

Ethical Implications of Artificial Intelligence (AI) In Healthcare Cybersecurity: A United Arab Emirates (UAE) Perspective

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ABSTRACT

Artificial Intelligence (AI) is reshaping healthcare cybersecurity in the United Arab Emirates (UAE), enabling improvements in threat detection, fraud prevention, and clinical workflow efficiency. However, the integration of AI into sensitive health systems introduces significant ethical challenges related to algorithmic bias, data governance, transparency, and accountability. This study investigates the ethical implications of AI-driven cybersecurity in UAE healthcare, examining the extent to which current national regulations, such as NESAs, the Dubai Data Law, and the PDPL, address AI-specific risks. Using a qualitative methodology combining literature review, policy analysis, and structured interviews with UAE healthcare professionals, the study identifies gaps in practitioner awareness, informed consent, explainability, and liability structures. Findings reveal a mismatch between the UAE's rapid AI adoption and its ethical preparedness, with limited bias mitigation, inconsistent transparency mechanisms, and inadequate guidance for AI-related decision-making. To address these shortcomings, the study proposes a UAE Healthcare AI Ethics Governance Framework built on cultural and religious values, international standards, technical safeguards, stakeholder engagement, and regulatory enhancement. The study concludes that trustworthy AI requires not only robust technology but also culturally aligned ethical governance to maintain patient dignity, safety, and public trust.

Keywords: Alethics in healthcare, Ethical governance, Algorithmic bias, Data privacy, Responsible AI, UAE policy framework

INTRODUCTION

Artificial Intelligence (AI) is increasingly embedded within UAE healthcare systems to secure electronic health records (EHRs), detect anomalous behaviour, and automate cybersecurity operations (Sheikholeslami et al., 2023), (Matlali, 2023). National initiatives such as the UAE National Strategy for Artificial Intelligence 2031 have accelerated the adoption of AI-driven tools across public-health infrastructures, positioning the UAE as a regional leader in digital transformation (UAE Artificial Intelligence Office, 2021). However, this expansion raises pressing ethical concerns regarding algorithmic fairness, data protection, transparency, and accountability,

especially in a multicultural society where expatriates constitute nearly 90% of the population (Liu, 2023), (Bouri and Mukherjee, 2023), (Dubai Health Authority, 2023).

While AI enhances cybersecurity by automating threat detection and strengthening monitoring of IoT-connected devices (Bouri and Mukherjee, 2023), (Almuhairi et al., 2021), these systems often function as “black boxes,” offering limited explainability for their decisions. This opacity complicates professional accountability when AI errors result in misclassification, unauthorized access, or security failures (Sheikholeslami et al., 2023), (Obermeyer et al., 2023), (Obermeyer, 2019). Interviews with UAE clinicians confirm that AI alerts are frequently difficult to interpret, and overriding them can be complex, reinforcing concerns about trust and transparency.

Moreover, documented cyber incidents in the UAE, including ransomware attacks on AI-powered radiology systems, adversarial manipulation of diagnostic tools, and breaches involving third-party AI vendors, demonstrate that AI systems themselves have become new attack surfaces (Bouri and Mukherjee, 2023), (Almuhairi et al., 2021), (Dubai Health Authority, 2023). Such events highlight the gap between technical innovation and ethical preparedness.

Existing UAE regulatory frameworks, including NESAs, the Dubai Data Law, and the PDPL, provide strong cybersecurity foundations but do not yet address AI-specific ethical challenges such as algorithmic bias, explainability requirements, and liability for autonomous decisions (UAE Artificial Intelligence Office, 2024), (Alhashmi et al., 2020), (Global Legal Insights, 2025). As a result, hospitals face ambiguity regarding patient consent for AI-enabled processing and limited guidance on ensuring fairness and accountability in automated decision-making.

This study therefore aims to:

- 1) Identify major ethical risks associated with AI-based healthcare cybersecurity in the UAE,
- 2) Evaluate the adequacy of current national regulations in addressing these risks, and
- 3) Propose a culturally aligned, ethically grounded governance framework that integrates Islamic values, UAE social norms, and international best practices (Liu, 2023), (European Union, 2024), (World Health Organization, 2021), (Ministry of Health and Prevention, 2025).

Through a qualitative research design combining literature analysis and structured interviews with healthcare professionals, the study demonstrates that ethically responsible AI requires culturally contextualized governance, meaningful consent, transparent decision-making, and strong accountability structures.

LITERATURE REVIEW

Artificial Intelligence (AI) has become central to global healthcare operations, enhancing diagnostics, analytics, and cybersecurity. This rapid integration

has raised concerns regarding fairness, explainability, privacy, and security, prompting international bodies such as the World Health Organization (WHO) to establish ethical principles emphasizing autonomy, transparency, safety, accountability, inclusiveness, and sustainability (World Health Organization, 2021). Parallel regulatory efforts include the EU AI Act (2024), which categorizes healthcare AI as “high-risk” and mandates transparency, post-market monitoring, and human oversight (European Union, 2024), while the GDPR provides additional safeguards through data-subject rights such as protection from fully automated decision-making (European Union, 2016). In the United States, NIST’s AI Risk Management Framework offers practical tools for bias evaluation, explainability, and security throughout the AI lifecycle (National Institute of Standards and Technology, 2023).

Despite these advancements, global research consistently reports persistent algorithmic bias, particularly when models are trained on unrepresentative datasets. Studies demonstrate that skewed training data can disproportionately misclassify vulnerable or minority populations (Obermeyer et al., 2023), (Obermeyer, 2019). Similarly, AI-enabled systems are vulnerable to adversarial attacks, where subtle manipulation of inputs can cause medical diagnostic models to produce incorrect outputs (Finlayson et al., 2019). Such evidence underscores the necessity of ethical-by-design approaches integrating fairness, robustness, and transparency into AI development.

AI Ethics in the UAE Healthcare Cybersecurity Context

The UAE is progressing rapidly in healthcare digitalization, guided by national initiatives such as the National AI Strategy 2031 and the AI Ethics Principles and Guidelines (UAE Artificial Intelligence Office, 2021), (UAE Artificial Intelligence Office, 2024). These frameworks provide broad commitments to ethical AI but lack binding obligations for explainability, bias mitigation, or liability assignment. Existing cybersecurity protection is primarily governed by the National Enterprise Security Authority (NESA), which provides standards for encryption, access control, and risk management (Khan, 2022). While effective for traditional cybersecurity, NESA does not fully address AI-specific risks such as adversarial manipulation or algorithmic discrimination.

UAE case studies show the implications of this gap. During COVID-19, AI systems used in triage and vaccine distribution were targeted by ransomware and phishing campaigns, leading to delays in care and data breaches (Bouri and Mukherjee, 2023), (Almuhairi et al., 2021). Diagnostic AI systems have demonstrated susceptibility to adversarial interference, while third-party vendor compromises have resulted in corrupted training datasets and clinical mis recommendations (Bouri and Mukherjee, 2023), (Rizvi, 2023). These incidents highlight that AI systems can themselves be exploited as attack surfaces, amplifying vulnerabilities in healthcare cybersecurity.

At the ethical level, research and UAE health authority reports document disparities resulting from biased AI models, including misclassification of expatriate patients who constitute the majority demographic (Dubai Health Authority, 2023). Such errors undermine fairness and public trust, two essential requirements in culturally diverse healthcare settings.

Regulatory Gaps and Missing Ethical Standards

Current UAE data laws, including the PDPL and Dubai Data Law, emphasize data residency and security but fall short of mandating AI explainability, fairness audits, or human-in-the-loop controls (Alhashmi et al., 2020), (Global Legal Insights, 2025). These omissions contrast with global regulatory expectations such as the EU AI Act and GDPR, which explicitly require explainability, documented risk assessments, and protections from biased automated decisions (European Union, 2024), (European Union, 2016).

Furthermore, enforcement mechanisms in the UAE remain limited. Although NESAs conduct audits, healthcare organizations inconsistently implement their controls (Bouri and Mukherjee, 2023). Liability for AI-related harms is determined under general legal provisions rather than AI-specific rules, leaving ambiguity about responsibility for errors involving autonomous or semi-autonomous systems (Global Legal Insights, 2025). This regulatory fragmentation hinders accountability and increases institutional risk.

Regional Benchmarking: UAE, Saudi Arabia, and Qatar

Across the GCC, countries have adopted varying AI governance approaches. The UAE leads in establishing early AI ethics guidelines and deploying large-scale healthcare AI systems (UAE Artificial Intelligence Office, 2024). Saudi Arabia's SDAIA under Vision 2030 has expanded national AI capacity but is still developing specialized ethical frameworks for healthcare, while Qatar's AI strategy remains primarily research centered. Comparative analyses reveal the UAE as the most advanced in formalizing governance but facing similar regional challenges, including workforce readiness, limited ethical training, and insufficient enforcement (World Health Organization, 2021), (Rizvi, 2023).

Building Ethical, Robust, and Culturally Aligned AI Systems

Recent UAE initiatives, such as Abu Dhabi's Ethical AI Toolkit, encourage fairness checks and transparency enhancement but remain voluntary (Floridi et al., 2018). The literature reveals limited technical capacity within hospitals to independently conduct bias audits, adversarial testing, or implement explainable AI (XAI) tools due to vendor opacity and workforce skill gaps (Obermeyer et al., 2023), (Bouri and Mukherjee, 2023), (Mubadala Health, 2023).

Furthermore, UAE's multicultural environment requires AI systems to support multilingual consent, cultural norms of family involvement, and Islamic ethical principles such as justice, welfare, and harm prevention (Liu, 2023), (Ministry of Health and Prevention, 2025). These culturally grounded requirements are not yet systematically integrated into existing AI governance.

Use Cases Illustrating Ethical and Governance Needs

Current UAE deployments, such as DHA's AI-enhanced chest X-ray screening and Burjeel Holdings' multilingual generative AI patient-engagement agents, demonstrate the country's leading role in adopting practical AI applications

(Shea, 2022), (Burjeel Holdings, 2025). These systems improve operational efficiency and patient experience but also highlight the need for oversight, validation, and ethical safeguards, particularly regarding data handling, oversight boundaries, and fairness in diverse populations.

The literature shows that while the UAE is a frontrunner in AI adoption, its governance mechanisms have not fully kept pace with the ethical and cybersecurity risks posed by AI. The global consensus on fairness, transparency, and accountability contrasts with regional gaps in enforcement, explainability, and bias mitigation. The UAE's unique demographics further intensify the need for culturally grounded governance frameworks. These gaps form the rationale for this study's proposed UAE Healthcare AI Ethics Governance Framework.

PROBLEM STATEMENT

The rapid integration of Artificial Intelligence (AI) into UAE healthcare cybersecurity has outpaced the ethical and regulatory mechanisms needed to govern it. AI systems used for threat detection, anomaly analysis, and data protection introduce risks related to algorithmic bias, opaque decision-making, patient consent, and unclear accountability structures (Bouri and Mukherjee, 2023), (Dubai Health Authority, 2023), (Alhashmi et al., 2020). Existing national frameworks, including NESAs, the Dubai Data Law, and the PDPL, offer strong cybersecurity foundations but lack AI-specific guidance on fairness audits, explainability, and liability assignment (UAE Artificial Intelligence Office, 2024), (Alhashmi et al., 2020), (Global Legal Insights, 2025). These gaps are particularly consequential in the UAE's multicultural healthcare environment, where expatriates make up nearly 90% of the population and may be disproportionately affected by biased or non-transparent AI systems (Liu, 2023), (Bouri and Mukherjee, 2023), (Dubai Health Authority, 2023). Therefore, a structured assessment of ethical risks and a culturally aligned governance framework are urgently needed to safeguard patient rights, institutional trust, and AI-driven healthcare security.

RESEARCH QUESTION

This study is guided by three core research questions designed to address the ethical and governance challenges of AI-enabled healthcare cybersecurity in the UAE:

- 1) What are the key ethical risks associated with AI-driven cybersecurity in UAE healthcare, particularly regarding algorithmic bias, informed consent, privacy, and data governance?
- 2) To what extent do current UAE regulatory frameworks, including NESAs, the PDPL, DHA data governance guidelines, and the Dubai Data Law, adequately address these AI-specific ethical risks?
- 3) How can a culturally aligned governance framework be co-developed with UAE healthcare stakeholders to integrate local values (e.g., Islamic ethics, multicultural inclusivity) with international best practices for ethical AI cybersecurity?

RESEARCH METHODOLOGY & DESIGN

This research adopts an exploratory qualitative methodology combining documentary analysis, case-study review, and structured interviews to examine AI ethics in UAE healthcare cybersecurity. A qualitative design enables in-depth exploration of practitioner experiences, regulatory gaps, and ethical perceptions that cannot be captured through quantitative measures alone (Global Legal Insights, 2025), (World Health Organization, 2021).

Data Collection

- **Literature & Policy Analysis:** Academic sources, government documents, and international frameworks (EU AI Act, GDPR, WHO, NIST, NESAs, PDPL) were analyzed to map global and UAE-specific ethical standards (UAE Artificial Intelligence Office, 2021), (European Union, 2024), (UAE Artificial Intelligence Office, 2024), (National Institute of Standards and Technology, 2023).
- **UAE Case Studies:** Real-world incidents, including ransomware attacks on AI-powered radiology systems, adversarial manipulation of diagnostic models, and third-party vendor breaches, were examined to contextualize ethical risks (Bouri and Mukherjee, 2023), (Almuhairi et al., 2021), (Dubai Health Authority, 2023).
- **Structured Interviews:** Five healthcare professionals (clinical and IT roles) were purposively sampled from UAE government and private hospitals. Interviews explored perceptions of AI ethics, PDPL awareness, trust, bias, consent processes, and security vulnerabilities. Ethical approval was obtained from Zayed University, and all participants provided informed consent in alignment with PDPL requirements (Global Legal Insights, 2025).

Data Analysis

- **Thematic Coding:** Interview transcripts and literature findings were coded for recurring themes such as transparency, bias, privacy, training, and accountability (Liu, 2023), (Bouri and Mukherjee, 2023).
- **Comparative Framework Analysis:** UAE frameworks (NESAs, PDPL, DHA) were compared to global standards (GDPR, EU AI Act, NIST) to identify regulatory gaps in transparency, fairness auditing, and human oversight (European Union, 2024), (European Union, 2016), (National Institute of Standards and Technology, 2023).
- **Triangulation:** Convergence between literature, case studies, and practitioner testimony strengthened validity. For instance, interview evidence of limited AI ethics training aligned with national workforce readiness surveys (Mubadala Health, 2023).

INTERVIEWS WITH UAE HEALTHCARE PROFESSIONALS

To complement the literature and policy review, five structured interviews were conducted with UAE healthcare professionals between August and October 2025. Participants represented diverse specialties, including

radiology, dentistry, ophthalmology, and urology, across both public and private hospitals. Ethical approval was obtained from Zayed University, and all participants provided informed consent in line with PDPL requirements (Global Legal Insights, 2025). Key Themes Identified:

AI Awareness and Usage

Participants demonstrated uneven understanding of AI concepts. While P2, P3, and P5 used AI daily for diagnostics, anomaly detection, and medical transcription, others (P1, P4) had limited exposure. Misconceptions existed, such as mistaking robotics for AI.

Trust and Explainability

AI systems were frequently described as “black boxes,” limiting clinicians’ ability to understand or justify AI outcomes. Professionals trusted AI for efficiency but relied on human judgment to validate decisions, aligning with WHO’s transparency principle (World Health Organization, 2021).

Ethical Awareness and PDPL Compliance

Awareness of PDPL obligations was inconsistent. Only two participants understood consent, data minimization, and lawful processing requirements. Three disclosed that patients were not informed their data was processed by AI, indicating a compliance gap.

Training and Preparedness

All participants reported no formal AI ethics training. Workshops focused on general privacy rather than AI-specific risks such as bias, adversarial attacks, or explainability, reflecting national workforce gaps (Mubadala Health, 2023).

Professional Recommendations

Clinicians emphasized the need for:

- Multilingual, culturally adaptive consent,
- Explainable AI interfaces,
- Mandatory AI ethics training,
- Clear accountability rules for AI errors.

These insights highlight practitioner support for more transparent, culturally aligned AI governance.

METHODOLOGY & PLAN

This research used a qualitative exploratory methodology to analyse ethical implications of AI in UAE healthcare cybersecurity. This approach enabled deep examination of practitioner perceptions, regulatory gaps, and culturally specific ethical concerns.

Data Sources

- 1.1. Literature and Policy Review: Analysis of global frameworks (GDPR, EU AI Act, WHO, NIST) and UAE policies (NESA, Dubai Data Law, PDPL, National AI Strategy 2031) to identify gaps in fairness, transparency, and oversight (UAE Artificial Intelligence Office, 2021), (European Union, 2024), (Alhashmi et al., 2020), (National Institute of Standards and Technology, 2023).
- 1.2. UAE Case Evidence: Documented cyber incidents, including ransomware attacks on radiology AI, data poisoning, adversarial manipulation, and vendor breaches, were used to contextualize ethical risks (Bouri and Mukherjee, 2023), (Almuhairi et al., 2021), (Dubai Health Authority, 2023), (Rizvi, 2023).
- 1.3. Stakeholder Interviews: Five structured interviews collected real-world insights on trust, bias, consent, transparency, and security awareness among healthcare professionals.

Analysis Procedures

- Thematic Coding: Identifying patterns related to bias, privacy, consent, accountability, and explainability.
- Comparative Framework Analysis: UAE laws compared with global ethical requirements for high-risk AI.
- Triangulation: Case studies, literature, and interviews cross-validated findings.

Research Plan

The plan integrated:

- Mapping ethical risks
- Assessing regulatory adequacy
- Designing a culturally aligned governance framework
- Proposing measurable indicators for AI ethics compliance

RESULT & DISCUSSIONS

The results combine interview insights, documentary evidence, and regulatory analysis. They demonstrate a consistent gap between AI's technical utility and its ethical readiness within UAE healthcare.

1.1. Ethical Risks Identified

- Algorithmic Bias: Interviews and case reports confirm bias in AI triage and diagnostic systems, often disadvantaging expatriate populations, consistent with global findings of data imbalance (Obermeyer et al., 2023), (Dubai Health Authority, 2023).
- Opacity and Explainability: Clinicians described limited visibility into AI decision processes. This opacity undermines accountability, reproducing concerns raised in EU AI Act and WHO ethics guidelines (European Union, 2024), (World Health Organization, 2021).

- **Informed Consent and Data Privacy:** Three participants confirmed that patients are not informed when AI processes their data, revealing inconsistencies with PDPL mandates (Global Legal Insights, 2025).
 - **Liability Ambiguity:** When asked who is responsible for AI errors, responses varied (vendor vs. hospital). UAE laws lack AI-specific liability provisions, leaving institutions uncertain (Alhashmi et al., 2020), (Global Legal Insights, 2025).
 - **Security Threats:** Adversarial attacks, ransomware, and model poisoning were identified as major vulnerabilities, aligning with documented regional cyber incidents (Bouri and Mukherjee, 2023), (Finlayson et al., 2019).
- 1.2. **Perceived AI Efficiency** AI was rated 3–8/10 in improving daily workflows. High-usage participants valued AI for reducing documentation burden and accelerating diagnostics; low-usage participants associated AI with misclassification or unreliability. Human oversight remained essential.
 - 1.3. **Training and Professional Readiness** All participants reported zero formal AI ethics training, confirming systemic workforce gaps also reflected in national surveys (Mubadala Health, 2023).
 - 1.4. **Evaluation of UAE Regulations** the UAE provides strong baseline cybersecurity controls (NESA, Dubai Data Law), but: No mandatory explainability No bias auditing requirements No AI-specific liability rules Limited enforcement mechanisms Compared to the EU AI Act and NIST RMF, UAE frameworks lack AI-specific depth in fairness, transparency, and human oversight (European Union, 2024), (National Institute of Standards and Technology, 2023).
 - 1.5. **Integrated Discussion** The combined evidence reveals: UAE hospitals adopt advanced AI tools but lack ethical preparedness. Clinicians intuitively value fairness, transparency, and accountability, aligning with WHO guidance (World Health Organization, 2021). Cultural and religious considerations (e.g., multilingual consent, family involvement, Islamic ethics) are essential but currently absent in AI governance. These findings support the need for the proposed UAE Healthcare AI Governance Framework, integrating cultural values, international standards, technical safeguards, and stakeholder participation.

CONCLUSION

AI is strengthening healthcare cybersecurity in the UAE, yet its rapid adoption has created ethical challenges that current regulations do not fully address. This study shows that while AI improves detection, efficiency, and monitoring, significant gaps remain in bias mitigation, explainability, informed consent, and accountability. Interviews with UAE healthcare professionals confirm limited awareness of AI-related obligations and the absence of structured ethics training. Existing frameworks such as NESA, the PDPL, and the Dubai Data Law provide strong cybersecurity foundations but lack AI-specific safeguards.

The proposed UAE Healthcare AI Ethics Governance Framework, incorporating cultural values, international standards, technical controls,

and stakeholder oversight, offers a pathway to more transparent, fair, and accountable AI use. Ultimately, building trustworthy AI in UAE healthcare requires not only advanced technologies but continuous ethical governance and human-centered oversight to protect patient rights and reinforce public trust.

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