, 2022, p. 157.

²- The Arab Hospital Magazine, Machine Learning – ML, <https://www.thearabhospital.com>

³- Al-Bayati F, "Artificial Intelligence in Scientific Research: Tools and Techniques for Contemporary Researchers, First Edition, 2024, p. 28.

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treatment, analyse health survey data, and identify interventions that can assist healthcare professionals in improving patient care¹

Beyond diagnosis and prediction, machine learning is employed to combat infections, enhance personalized care, analyse medical imaging with greater accuracy, improve treatment outcome predictions, and optimize hospital and health center management by efficiently distributing medical resources. It also supports healthcare staff in tasks such as detecting anomalies during medical imaging, assisting in robotic surgery, remote patient monitoring, and tracking medical histories. These applications reduce the operational burden in healthcare while improving patient care².

3. Challenges in Applying Machine Learning in Healthcare:

Significant challenges include potential violations of privacy and personal data rights, whether through hacking, data espionage by cybercriminals, or the misuse of stolen data.³ Machine learning requires large, diverse datasets to make accurate decisions; however, healthcare institutions may face data scarcity or difficulties in collecting comprehensive datasets. Artificial intelligence applications in healthcare must ensure patient privacy and data protection, supported by appropriate legal and technical frameworks to guarantee safe implementation⁴

B). Deep Learning

AI has become an indispensable partner in healthcare systems, with deep learning representing a revolution in the field.

1. Concept of Deep Learning:

Deep learning, a subset of machine learning, uses multi-layered artificial neural networks to simulate the human brain.⁵ In research, deep learning has become a crucial tool for analyzing medical images

¹-Maher Abdel Latif R, **Artificial Intelligence in Healthcare**, First Edition, Arab Center for Authoring and Translation of Health Sciences, Kuwait, 2024, p. 1.

² - The Arab Hospital Magazine, Machine Learning – ML, <https://www.thearabhospital.com>

³ - Muhammad A, **Criminal Liability for Artificial Intelligence Damages**, Dar Al Nahda Al Arabiya, First Edition, Cairo, Egypt, 2024, p. 31.

⁴ - Machine Learning in Healthcare, <https://fahed.ai/machine-learning-in-healthcare/>

⁵ - Al-Bayati F, Op.cit, p. 28.

and drugs and plays a significant role in predicting motor disorders, cardiovascular diseases, cancer, lung diseases, and more.¹

2. Types of Medical Imaging Supported by Deep Learning:

Deep learning serves key imaging modalities, including X-rays, MRI, CT scans, ultrasound, and nuclear imaging (PET, SPECT). Applications include breast cancer detection from mammograms, lung disease identification from X-rays, brain image analysis to detect Alzheimer's or stroke markers, and tumor identification and differentiation from healthy tissue.

3. Challenges of Deep Learning in Healthcare:

Challenges include the need for vast, diverse medical datasets, difficulty in interpreting neural network decisions, ethical and privacy issues, and biases from imbalanced data. AI may struggle with complex, sensitive scientific topics, potentially generating outputs more complex than human-written texts, raising ethical concerns such as unintentional plagiarism or misleading information.² Using limited reference materials may hinder AI generated text from accurately conveying nuances and authors' contexts, potentially affecting quality and readability³.

C). Cybersecurity as a Component of Health Security

Cybersecurity is a core element of health security in the digital era, as protecting medical information directly impacts the continuity of healthcare services and patient safety. With escalating digital threats and increased use of sensitive data, AI serves as a pivotal tool in building proactive systems capable of detecting threats, responding to them, and safeguarding patient privacy.⁴ Key applications include:

¹ - Taaima A, **Deep Learning and Its Uses in Healthcare: 25 Deep Learning Projects Solved and Explained Using Python**, DL in Arabic, Iraq, 2022

² - Deep Learning and Medical Imaging, <https://arsco.org/articles/article-detail-45966/>

³ - Al-Gharbi A M, Artificial Intelligence in Higher Education and Scientific Research, Arab Science Community Organization, arsko.org

⁴ - Hernandez-Jaimes, M. L., Martinez-Cruz, A., Ramírez-Gutiérrez, K. A., and Feregrino-Urbe, C, “**Artificial Intelligence for IoMT Security**”, A Review of Intrusion Detection Systems, Attacks, Datasets and Cloud-Fog-Edge Architectures. Internet of Things, Volume 23, 100887, 2023, P. 2.14.

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1. Protecting Sensitive Data via Early Detection Algorithms: AI analyzes data patterns and contexts within hospitals to detect unusual behavior indicating potential breaches or leaks, using AI-driven intrusion detection systems that learn from previous attacks and issue instant alerts¹.

2. Countering the Financial Value of Data via Smart Encryption: AI enhances predictive encryption techniques and manages dynamic keys, rendering leaked data useless and reducing its black-market value².

3. Updating Legacy Systems through Intelligent Vulnerability Analysis: AI systems can analyze older infrastructures to identify security vulnerabilities and propose immediate corrections, e.g., detecting "active weak points" in outdated electronic health records³.

4. Securing Interconnected Systems via Continuous Monitoring: AI algorithms monitor connected healthcare networks, identifying complex intrusion patterns that are difficult to detect by conventional means, reducing the risk of cascade attacks across networks⁴.

5. Raising Security Awareness through Smart Training and Simulation: AI-powered interactive training platforms simulate realistic cyber-attacks, enabling healthcare staff to acquire practical cybersecurity skills without endangering actual systems⁵.

¹ - Okonkwo, Roy, Adegede, Job, Tettey, Clement Yayra, Owusu, Betty Anyamesem, Adebayo, Sulaimon, **"A Study on Advanced AI-Driven Continuous Compliance Monitoring for Cybersecurity Regulations in Healthcare"**, World Journal of Advanced Research and Reviews, Volume 26, N. 3, 2025, P. 2249-2255

² - Abdelhedi M, Omessaad H, **Intelligence artificielle pour la sécurité en e-santé dans Gestion de la sécurité en e-santé, Techniques et dispositifs de protection des données médicales**, Rennes : ISTE Groupe, 2024, P. 213-230.

³ - Kodela, Venkatesh, **"Securing Medical IoT Devices: AI-Based Approaches to Vulnerability Management"**, International Journal of Intelligent Systems and Applications in Engineering, Volume 12, N. 1s, 2024, P. 827-832.

⁴ - Zhang, Wei, Helena Duarte, **"AI-Enhanced Continuous Monitoring for Securing Interconnected Healthcare Systems"**, IEEE Journal of Biomedical and Health Informatics, Volume 28, N. 2, 2025, P. 133.

⁵ - brahim N, and Jonathan S, **"Intelligent Simulation-Based Training for Cybersecurity Awareness in Healthcare"**, Journal of Medical Systems, Volume 48, N. 5, 2024, P. 97.

6. Supporting Regulatory Compliance via Intelligent Monitoring: AI automatically analyzes compliance with healthcare regulations (e.g., personal data protection), monitoring data flows to detect potential violations before they occur¹.

7. Responding to Ransomware Attacks with Automated Countermeasures: AI can detect ransomware activity instantly, isolate affected systems, and trigger self-encrypted backup responses, ensuring the continuity of essential healthcare services².

8. Compensating for Limited Resources via AI Systems: In resource-constrained institutions, AI can perform monitoring, analysis, and security updates autonomously, reducing reliance on large human teams while ensuring efficient use of technical and financial resources³.

Integrating AI into the protection of healthcare data and systems represents not just a technical solution but a strategic choice linking cybersecurity with national health security. Data protection is not merely a digital defense; it ensures the continuity of medical services, maintains public trust in healthcare systems, and secures health sovereignty amid escalating global challenges⁴.

Below, we outline a framework that coordinates digital health data protection, based on the integration of technology, cybersecurity, policies, legislation, data governance, and risk assessment across three interconnected levels: strategic, tactical, and operational. This integration aims to ensure compliance, regulatory governance, and security practices to effectively protect digital health data.

¹ - González, Marta, Daniel R. Lee, “**AI-Driven Compliance Monitoring in Healthcare: Ensuring Data Protection and Regulatory Alignment**”, Health Informatics Journal, Volume 30, N. 1, 2024, P. 42.

² - Patel R, and Kovacs E, “**Autonomous AI Response Systems against Ransomware Attacks in Healthcare Networks**”, Journal of Cybersecurity and Digital Health, Volume 8, N. 2, 2024, P. 56.

³ - Chen, Li, and Ahmed Al-Rahman, “**AI-Enabled Cybersecurity Optimization in Resource-Constrained Healthcare Institutions**”, Journal of Health Informatics and Security, Volume 12, N. 3, 2023, P. 118.

⁴ - Arefin S and Simcox M, “**AI-Driven Solutions for Safeguarding Healthcare Data: Innovations in Cybersecurity**”, International Business Research, Volume 17, N. 6, 2024, P. 74.

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Figure 1: Integrated digital health data compliance framework



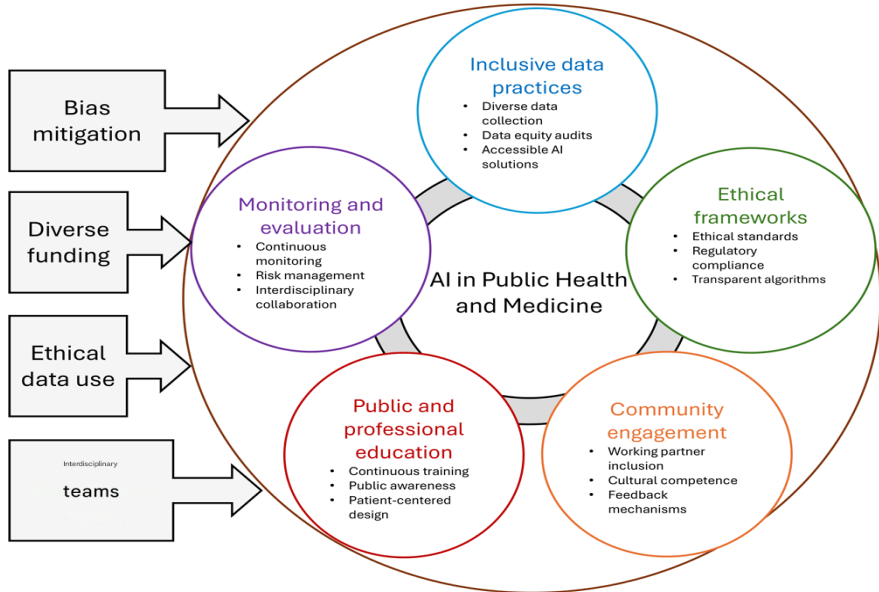
Source:

Davies C. Ogbodo and authers, From Regulati, “**on to Reality: A Framework to Bridge the Gap in Digital Health Data Protection**”, Electronics, 2025, p 27.

D). Legal-political dimensions of artificial intelligence in the health sector

The growing use of artificial intelligence tools in the health sector presents a legal and political challenge centered on balancing innovation with the protection of human values. From a legal perspective, this integration requires the establishment of regulatory frameworks that ensure transparency, accountability, and the protection of health data, thereby reinforcing principles of justice and non-discrimination in access to technology. From a political standpoint, it calls for the adoption of digital health policies that consider the ethical and social dimensions of AI and promote public participation in decision-making. This comprehensive approach serves as a safeguard to direct artificial intelligence toward the public good and to strengthen trust in the digital transformation of healthcare systems. The best expression of this argument is what we explore through this form:

Figure2: Dimensions of Ethical and Equitable AI in Health and Medicine



Source:

Irene Dankwa-Mullan, MD, MPH, Health Equity and Ethical Considerations in Using Artificial Intelligence in Public Health and Medicine - 2024, August 22. Retrieved from Preventing Chronic Disease: https://www.cdc.gov/pcd/issues/2024/24_0245.htm

In the same vein, the following figure reflects the multiple legal and political dimensions of AI governance in the healthcare sector, highlighting the intersection of ethical principles with institutional regulatory requirements to protect individual and collective rights. From a legal perspective, it emphasizes the need to regulate the use of health data in accordance with rules of transparency and accountability and to ensure equitable access to services. Politically, it highlights the importance of building public trust in digital health policies and striking a balance between innovation and regulation. It thus reveals the shift in healthcare governance from a logic of bureaucratic oversight to one of participation and shared responsibility in managing technical risks.

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Figure 3: The Legal and Political Dimensions of Artificial Intelligence Governance in the Health Sector



Source:

Jagreet Kaur, **Ethics and Governance of AI in Healthcare**, August 29, 2024, Retrieved from XenonStack Blog: <https://www.xenonstack.com/blog/ethics-and-governance-of-ai-in-healthcare>, (consulted novembre, 15, 2025)

Section 2: The Current Utilization of Artificial Intelligence in Algeria's Healthcare System

The Algerian health sector is undergoing a qualitative transformation in light of global trends toward employing artificial intelligence (AI) in medical services. AI contributes to improving the quality of care, enhancing diagnostic accuracy, and optimizing the management of health resources. This aligns with national strategic directions, academic initiatives, and opportunities presented by digital transformation. AI has become one of the most significant drivers of change in the 21st century, demonstrating its capacity to reshape work

systems across multiple domains, from industry and education to healthcare.

In Algeria, the integration of AI into the health sector is part of the national digital transformation agenda, aiming to modernize public services and enhance quality of life. Despite limited resources and infrastructural weaknesses in some regions, the state, universities, and research laboratories are striving to harness AI capabilities in areas such as early diagnosis, predictive medicine, and digital health administration¹.

A). Digital Transformation in Algeria's Health System

Integrating AI into Algeria's healthcare system represents a critical step toward modernizing healthcare infrastructure. AI's ability to analyse medical images and clinical data enables healthcare institutions to overcome technical and human resource constraints. For example, several university laboratories have begun developing prototypes for early detection of respiratory diseases using 3D imaging technologies, enhancing diagnostic capabilities in remote areas lacking specialists².

1.Key research laboratories include:

Electrical Engineering Laboratory (LAGE), Kasdi Merbah University, Ouargla: Specialized in medical signal processing, CT image analysis, and developing 3D imaging algorithms for respiratory diseases (e.g., COVID-19).

Biomedical Engineering Laboratory (GBM), University of Abou Bekr Belkaid, Tlemcen: Focused on biomedical engineering, bio-modeling, medical imaging, and developing digital tools to support medical diagnosis.

Medical Instrumentation and Imaging Laboratory (LIIM), USTO-MB, Oran: Specialized in designing digital medical imaging systems, 3D modeling of vital organs, and AI-based clinical image analysis.

¹ - Benamar H. and Djebbar S, "**L'intelligence artificielle dans le système de santé algérien : opportunités et défis**", Revue Algérienne de Santé Publique, Volume 5, N. 2, 2024, P. 42.

² - Chadli N, Benmamar H A, "**L'intelligence Artificielle dans l'Imagerie du Cancer du Poumon, Quel Avenir ?** ", Revue Algérienne des Technologies de l'Information et de la Communication, Volume 5, N 2 , 2023, P. 59–63.

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Medical Instrumentation Technology Lab (LTIM), Blida 1 University: Focused on precision medical devices, biosensing technologies, and computational diagnostic imaging.

Medical Informatics and Imaging Lab (LRIMI), University of Bejaia: Specialized in medical software, image processing, AI for disease diagnosis, and 3D imaging of lungs and brain.

Signal Processing and Medical Imaging Lab (LTSIM), Mentouri Brothers University, Constantine 1: Focused on biosignal processing, radiography, AI in medical imaging, and advanced image modeling.

Bio-Physics and Biomedical Engineering Lab (LBGB), Batna 2 University: Specialized in respiratory system modeling, medical image data analysis, and early detection algorithms for lung diseases.

Telecommunication and Medical Technologies Lab (LTTM), Setif 1 University: Focused on remote medical monitoring systems, biosignal analysis, and AI-based digital medical imaging.

Image Processing and Pattern Recognition Lab (LTIRF), Laghouat University: Specialized in computer vision, pattern recognition, 3D modeling, and AI applications in medicine.

Advanced Technology Development Center (CDTA), Algiers: Engaged in multidisciplinary research including AI, medical robotics, digital imaging, and technological solutions to support healthcare.

2. AI Contributions to Improving Healthcare Quality in Algeria

The added value of AI is evident in three main areas:

Enhanced Diagnostic Accuracy: Studies show intelligent systems can analyze X-rays and MRIs with high precision, reducing medical errors and expediting clinical decisions.

Predictive Care:¹ By analyzing patient data and identifying health patterns, AI can predict the emergence of chronic diseases before they worsen, enabling timely interventions.

Digitization of Administrative Processes: Intelligent algorithms reduce the administrative burden on medical staff by automating report generation and record management, allowing physicians to focus on patient care.

¹ - Qwaider L, Belkaid M J, “Examining Opportunities for Integrating Artificial Intelligence into Algerian Higher Education and Scientific Research”, Journal of Management and Economics Research, No. 01, 2025, P. 188-210.

B). Health System Engineering in Algeria

Integrating AI into Algeria's healthcare system is a key axis of national digital transformation, representing a strategic step toward modernizing infrastructure and enhancing public institution efficiency. This approach reflects the government's political will to transition from a traditional administrative model to a governance model based on digitization, efficiency, and transparency in public healthcare delivery. AI's high analytical capabilities in medical image and clinical data processing allow the system to overcome technical and human limitations, particularly in remote areas lacking resources and specialists¹.

From a political and legal perspective, this transformation is more than a technological advancement it redefines the state's role in ensuring the right to health, strengthening digital sovereignty, and building institutional trust between citizens and the healthcare system. Adopting AI reflects a new public governance approach that combines technological innovation with legal legitimacy, enhancing national health security and ensuring equitable access to services within a comprehensive strategic vision².

C). The Health Sector in Algeria's National AI Strategy

In 2024, Algeria launched its National AI Strategy, prioritizing the health sector. The plan aims to³:

- Develop applied research through partnerships between universities, hospitals, and start-ups.

- Build human capacity through training programs that bring together physicians and engineers.

- Strengthen digital infrastructure via digitized records and the creation of national medical databases.

¹ - Bendakal O A, **The Role of Digital Transformation in Enhancing Healthcare Governance in Algeria** a research paper presented at the National Forum entitled The Role of Digitization in Public Health Governance (Reality and Prospects), Mohamed Khider University, Biskra, Algeria, April 28, 2024, p. 3.

² -Ibid, p. 4.

³ - Ministère de l'Économie de la Connaissance, des Startups et des Micro-Entreprises, "Présentation de la première version de la Stratégie nationale de l'intelligence artificielle", 7 décembre 2024 :

<https://news.radioalgerie.dz/ar/node/56399>

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-Encouraging Academic and Research Conferences: Algerian universities are central to the digital transformation of the health sector, playing a pivotal role in applied research and localizing technological innovation. They establish strategic partnerships with hospitals and start-ups to translate research outcomes into clinical practice. Universities also develop human capacity through training programs combining medical and engineering expertise and enhance digital infrastructure through record digitization and national databases. These initiatives position universities as essential hubs integrating research, training, and digital infrastructure to serve public health¹.

Key institutions and events include²:

Study Day on Health and AI, University of Oran 1” (JESIA) st National Conference on Innovation in Data Engineering , Mohamed Boudiaf University, Oran”

International Conference on Biomedical Engineering, University of Tlemcen (BIOMEIC 2025)

International Conference on AI and Its Applications, University of Larbi Ben M’hidi, Oum El Bouaghi (IACAI 2025)

These initiatives foster growing academic and research interest in AI within the medical field, enhancing mechanisms to leverage technology in public health policy. AI has become a launchpad for restructuring Algeria’s healthcare system on scientific and innovative foundations. Through integrated governmental and academic efforts, a digital health ecosystem is emerging, balancing technology with human-centered care.

Section 3: Legal Protection and Ethics of Artificial Intelligence Use in Algeria’s Health Sector

The integration of artificial intelligence (AI) into the Algerian healthcare system presents significant challenges in terms of governance and legal regulation, requiring ethical and regulatory frameworks to ensure safe and transparent use while promoting

¹ - Merabet S, and Khadija Kadish, “**The Impact of Digital Transformation on Scientific Research Ethics: A Case Study of Algerian Universities**”, The Third Scientific Conference: Technological Knowledge and Digital Transformation in Higher Education, University of Oum El Bouaghi, Algeria, July 7, 2023, pp. 02-03.

² - Chakib Bouaguel, Les perspectives de l’intelligence artificielle en santé en Algérie, TrustMe, 01. 06.2025: <https://www.trustme.work/news/D0ls3x>

equitable access to healthcare. Despite the effectiveness of AI systems in improving diagnostic accuracy and accelerating treatment decisions, they may carry risks of algorithmic bias, potentially leading to unintended discrimination in medical service delivery. Addressing these risks necessitates alignment with national and international legal frameworks. Additionally, the protection of personal data and cybersecurity is critical, given the highly sensitive nature of health data feeding these systems, which calls for updated legislation and stringent measures to prevent breaches and data theft¹.

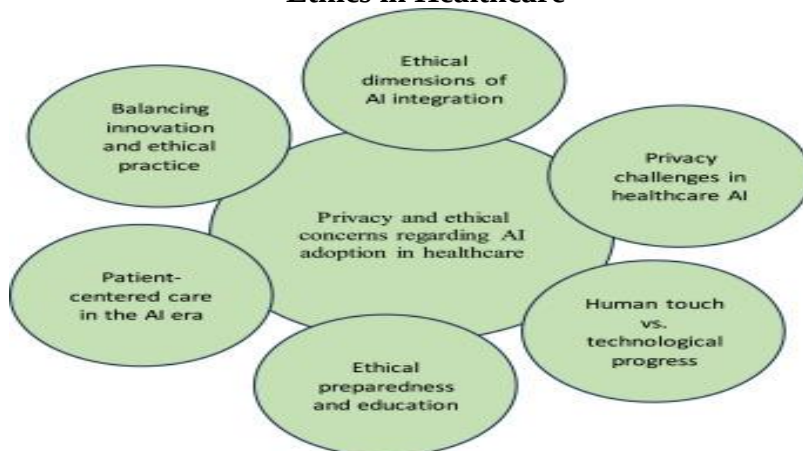
Furthermore, the intensive use of AI raises questions of legal liability in cases of medical errors. It must be clarified whether responsibility lies with the physician, the system developer, or the healthcare institution, requiring clear legal guidelines to ensure justice and accountability. Technological advancements also necessitate adapting health laws to keep pace, by updating existing regulations, creating new AI-specific frameworks, and training legal professionals in digital matters. This approach promotes a balanced integration of innovation and patient rights protection, emphasizing collaboration among healthcare professionals, legal experts, technologists, and legislators to manage this complex digital transformation in the healthcare system².

¹ - Azzouz D, Mentelchta Y, Grar Y, **L'intelligence artificielle dans le système de santé algérien: défis éthiques et juridiques à surmonter**, Laimma Éditions, 2025,P. 200.

² - Azzouz D, Mentelchta Y, Grar Y, Ibid, P.200.

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Figure 4: Nurses' Perspectives on AI-Related Privacy and Ethics in Healthcare



Source:

Rony, M. K, “Nurses’ perspectives on privacy and ethical concerns regarding artificial intelligence adoption in healthcare”, Heliyon, volume10, Issue 17, 2024, p 10.

Theoretically, this infographic highlights the key ethical and privacy considerations related to the adoption of AI in healthcare, focusing on six interconnected dimensions: the ethical aspects of integration, privacy challenges, the balance between technological advancements and the human touch, ethical preparedness and education, patient-centered care in the age of AI, and balancing innovation and ethical practices. This presentation aims to emphasize the ethical dimension as a key element in formulating digital health policies.

A). Ethical Principles for Using AI in Healthcare

The World Health Organization (WHO) has identified key ethical principles for AI in health, including¹:

Protection of human autonomy: Humans must remain in control of healthcare systems and medical decisions.

Protection of privacy and confidentiality: Data usage should be based on valid informed consent within appropriate legal frameworks.

¹ - Executive Summary on Ethics and Governance of Artificial Intelligence in the Health Sector, WHO Guidelines, 2021.

Promotion of human well-being: Ensuring physical and mental safety, advancing public interest, and preventing discrimination by promoting inclusivity and fairness.

Transparency and explain ability: AI technologies must be transparent and interpretable to improve quality in healthcare applications.

B). Protecting the Right to Privacy

The Algerian legislator, by virtue of Law No. 18-11 on health, addressed the basic provisions and principles aimed at ensuring prevention, protection, preservation and promotion of people's health while respecting dignity, freedom, safety and private life, while ensuring the continuity of public service and health security.¹

In the era of information technology and AI tools, violations of privacy have become a major risk, undermining IT development and threatening individuals' private lives. Given that most constitutions and national laws recognize privacy as a fundamental societal principle, safeguarding this right is essential. The primary legal challenge is ensuring the security of data for patients, physicians, and healthcare institutions.² This requires establishing a secure health information system to protect patient data from hacking and misuse, particularly for sensitive health information, demanding the highest levels of protection.

The Algerian approach to integrating artificial intelligence into the healthcare sector highlights a close relationship between technological innovation and public governance. Legally, these initiatives underscore the need for a clear regulatory framework governing the collection, sharing, and protection of medical data an essential prerequisite for respecting privacy and digital sovereignty. Politically, they reflect the state's desire to consolidate national technological sovereignty by supporting local research and aligning public policies with international standards in digital health. However, the absence of specific legislation governing medical AI use raises

¹ - Law No. 18-11 of July 2, 2018 relating to health- Official Journal of the People's Democratic Republic of Algeria- N. 46 of July 15, 2018, P. 3-118.

² - Hamidi H, Laslaj N, **Legal Challenges of Using Artificial Intelligence in Digital Health**, Proceedings of the Doctoral Day on Digital Health and Artificial Intelligence, Faculty of Media and Communication Sciences, University of Algiers 3, 2024, p. 10.

The role of artificial intelligence in enhancing health security in Algeria challenges related to accountability, algorithmic transparency, and bioethical concerns, necessitating comprehensive legal reform that balances innovation with health security¹.

Professor Sid Ahmed Ferroun's contribution emphasizes that digital transformation in healthcare is no longer merely a technical choice; it has become a political and legal issue directly linked to citizen health security and the state's legislative sovereignty. Adopting AI in diagnosis and treatment requires Algeria to reframe its legal system to reconcile medical innovation with the protection of individual rights, particularly regarding the confidentiality of health data and legal responsibility in cases of diagnostic errors caused by algorithms. Experts' call for the establishment of an independent national legislative framework reflects an awareness of the need to move from experimental technology to digital governance of health, capable of regulating interactions between physician, machine, and patient. In this context, integrating AI into the healthcare system becomes both a matter of "legislative sovereignty" and a strategic state choice aimed at ensuring equitable access to care and achieving national health security amid rapid digital transformation.

In light of the legislative vacuum surrounding AI use in Algeria's health sector, there is an urgent need for legal frameworks to keep pace with rapid technological developments in diagnosis and treatment. Despite research and institutional efforts by national centers, the absence of explicit laws regulating the collection and processing of health data and liability arising from technical errors remains a gap in digital health governance. This vacuum hinders the full potential of AI and raises legal issues related to privacy protection and the integrity of medical decision making, necessitating the adoption of a comprehensive legislative framework that ensures both health security and digital sovereignty.

C). Determining Legal Liability for AI-Induced Errors

The use of AI in healthcare raises challenges regarding the application of civil and criminal liability systems to damages and

¹-L'intelligence artificielle et le numérique au service de la santé, El Moudjahid, Alger, publié le 12 octobre 2024. Consulté le 15 octobre 2025, <https://www.elmoudjahid.com/fr/sante/l-intelligence-artificielle-et-le-numerique-au-service-de-la-sante-219643>

errors caused by AI technologies and associated crimes from their misuse.

1. Civil Liability for AI Related Damages in Healthcare

Civil liability for AI in healthcare may take the form of personal liability for medical errors, liability for acts of others, or product liability.¹ However, the unique nature of AI, distinct from natural and legal persons, complicates the application of personal liability. AI is characterized by non-materiality, functional autonomy, and unpredictability of actions, making it difficult to assign personal fault².

Applying guardian liability respondeat superior or custodian responsibility to AI damages faces challenges, as artificial intelligence does not naturally fall under guardianship principles. Even if applicable, identifying the “guardian” for AI is difficult. Nonetheless, guardian liability remains the most suitable framework for encompassing AI induced damages, potentially using the concept of multiple guardianship to assign joint liability among all responsible parties. Civil liability for artificial intelligence related damages in healthcare is a critical research area, emphasizing the need for legal frameworks that accompany rapid technological developments and protect individuals. Contracts concerning artificial intelligence technologies must explicitly define responsibilities, obligations, potential damages, mechanisms for compensation and dispute resolution, and identify who bears liability developer, provider, or physician³.

2. Criminal Liability for AI Related Damages in Healthcare

Criminal liability forms the foundation of penal law. Modern approaches in criminal law and policy emphasize that liability should extend beyond direct actions to include all contributory activities and errors. These approaches have expanded responsibility to include natural and legal persons. With AI advancements, it is necessary to

¹ - Suhair Sayed A M, “**Legal Responsibility for Artificial Intelligence**”, Legal Journal, Volume 17, Issue 7, 2023, p. 1504

² - Rafaf L, “**The Specificity of Civil Liability for Damages Caused by Artificial Intelligence Systems in Algerian Law**”, Tobna Journal of Academic Scientific Studies, Volume 6, Issue 1, 2023, p. 591.

³ - Basbas M, Souqi H, “**The Contractual Liability System in the Face of Artificial Intelligence Harms in Algerian Law**”, Journal of Legal and Political Thought, Volume 9, Issue 1, 2025, p. 40

The role of artificial intelligence in enhancing health security in Algeria consider the criminal liability of AI technologies. Despite their numerous advantages, AI presents challenges to the right to privacy a constitutionally and legally protected fundamental right as well as various crimes related to information and communication technologies arising from misuse of artificial intelligence.

3. The Algerian Legislator's Position on the Use of Artificial Intelligence in the Health Sector

Algeria's approach to integrating AI into the healthcare system represents a dual dimensional reform path scientific and institutional reflecting the transition from research and experimentation to the practical implementation of medical innovation within public health policies. Nevertheless, this technological progress, despite its importance, occurs in a legislative void that limits its effective utilization and raises legal challenges concerning actors' liability, protection of health data, and legitimacy of medical decisions made by intelligent systems. Therefore, the need arises to establish a specialized national legal framework regulating the use of AI technologies in healthcare, ensuring a balance between scientific innovation requirements and legal legitimacy, while establishing legislative policies grounded in legal oversight, transparency, and digital sovereignty.

Between technology and practice lies a wide array of rules, standards, structures, and values governing social worlds. This underscores the importance of studying AI in healthcare: to understand its integration in medical structures and practices, one must go beyond technical proficiency and examine how this technology adapts and complies with institutional medical regulations. These challenges represent obstacles that AI struggles to overcome and, in many cases, it is not yet fully equipped to address. Two concepts help in understanding these issues: one is technical in nature, and the other pertains to market rules¹.

In line with the above, integrating AI technologies into Algeria's healthcare sector represents a qualitative transformation that necessitates re framing the legal framework to ensure safe and responsible use of this sensitive technology. Given the nature of

¹-L'IA, dans le domaine de la santé, produit des résultats justes, mais qui ne correspondent pas aux protocoles en usage dans le milieu, Le Monde9, septembre 2025.

medical data and its direct link to human rights in privacy and bodily integrity, there is a need for a comprehensive legal approach that extends beyond the technical dimension to encompass legislative regulation and ethical risk management.

Despite the absence of specific legal texts regulating AI in healthcare, general provisions in civil law, particularly Article 106 affirming the principle of “the contract is the law of the parties,” provide a flexible framework for regulating digital medical contracts and relationships among parties (physician, healthcare institution, and AI system provider). In this context, it is recommended to prepare a detailed legal and technical specification that precisely defines the obligations of each party and liabilities arising from errors generated by intelligent systems, especially in cases of medical diagnosis or recommendations¹.

Moreover, the sensitivity of health data necessitates the application of Law No. 18-07 dated 10 June 2018 on the protection of natural persons in the processing of personal data, which requires healthcare institutions to obtain informed consent from patients and ensure data security against all forms of breaches or leaks. Managing the legal risks associated with medical AI therefore requires establishing continuous ethical and legislative oversight mechanisms that balance innovation in diagnosis and treatment with respect for fundamental patient rights, including the right to privacy and the integrity of medical decision making.

Accordingly, addressing the current legislative gap in healthcare AI requires enacting a specialized legal framework that sets standards for licensing, liability, and protection of sensitive medical data, ensuring AI systems are subject to both pre and post deployment oversight by specialized bodies. This would enhance citizen trust in the digital healthcare system and make the law an effective instrument for achieving national health security in the context of accelerated digital transformation.

¹- République Algérienne Démocratique et Populaire, Journal Officiel de la République Algérienne Démocratique et Populaire, n° 78 du 29 décembre 2007, Loi n° 07-05 du 13 mai 2007 modifiant et complétant l’Ordonnance n° 75-58 du 26 septembre 1975 portant Code civil, art. 106.

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Conclusion

It becomes evident, through the various research and institutional initiatives witnessed in Algeria in recent years, that the state is earnestly seeking to align its healthcare system with global technological transformations by promoting scientific research and developing AI based digital solutions to improve diagnosis, treatment, and prevention. Projects led by national bodies such as the Center for Research in Scientific and Technical Information (CERIST) and the Center for the Development of Advanced Technologies (CDTA) represent clear indicators of Algeria's engagement in health innovation dynamics, leveraging virtual reality, three-dimensional imaging, therapeutic games, and intelligent patient assistance systems, especially for the elderly.

However, this ambitious trajectory imposes, from a legal perspective, the urgent need to address the legislative vacuum surrounding the use of AI in the medical field, particularly concerning the regulation of legal responsibility arising from technical errors and ensuring the protection of sensitive health data, which constitutes the core of national health security. In this context, establishing a comprehensive legal framework is essential, defining licensing standards, monitoring mechanisms, and conditions for using intelligent systems in healthcare institutions, thereby reconciling innovative requirements with patient rights to privacy and bodily integrity.

The success of Algeria's digital transformation in the healthcare sector depends on its ability to transform AI from a purely technical tool into a legal and ethical lever that fosters trust between citizens and the state and supports the construction of a sustainable health policy based on science, responsibility, and information security. Accordingly, achieving (digital health sovereignty) can only be realized through a national legislative framework dedicated to medical AI that establishes clear foundations for regulation, accountability, and rights protection in the digital space.

Recommendations

Legal Field

1. Enact a specific law regulating AI in the health sector, defining the conceptual framework, permitted applications, and legal and ethical constraints for using these technologies in diagnosis, treatment, and medical research.

2. Clearly determine legal liability in cases of errors arising from the use of intelligent systems, whether related to the physician, system developer, or healthcare institution, ensuring legal security for patients.

3. Amend the Personal Data Protection Law (Law No. 18-07) to include provisions specifically addressing digital health data processed via AI algorithms, requiring healthcare institutions to conduct legal and ethical impact assessments before deploying or using any intelligent system.

4. Establish a national oversight mechanism under the Ministry of Health or the Health Security Agency, responsible for evaluating AI systems' compliance with legal and ethical standards and monitoring incidents of technical deviations or misuse.

5. Integrate AI into medical contract legislation by establishing regulations defining the form of a (digital medical contract) and the rights of parties interacting with intelligent systems.

Political and Institutional Field

1. Adopt a national strategy for health AI, co-developed by the Ministries of Health, Higher Education, Digitalization, and Justice, to coordinate legislative and research efforts.

2. Create a national observatory for health AI to monitor technical and legal developments and assess the social and political impacts of AI use in the healthcare system.

3. Strengthen scientific and health diplomacy through partnerships with international research centers to exchange legal and technical expertise in AI based diagnosis and treatment technologies.

4. Incorporate health AI as a priority in national security policies within a comprehensive health security framework, recognizing it as a strategic element for future pandemics and health crises.

5. Develop a legal digital culture among healthcare stakeholders (physicians, researchers, administrators) through continuous training programs in digital health law and AI ethics.

Ethical and Social Field

1. Activate digital medical ethics committees in all academic and research healthcare institutions to ensure a balance between innovation and human dignity.

2. Engage civil society and health associations in public discussions on AI ethics, enhancing transparency and social accountability.

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3. Establish a national charter for AI ethics in healthcare aligned with international standards (UNESCO, WHO) while responding to the specific legal and political environment of Algeria.

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