

(1) Title

Blockchain-Enabled Personal Health Records: A Systematic Review of Security, Adoption, and Patient-Centered Designs

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(2) Abstract

Blockchain technology has emerged as a promising solution for improving the security, transparency, and patient-centered design of Personal Health Record (PHR) systems. Traditional PHR models often suffer from limited interoperability, unclear data ownership, and heightened vulnerability to breaches, creating barriers to trust and adoption among patients and healthcare providers. This systematic review synthesizes existing research on blockchain-enabled PHR systems, focusing on three core themes: (1) security and privacy enhancements enabled through decentralization, smart contracts, and immutable audit trails; (2) patient perceptions of usability, control, trust, and willingness to adopt blockchain-based systems; and (3) system design elements that support efficiency, accessibility, and real-world deployment.

A structured search was performed across IEEE Xplore, PubMed, ACM Digital Library, Scopus, and Google Scholar, yielding studies published between 2017 and 2025. Inclusion criteria required that studies evaluate blockchain applications specifically within the PHR context or explore patient-centered approaches to health data management. The findings highlight a consistent emphasis on blockchain's capacity to strengthen data integrity and access control, while also revealing persistent challenges related to scalability, user literacy, regulatory alignment, and integration with existing health information systems. This review contributes a consolidated evidence base that can guide researchers, system designers, and policymakers as they evaluate the feasibility and patient impact of emerging Web3 health data architectures. **Keywords:** Blockchain, Personal Health Records, Web3 Healthcare, Patient-Centered Design, Health Data Security, Smart Contracts, Digital Health Systems.

Personal Health Records (PHRs) play a crucial role in empowering patients to manage their health information, yet current systems continue to face challenges related to security, interoperability, and trust. As blockchain technology emerges as a potential solution, researchers and system designers have explored new ways to enhance

patient control and data protection. This systematic review organizes and analyzes existing evidence to assess the feasibility and patient impact of blockchain-enabled PHR models.

OUTLINE — SYSTEMATIC REVIEW

1. Introduction

- Background on PHR systems
 - Limitations of current digital health infrastructures
 - Why blockchain is relevant
 - Purpose and significance of this review
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2. Methodology

2.1 Search Strategy

- Databases searched
- Keywords used
- Timeframe (2017–2025)

2.2 Inclusion Criteria

- Peer-reviewed or preprint
- Blockchain applied specifically to PHR or patient-centered data
- Studies discussing security, trust, adoption, or design

2.3 Exclusion Criteria

- Studies focused on EHR without patient perspective
- Blockchain used ONLY for supply chain, billing, genomics, etc.
- No English-language availability

2.4 Screening Process (PRISMA)

- Total studies found
- Duplicates removed
- Final studies included

A PRISMA flow diagram will be included in the final completed version of this review.

3. Results — Thematic Findings

Theme 1: Security & Privacy Enhancements

- Encryption methods
- Smart contracts
- Access control models
- Auditability

Theme 2: Patient Adoption & Trust

- Transparency
- Usability
- Perceived complexity
- Barriers to adoption

Theme 3: System Design & Efficiency

- Interoperability
 - Storage models (IPFS, off-chain, hybrid)
 - Scalability challenges
 - Real-world deployment considerations
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4. Discussion

- Consolidated insights
- How blockchain supports modernization

- Gaps in current research
 - Need for UX-centered blockchain design
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5. Implications for Future Web3 Healthcare Systems

- National digital health initiatives
 - Regulatory alignment
 - Patient-centered governance models
 - Zero-trust security frameworks
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6. Limitations of the Review

- Database-selection bias
 - Variability in study quality
 - Early-stage nature of blockchain research
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7. Conclusion

- Summary
 - Path forward for blockchain-based PHR systems
 - Message to policymakers & system architects
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