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Blockchain and AI Integration for Secure Cross-Border Health Data Sharing in Medical Tourism: Current Applications and Future Directions

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ÖZET

Tıbbi turizm hızla büyüyen küresel bir sektör olmasına rağmen, sınır ötesi sağlık verisi paylaşımı; yasal parçalanma, birlikte çalışabilirlik sorunları, gizlilik riskleri ve güven eksikliği gibi önemli zorluklarla karşı karşıyadır. Bu çalışmanın amacı, blockchain ve yapay zekâ (AI) entegrasyonunun bu sorunları nasıl çözebileceğini ve tıbbi turizmde güvenli veri paylaşımını nasıl geliştirebileceğini incelemektir.

Bu çalışma, sistematik arama stratejisi ile desteklenen anlatı literatür derlemesine dayanmaktadır. PubMed, Scopus, Web of Science, IEEE Xplore ve Google Scholar veri tabanlarında yapılan taramada 180 çalışma belirlenmiş, eleme süreci sonucunda 52 kaynak analize dahil edilmiştir. Dahil edilme kriterleri; sağlık alanında blockchain ve/veya AI uygulamaları, veri paylaşımı ile ilişkili olması ve sınır ötesi boyut içermesidir. Ayrıca uluslararası kuruluş raporları da değerlendirmeye alınmıştır.

Bulgular, blockchain'in veri güvenliği, izlenebilirlik ve hasta kontrollü erişim sağladığını; AI'nın ise öngörüsel analiz, anomali tespiti ve karar destek süreçlerini geliştirdiğini göstermektedir. Bu teknolojilerin entegrasyonu veri güvenliğini artırmakta ve paydaşlar arası güveni güçlendirmektedir. Ancak ölçeklenebilirlik, maliyet ve düzenleyici uyumsuzluk gibi sınırlılıklar devam etmektedir.

Sonuç olarak, blockchain ve AI entegrasyonu önemli bir potansiyel sunmaktadır. Bu potansiyelin hayata geçirilmesi için uluslararası standartların geliştirilmesi, politika uyumu ve dijital altyapı yatırımları gereklidir.

Anahtar Kelimeler: Blok Zinciri, Yapay Zeka, Sağlık Turizmi

ABSTRACT

Medical tourism is a rapidly expanding global sector; however, secure cross-border health data sharing remains a critical challenge due to regulatory fragmentation, interoperability limitations, privacy risks, and trust deficits. This study aims to examine how the integration of blockchain and artificial intelligence (AI) can address these challenges and enhance secure, patient-centered data exchange in medical tourism.

A narrative literature review with a systematic search strategy was conducted across major databases including PubMed, Scopus, Web of Science, IEEE Xplore, and Google Scholar. A total of 180 studies were initially identified, of which 52 sources were selected based on predefined inclusion criteria such as relevance to healthcare data sharing, blockchain/AI applications, and cross-border interoperability. In addition, grey literature from international organizations (OECD, WHO, World Economic Forum) was incorporated to capture real-world implementations and policy perspectives.

The findings indicate that blockchain provides secure, decentralized, and immutable data infrastructures enabling traceability, patient-controlled access, and interoperability, while AI enhances predictive analytics, anomaly detection, and decision support. The integration of these technologies creates a synergistic framework that improves data security, reduces administrative burden, and strengthens trust among stakeholders. However, key challenges persist, including scalability issues, regulatory inconsistencies, high implementation costs, and lack of standardized governance frameworks.

The study concludes that blockchain-AI integration has significant potential to transform cross-border health data exchange into a secure and efficient system within medical tourism. To realize this potential, coordinated international policies, interoperable standards, and investment in digital health infrastructure are essential. Policymakers, healthcare providers, and technology developers must collaborate to ensure ethical, scalable, and sustainable implementation.

Keywords: Blockchain, Artificial Intelligence, Medical Tourism

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1. INTRODUCTİON

Medical tourism is a significant global phenomenon driven by various factors such as cost considerations, access to superior treatment options, lower waiting times, and access to specialized treatment options not available in their home countries. Estimates by various sources indicate that millions of people cross borders to receive medical treatment every year and contribute significantly to the economies of these countries, especially those in Asia, Latin America, and Europe. The OECD has recognized the increasing tendency towards the use of international mobility in health services, with foreign-trained health professionals and patients underscoring the interconnectedness of health services globally (1).

Health data sharing across borders is a critical requirement to ensure continuity of treatment and to perform accurate pre-treatment evaluations, post-operative treatment, and emergency treatment interventions. However, disparate regulatory environments such as varying implementations of data protection regulations such as GDPR in the EU or varying national privacy regulations create significant barriers to safe health data sharing across borders. These barriers include risks of data breaches, unauthorized access to data, loss of patient privacy, and compatibility issues with various EHR systems. The World Health Organization (WHO) has emphasized the requirement to ensure safe and equitable handling of health data in digital environments and has expressed concerns about inadequate data protection measures leading to a loss of trust and increased health inequities (2). These persistent challenges in cross-border health data sharing highlight the need for innovative, technology-driven solutions that go beyond traditional centralized systems. In this context, emerging digital technologies such as blockchain and artificial intelligence (AI) have gained increasing attention due to their complementary capabilities. While blockchain ensures secure, transparent, and tamper-proof data management, AI enables intelligent data processing, predictive analytics, and automated decision-making. Establishing a conceptual link between these technologies is essential to understand how their integration can address the complex, multi-layered barriers present in medical tourism data exchange.

The integration of blockchain and AI provides a decentralized, immutable ledger that ensures controls (2). However, understanding the practical value of this integration requires situating it within existing academic and applied research. The combined use of blockchain and AI is not merely a theoretical proposition but is increasingly reflected in empirical studies and pilot implementations across different healthcare domains. Therefore, examining the current body of literature is essential to evaluate how this technological convergence has been conceptualized and applied, particularly in contexts requiring high levels of trust, security, and interoperability such as medical tourism. With AI layered on top, blockchain enables smart data management detecting fraud via anomaly detection, predicting treatment outcomes, and automating consent management while ensuring privacy via methods such as federated learning or zero-knowledge proofs (3) This combination directly addresses typical challenges in cross-border data sharing by providing immutable records and secure, permissioned access without the need for centralized intermediaries.

Recent studies have highlighted the potential of blockchain and AI integration in healthcare contexts requiring high levels of data security and traceability. For example, Tandon et al. (2020) identify blockchain as a key enabler of secure health data exchange, while Abu-Elezz et al. (2020) emphasize its role in improving trust and transparency in healthcare systems. In parallel, Ahmad et al. (2025) propose blockchain-based frameworks for secure communication in medical tourism, demonstrating its applicability in cross-border contexts. Additionally, World Economic Forum reports (2020; 2025) underline the importance of integrating AI with secure data infrastructures to enhance predictive capabilities and system resilience in global health ecosystems. In medical tourism, blockchain and AI can help optimize the validation of medical records, reduce administrative burdens, and enhance patient, provider, and payer trust.

This article is based on a comprehensive narrative literature review supplemented by targeted searches for real-world implementations and policy documents. The review aimed to synthesize existing knowledge on the integration of blockchain and artificial intelligence for secure cross-border health data sharing, with a specific focus on applications in medical tourism. To address this gap, this study aims to answer the following research questions:

RQ1: How can the integration of blockchain and artificial intelligence improve secure cross-border health data sharing in medical tourism?

RQ2: What are the current applications and limitations of blockchain-AI integration in this context?

RQ3: What policy, technical, and organizational challenges must be addressed to enable large-scale implementation?

Unlike existing reviews that focus broadly on blockchain or AI in healthcare, this study specifically examines their combined application within the medical tourism context, offering a cross-disciplinary and policy-oriented perspective. It contributes to the literature by synthesizing technological, regulatory, and practical dimensions into a unified analytical framework.

2. METHODOLOGY

Bu This study adopts a narrative literature review approach to explore the integration of blockchain and artificial intelligence in secure cross-border health data sharing within medical tourism.

A systematic search strategy was employed to ensure

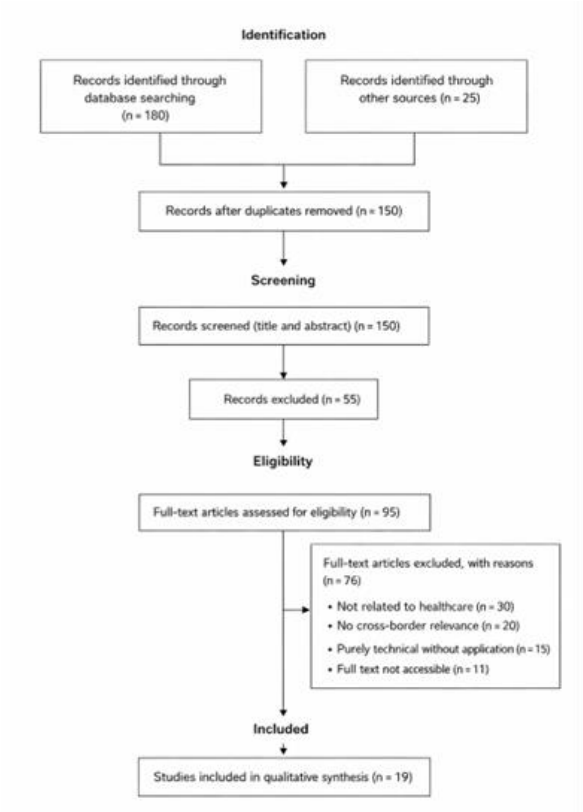
comprehensive coverage of relevant literature. Electronic databases including PubMed, Scopus, Web of Science, IEEE Xplore, and Google Scholar were searched using combinations of keywords such as "blockchain", "artificial intelligence", "health data sharing", "medical tourism", and "cross-border healthcare".

The initial search yielded approximately 180 publications. After removing duplicates and screening titles and abstracts for relevance, 95 studies were retained for full-text review. Inclusion criteria consisted of: (i) studies focusing on blockchain and/or AI in healthcare,(ii) relevance to health data management or data sharing,(iii) discussion of cross-border or interoperability aspects,(iv) publications in English.

Exclusion criteria included:(i) studies unrelated to healthcare,(ii) purely technical papers without healthcare application,(iii) non-accessible full texts.

Following full-text assessment, 52 sources were selected for final inclusion. In addition to academic literature, grey literature such as reports from international organizations (OECD, WHO, World Economic Forum) and institutional documents were incorporated to capture real-world implementations and policy perspectives. The study follows a qualitative synthesis approach, aiming to identify key themes, technological frameworks, challenges, and future directions. The study selection process is illustrated in Figure 1 using a PRISMA 2020 flow diagram.

Figure 1. PRISMA 2020 Flow Diagram



2.1. Medical Tourism and Cross-Border Health Data Challenges

Medical tourism, which refers to the deliberate movement of patients across national boundaries for the purpose of health care, has recorded significant growth in recent decades due to disparities in health care costs, quality, and availability between countries. Patients from high-income countries visit countries like Thailand, India, Mexico, Turkey, and some European countries because they provide affordable health care options, high-quality treatment, and shorter waiting times for patients undergoing elective and other surgical interventions.

A basic requirement for the successful conduct of medical tourism is the free exchange of health data between countries. The correct exchange of health data, which includes patients' medical history, imaging studies, laboratory results, treatment plans, and follow-up notes, is critical for preoperative, intraoperative, and postoperative care and upon return to the patients' home countries. Without the correct exchange of health data, health care providers risk many adverse consequences, which can result in harm to patients (3). According to the World Health Organization (WHO), improper data handling in medical tourism can compromise patient safety and can result in health inequities, especially when patients face complications that require coordinated care while abroad (4).

When health information crosses borders, it exposes itself to security breaches and unauthorized access and use. This may result in identity theft and discrimination or stigmatization of those whose information has been shared (10). The WHO has also pointed out the ethical implications of health information crossing borders and how it affects individuals' trust in such information and their willingness to access cross-border healthcare services (4). This has seen people lose trust and confidence in such services due to a lack of fairness and fear of being taken advantage of by those with their health information.

2.2. Blockchain Technology in Healthcare: Principles and Advantages

Blockchain technology began as the infrastructure for digital currencies such as Bitcoin but has since evolved into a dynamic and scalable distributed ledger system with profound potential for the healthcare industry. Fundamentally, blockchain is a decentralized, peer-to-peer system that maintains a growing, permanent record of transactions in the form of a chain of blocks, each of which is secured through a cryptographic hash. Each block is

stamped with a timestamp, a record of transactions, and a reference to the previous block, creating an unbroken and immutable record (8).

Data integrity and traceability represent additional key advantages. The immutable ledger ensures that medical records, clinical trial data, or supply chain information (e.g., pharmaceutical provenance) remain unaltered, creating verifiable audit trails essential for regulatory compliance and trust-building (8). In medical tourism contexts, this traceability facilitates accurate verification of treatment histories, reducing risks of fraud or errors during international transitions. Interoperability is improved through standardized, decentralized protocols that bridge disparate EHR systems without centralized intermediaries, addressing long-standing fragmentation issues (9).

Blockchain also supports patient-centric models by empowering individuals with sovereign control over their health data. Through mechanisms like self-sovereign identity and zero-knowledge proofs, patients can share specific data subsets securely without exposing entire records, aligning with ethical principles of autonomy and consent (10). The OECD has explored blockchain's potential in cross-border applications, noting its capacity to strengthen economic ties in health services while supporting portable credentials and secure data flows (11).

However, while considering the benefits of blockchain, one must also consider the needs it requires to operate, such as energy consumption, as well as good governance, but considering its capabilities, one can say that it is a foundational tool within a trustworthy environment, especially when combined with other technologies, such as AI, as discussed further on.

2.3. Artificial Intelligence in Health Data Management

Artificial intelligence (AI) encompasses a range of computational techniques, including machine learning (ML), deep learning, natural language processing (NLP), and predictive analytics, that enable systems to perform tasks requiring human-like intelligence, such as pattern recognition, decision-making, and data interpretation (1). In health data management, AI processes vast, heterogeneous datasets from EHRs, medical imaging, wearable devices, genomic sequencing, and patient-reported outcomes to extract actionable insights, support clinical decisions, and optimize administrative processes (2).

Despite these advantages, AI in health data management faces limitations. Data quality issues, including incompleteness, inconsistency, and bias in training datasets, can propagate errors or inequities (12). Algorithmic transparency ("black box" models) hinders trust and accountability, while integration with legacy EHR systems poses technical challenges (13).

Privacy concerns arise from handling sensitive health information, necessitating robust safeguards like differential privacy or secure multi-party computation (14). The OECD stresses that without coordinated governance, AI risks exacerbating disparities, fragmented adoption, or unintended harms from poor-quality inputs (5).

Ethical considerations are paramount: ensuring fairness, explainability, and human oversight remains essential to prevent discrimination and maintain clinical validity (15). Workforce implications include the need for upskilling health professionals in AI literacy and data interpretation. Additional ethical concerns include the risk of data colonialism, where health data from low- and middle-income countries may be disproportionately accessed, controlled, or exploited by entities in high-income countries. This raises questions about data ownership, sovereignty, and equitable benefit sharing. Moreover, the use of smart contracts introduces legal and ethical challenges regarding liability. In cases of automated decision-making or data access errors, it remains unclear who holds responsibility developers, healthcare providers, or platform operators. These issues highlight the need for clear governance frameworks and legal standards in blockchain-based healthcare systems. (16,17). Overall, AI transforms health data from static repositories into dynamic, intelligent assets, but its effective deployment demands interdisciplinary collaboration, standardized data practices, and policy alignment to maximize benefits while mitigating risks.

When synergized with blockchain as explored next this AI capability gains enhanced security, traceability, and patient control, addressing many cross-border sharing vulnerabilities in medical tourism.

2.4. Integration of Blockchain and AI for Secure Data Sharing

The integration of blockchain and artificial intelligence (AI) represents a synergistic advancement in healthcare, combining blockchain's decentralized, immutable, and transparent ledger with AI's analytical, predictive, and decision-support capabilities to create robust frameworks for secure cross-border health data sharing (1). This convergence addresses longstanding limitations in traditional systems such as centralized vulnerabilities, interoperability barriers, and privacy risks by enabling tamper-proof storage, intelligent processing, and automated governance while preserving patient control and regulatory compliance (2).

Patient health records are stored off-chain (e.g., via IPFS or encrypted databases) with cryptographic hashes and metadata recorded on-chain, ensuring integrity without exposing full datasets. Smart contracts automate consent

management, access permissions, and audit trails: patients define granular rules (e.g., "share preoperative imaging only with the destination provider for 30 days"), which are enforced immutably (3).

A key synergy lies in privacy-preserving AI computations. Techniques like zero-knowledge proofs allow verification of data properties (e.g., confirming a patient's vaccination status or eligibility for a procedure) without revealing underlying details, while homomorphic encryption or secure multi-party computation enables AI-driven insights (e.g., risk prediction for postoperative complications) on encrypted data shared across borders (5). Federated learning further supports collaborative model training: hospitals in different countries contribute to shared AI models for personalized treatment recommendations or outcome forecasting, aggregating updates on blockchain without exchanging sensitive records (6). This is particularly valuable in medical tourism, where AI can predict complications based on aggregated international data while blockchain ensures traceability and patient consent revocation.

Hyperledger Fabric) utilizing consensus mechanisms such as Practical Byzantine Fault Tolerance (PBFT) to ensure efficiency and scalability in healthcare settings. Health data is typically stored off-chain, while blockchain maintains hash references and access logs. Interoperability is facilitated through standards such as HL7 FHIR, enabling structured and standardized data exchange across heterogeneous health information systems. Oracle mechanisms are employed to bridge on-chain smart contracts with off-chain clinical data sources. AI components are often implemented using federated learning architectures, allowing decentralized model training across institutions without transferring sensitive patient data. This approach enhances privacy while enabling collaborative intelligence across borders.

2.5. Current Applications in Medical Tourism

Current applications of blockchain and AI integration in medical tourism remain largely in the pilot, conceptual, and early adoption phases, with limited large-scale deployments due to regulatory, interoperability, and scalability hurdles.

In ASEAN countries, blockchain is being integrated into medical tourism corridors to ensure secure transfer of diagnostic images, prescriptions, and treatment summaries between origin and destination providers, supporting seamless continuity in hubs like Thailand and Singapore (4). These efforts align with broader digital health passport concepts that combine blockchain for immutability with patient-centric access controls (5).

Blockchain's transparency enables auditable AI decisions e.g., tracing why a model recommended a specific intervention while AI can monitor for biases in cross-cultural datasets, promoting fairness in global applications (9). The World Economic Forum has advocated for such hybrid approaches to build trust in digital health ecosystems, noting their potential to enable secure, equitable data flows across borders (17). Similarly, OECD analyses highlight blockchain-AI synergies in overcoming regulatory fragmentation for secondary data use, including in international health services (11).

Real-world pilots demonstrate feasibility: frameworks using blockchain for secure EHR sharing combined with AI for predictive analytics have shown improved anomaly detection and reduced breach risks in distributed networks (12). In medical tourism contexts, proposals like edge-AI empowered blockchain platforms aim to enable secure, real-time data exchange for international patients, reducing administrative delays and enhancing trust (13).

From a technical perspective, most proposed architectures rely on permissioned blockchain networks (e.g.,

AI enhances these blockchain infrastructures by providing intelligent analytics and decision support. Hybrid systems leverage AI for predictive risk assessments (e.g., complication forecasting based on aggregated anonymized international data) and anomaly detection in cross-border transactions, while blockchain ensures traceability and consent enforcement (6). In medical tourism-specific contexts, AI-powered platforms assist in personalized treatment matching, preoperative optimization, and postoperative monitoring, with blockchain securing the underlying data flows to comply with diverse privacy regulations such as GDPR adequacy in destination countries (7).

Real-world examples include conceptual and pilot projects in regions with strong medical tourism ecosystems. In the United Arab Emirates and Saudi Arabia, national AI and blockchain councils promote frameworks for secure health data in cross-border care, supporting medical tourism growth through verifiable credentials and privacy-preserving sharing (8). Estonia's long-standing blockchain deployment in national health records (since 2008) offers a foundational model adaptable to international patients, enabling tamper-proof access for foreign providers (9). Emerging platforms explore tokenized health data or self-sovereign wallets for portable medical histories, allowing patients to grant temporary, granular access to overseas clinicians without intermediaries (10).

Broader literature highlights pilots combining AI and blockchain for secure EHR exchange in distributed networks, showing reduced breach risks and improved

interoperability benefits directly transferable to medical tourism (12,18).

To illustrate key emerging applications and their maturity levels, the following table 1 summarizes representative initiatives.

Table 1. Application Area

Application Area	Description	Key Technologies	Maturity Level	Geographic Focus	Benefits In Medical Tourism	Source/Reference
Electronic Health Passports	Secure, verifiable storage and sharing of health records for international travel and care	Blockchain (immutability), AI (verification)	Pilot/Conceptual	Global/ASEAN	Streamlines compliance, reduces forgery risks	(3,5)
Cross-Border Data Corridors	Secure transfer of diagnostics, prescriptions, and histories in tourism hubs	Blockchain ledger, smart contracts	Early Adoption/Pilot	ASEAN (Thailand, Singapore)	Ensures continuity, builds trust	(4)
Patient-Controlled Portable Records	Self-sovereign wallets for granting temporary access to overseas providers	Blockchain + AI analytics	Conceptual/Pilot	Middle East, Global	Enhances patient agency, minimizes silos	(10)
Credential Verification Platforms	Immutable verification of provider qualifications and patient histories	Blockchain transparency	Emerging	Middle East, Esto nia model	Reduces liability, supports quality assurance	(8,9)

Note:
AI, Artificial Intelligence; ASEAN, Association Of Southeast Asian Nations; Blockchain, Distributed Ledger Technology Ensuring Secure And Immutable Data Storage; Smart Contracts, Automated Digital Agreements Executed On Blockchain Platforms; Self-Sovereign Records, Patient-Controlled Digital Health Records

2.6. Case Studies and Real-World Implementations

While large-scale, fully operational blockchain-AI integrated systems specifically tailored for medical tourism remain emerging, several notable case studies and implementations illustrate practical progress in secure cross-border health data sharing.

In the United Arab Emirates (UAE), the Ministry of Health and Prevention (MoHAP) launched a blockchain-based platform in 2020 for storing and managing data of licensed health and pharmaceutical facilities, practitioners, and drug information. Integrated with national AI strategies aiming for 100% incorporation into health services, this platform enhances data security, traceability, and accessibility while promoting medical tourism through transparent, high-quality information on healthcare providers. By facilitating secure sharing and verification, it reduces administrative barriers for international patients seeking treatment in Dubai or Abu Dhabi, aligning with the UAE's position as a leading medical tourism hub in the region (3).

Saudi Arabia has advanced similar initiatives through its national AI and blockchain governance structures, including councils dedicated to these technologies. Efforts focus on secure health data management to support Vision 2030 goals, including medical tourism growth. Blockchain frameworks enable verifiable credentials and privacy-preserving data flows, with AI for analytics, addressing cross-border regulatory challenges in the Gulf region where patients from neighboring countries frequently seek care (4).

Conceptual and pilot applications in ASEAN countries (e.g., Thailand, Singapore, Malaysia) explore blockchain for medical tourism corridors. Studies highlight secure data sharing for diagnostics, prescriptions, and post-procedure follow-up, with disintermediation, cryptocurrency payments, and trusted review systems reducing costs and enhancing transparency. In the context of Turkey, significant progress has been made in digital health infrastructure, particularly through the national e-Nabız system, which enables citizens to access and manage their personal health records electronically. The system allows controlled data sharing with healthcare providers, supporting patient-centered data governance and improving continuity of care. While e-Nabız is not blockchain-based, it reflects an advanced level of digital health maturity and provides a foundational framework for potential integration with emerging technologies such as blockchain and AI (19).

Furthermore, Turkey has implemented strict data protection regulations under the Personal Data Protection Law (KVKK), which aligns with global standards such as GDPR. These developments position Turkey as a strong candidate for future blockchain-AI integration in medical tourism, particularly given its growing role as a major destination for international patients.

Despite these promising developments, several limitations must be critically considered. Scalability remains a major concern, as blockchain-based systems often face performance constraints when handling large-scale health data. Cost implications, including infrastructure

investment and maintenance, may limit adoption, particularly in low- and middle-income countries. Furthermore, stakeholder incentive misalignment presents a significant barrier. Healthcare providers, regulators, and technology developers may have differing priorities regarding data ownership, control, and monetization. Implementation risks also include regulatory uncertainty, integration challenges with legacy systems, and resistance to organizational change. Therefore, while these case studies demonstrate feasibility, their long-term sustainability and scalability require further empirical validation and policy alignment.

To summarize key case studies and their implications for cross-border health data in medical tourism, Table 2 presents an overview:

Table 2. Selected Case Studies of Blockchain (and AI-Integrated) Implementations Relevant to Medical Tourism

Case Study / Implementation	Key Features	Technologies Involved	Scope / Maturity	Geographic Focus	Relevance to Medical Tourism	Outcomes / Benefits	Source/ Reference
Estonia e-Health System	National digitized records with blockchain-secured integrity and patient access via e-ID	KSI Blockchain, e-ID integration	Fully operational (since 2008/2012)	Estonia (national, extensible)	Verifiable, immutable records for international patients/follow-up	High trust, interoperability, tamper-proof data	(1,2)
UAE MoHAP Blockchain Platform	Storage of facility, practitioner, and drug data; supports AI integration	Blockchain ledger, AI strategy	Operational (launched 2020)	UAE	Transparent provider info, secure sharing for tourists	Promotes medical tourism, efficiency, compliance	(3)
Saudi Arabia AI/Blockchain Governance	National councils for secure data in healthcare; Vision 2030 alignment	Blockchain + AI frameworks	Emerging / Strategic	Saudi Arabia	Supports regional patient flows, credential verification	Enhanced trust, data security in Gulf tourism	(4)
ASEAN Medical Tourism Corridors	Secure sharing of diagnostics/prescriptions; disintermediation proposals	Blockchain, smart contracts	Conceptual / Pilot studies	Thailand, Singapore, Malaysia	Continuity of care, privacy in high-volume hubs	Reduced costs, transparency, collaboration	(5,6)

Note:
AI, Artificial Intelligence; MoHAP, Ministry of Health and Prevention (United Arab Emirates); UAE, United Arab Emirates; ASEAN, Association of Southeast Asian Nations; e-ID, Electronic Identification System; KSI Blockchain, Keyless Signature Infrastructure blockchain technology; Smart contracts, automated digital agreements executed on blockchain platforms.

3. CONCLUSİON

This review highlights that the integration of blockchain and artificial intelligence offers a promising and increasingly necessary solution to the persistent challenges of cross-border health data sharing in medical tourism. The findings indicate that while both technologies individually contribute to improving data security, interoperability, and decision-making, their combined use creates a more robust and scalable framework capable of addressing complex international healthcare needs.

At the global level, the analysis shows that although several pilot projects and national-level implementations (e.g., Estonia, UAE, ASEAN initiatives) demonstrate the feasibility of blockchain-AI integration, large-scale adoption remains limited due to regulatory fragmentation, lack of standardization, and technical barriers. The literature consistently emphasizes the need for international collaboration, interoperable standards, and harmonized regulatory frameworks.

At the national level, countries with advanced digital health infrastructures, such as Turkey, have significant potential to integrate these technologies into existing systems. Platforms like e-Nabız illustrate readiness in terms of digital maturity, but further innovation is required to incorporate decentralized and AI-driven solutions.

Based on the findings, several policy and practical recommendations can be proposed:

(i) Governments should develop regulatory frameworks that support secure cross-border data sharing while ensuring privacy and ethical standards,(ii) Healthcare

institutions should invest in interoperable and scalable digital infrastructures,(iii) International organizations should promote global standards and collaborative platforms,(iv) Technology developers should prioritize privacy-preserving AI and energy-efficient blockchain solutions.

Ultimately, the successful implementation of blockchain-AI integration in medical tourism depends on multi-stakeholder collaboration, including policymakers, healthcare providers, technology developers, and patients. Future research should focus on empirical validation, large-scale pilot implementations, and the development of standardized frameworks to transition from conceptual potential to real-world impact.

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