

Article

Strategic Policies for Interoperability of Electronic Healthcare Records

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Abstract

The adoption of electronic health records (EHRs) and health information technology (HIT) is foundational to building a more integrated, efficient, and patient-centered healthcare system. Despite significant investments and advancements, the U.S. healthcare system continues to face critical barriers to EHR interoperability. The purpose of this study was to identify the primary policy barriers hindering interoperability and propose actionable modifications to address these challenges. This research employed a qualitative meta-synthesis, complemented by a scoping literature review, to explore the policy landscape shaping EHR interoperability. The data were systematically organized and analyzed using NVivo® 12 software provided by Purdue University. Manual annotations provided critical context to qualitative findings. Two key themes emerged: (a) policy perspectives and (b) economic challenges. Recommendations included adaptive policy enforcement mechanisms, sustained and equitable financial support, and targeted leadership development initiatives. These strategies hold the potential to inform ongoing effort creating a more integrated and efficient healthcare system.

Keywords: electronic health records (EHRs); health information technology (HIT); EHR interoperability; policy interventions; HITECH Act; healthcare technology; U.S. healthcare system

1. Introduction

The adoption of electronic health records (EHRs) and health information technology (HIT) aimed to leverage advanced data management and analytics to improve outcomes, enhance patient care, and reduce costs ([HealthIT.gov, 2023](#)). Despite significant progress, interoperability challenges continue to obstruct the realization of a fully integrated healthcare ecosystem ([Dias et al., 2018](#)). Interoperability refers to the ability of different EHR systems to communicate, exchange, and use information seamlessly. This capability is critical for enabling efficient and effective healthcare delivery. It ensures real-time access to patient data by healthcare providers, thereby improving care coordination, reducing medical errors, and lowering costs ([Happer, 2025](#); [Health Information Management Systems Society \[HIMSS\], 2026](#)). However, persistent barriers—including technical complexities, system incompatibilities, and inconsistent data formats—limit providers' access to comprehensive patient data, leading to inefficiencies and diminished care quality ([McGeorge et al., 2015](#)).

The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 was a landmark policy aimed at addressing some of these challenges. By incentivizing the adoption and meaningful use of EHR systems, it sought to establish a framework for



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data exchange and interoperability (U.S. Department of Health and Human Services, 2020). However, achieving full interoperability across diverse EHR systems remains a significant challenge, necessitating further exploration of the policies governing this critical issue (Office of the National Coordinator for Health Information Technology, 2024).

A fundamental component of interoperability is the use of standardized data formats, such as Health Level Seven (HL7) and Fast Healthcare Interoperability Resources (FHIR). HL7 facilitates the transfer of data between healthcare systems, ensuring effective communication even when systems are developed by different vendors. FHIR, as a modern standard, simplifies data exchange using web-based technologies, offering a scalable and flexible solution for interoperability. These standards are vital for addressing technical challenges in seamless data exchange.

1.1. Statement of the Problem

Integrating EHR systems within the U.S. healthcare landscape is essential for improving the quality and efficiency of healthcare delivery (McGeorge et al., 2015; O'Reilly-Shah et al., 2020). Unfortunately, technical complexities, system incompatibilities, and the lack of standardized data formats present major obstacles to the seamless exchange of vital health information across healthcare platforms (Dias et al., 2018; Office of the National Coordinator for Health Information Technology, 2024).

These barriers have real-world implications that affect both healthcare providers and patients. For example, when providers use different EHR systems that are unable to communicate effectively, crucial patient data—such as medical histories, medication lists, and test results—may not be accessible to all involved in a patient's care (Walker et al., 2023). In addition, the lack of interoperability also imposes financial burdens on healthcare organizations. Healthcare providers are often forced to manually transfer or re-enter patient data, which increases administrative workloads and introduces the risk of errors. These inefficiencies drive up operational costs and reduce the time available for direct patient care (HealthIT.gov, 2023).

1.2. Significance

This study addressed the urgent need to enhance EHR interoperability within the U.S. healthcare system, a need underscored by the SARS-CoV-2 pandemic. The crisis accelerated digital health adoption and highlighted the importance of seamless health information exchange to ensure efficient and equitable care delivery (O'Reilly-Shah et al., 2020).

By examining administrative barriers and facilitators to EHR integration, this research offers actionable insights for policymakers and healthcare administrators to strengthen system resilience and patient care. It also identifies policy challenges in interoperability and outlines strategies for improvement within the evolving healthcare landscape (Everson et al., 2021).

The study's significance lies in its potential to guide healthcare policy and practice in the post-pandemic era. Through a comprehensive analysis of EHR interoperability, it contributes to efforts to improve health outcomes, operational efficiency, and the development of a more integrated and patient-centered U.S. healthcare system (Centers for Disease Control and Prevention [CDC], 2023; HealthIT.gov, 2023).

1.3. Study Purpose and Research Questions

The investigation centered on identifying administrative and policy barriers to EHR interoperability and determining strategies to navigate or mitigate these challenges. The primary objective was to examine how these issues collectively reflect the policy environment's impact on EHR interoperability and to explore how innovative policy initiatives could facilitate technology adoption and integration.

The guiding questions of this research were:

1. What are the major barriers hindering successful EHR interoperability within the U.S. healthcare infrastructure?
2. What policy modifications barriers and improve EHR interoperability within the U.S. healthcare system?

2. Literature Review Methods

The work involved a qualitative meta-synthesis, complemented by a scoping literature review (Creswell & Creswell, 2018; Younas et al., 2025), focused on “Policy Barriers and Facilitators to EHR Integration.” Torraco (2005, 2016) advocated for the importance of gaining new knowledge through a literature review approach, as did Chigbu et al. (2023). The search began with a predefined set of keywords and phrases aligned with the dissertation’s core themes, such as “EHR interoperability,” “healthcare administration,” “policy barriers in healthcare IT,” “financial impact of EHR systems,” and “data standardization in healthcare.” The search process was anchored in targeted academic databases, including PubMed, IEEE Xplore, JSTOR, and the ACM Digital Library. Additional databases specializing in healthcare policy and administration, such as Health Affairs, CMS, and ONC repositories, were also consulted.

Inclusion and exclusion criteria were rigorously applied to maintain the relevance and quality of the literature. Studies were included based on their focus on the U.S. healthcare system, their relevance to policy aspects of EHR integration, and their contributions to understanding the financial and technical challenges of interoperability. Exclusion criteria filtered out studies outside the U.S. context, irrelevant themes, and literature that lacked qualitative or mixed-methods insights. Preference was given to peer-reviewed articles, official reports, and recent publications (within the last 15 years) to ensure the review was timely and applicable.

2.1. Researcher Reflexivity

The first author’s professional background spans multiple sectors of the U.S. healthcare system, including private hospitals, the Veterans Health Administration, and exposure to medical operations within the United States Army. This experience provided a comprehensive understanding of the challenges and opportunities associated with achieving interoperability in both public and private environments. To ensure reflexivity, the first author engaged in an auto-ethnographic reflection to examine personal perspectives that could influence interpretation of the data. Through this reflective process, it became apparent that policy enforcement mechanisms introduced through the HITECH Act and the 21st Century Cures Act improved care coordination and health outcomes while simultaneously expanding administrative bureaucracy and financial pressures on healthcare organizations. The reflection also emphasized that progress toward interoperability remains constrained by financial inequities, fragmented leadership, and the persistent treatment of healthcare as a profit-driven enterprise rather than a public good.

The second author serves as a faculty member in the Department of Technology Leadership at Purdue University, and she is a professor emeritus from Oregon State University. She is also an international instructor at the National Institute for Development Administration in Bangkok, Thailand. Her research focuses on human resource development, program evaluation, leadership, and ethics.

2.2. External Peer Validation

To strengthen confirmability, the first author conducted a peer debriefing conversation with a healthcare professional experienced in EHR implementation. The individual

has worked as a Physician Assistant within a large regional hospital system for seven years, providing both inpatient and outpatient care and collaborating closely with administrative services on electronic health record utilization and workflow optimization. This background offered direct experience with the practical and policy-related challenges of interoperability, documentation, and compliance in clinical operations.

The external peer was provided with a complete copy of the manuscript and an outline of the key findings from the meta-synthesis. They reviewed the document in advance and were asked to reflect on the accuracy, applicability, and clarity of the study's interpretations based on their professional experience. A structured discussion followed, focusing on the realism of the identified barriers, the feasibility of the recommendations, and the alignment of conclusions with operational practice. The purpose of this conversation was to confirm the credibility and practical resonance of the study's findings rather than to generate new empirical data.

Both participants noted that costs remain the greatest operational barrier for under-resourced systems and that leadership engagement is inconsistent, often limited by organizational silos and competing financial priorities. The conversation reaffirmed that policy implementation, supported by financial incentives and unified leadership, is essential for achieving sustainable interoperability across U.S. healthcare systems.

The auto-ethnographic reflection and peer debriefing were consistent with the thematic findings derived from the qualitative meta-synthesis. This alignment between synthesized evidence and professional experience enhanced the confirmability of the study's interpretations while maintaining a clear boundary between reflexive validation and empirical analysis. These reflexive activities complemented the study's existing trustworthiness strategies of triangulation, audit trail maintenance, and transparent coding documentation.

3. Findings

In examining EHR interoperability within the U.S. healthcare system, this literature review focused on two critical and interconnected themes. The first theme explored the pivotal role of healthcare policies in shaping the direction and success of EHR integration. The second theme examined the financial barriers and incentives influencing the adoption and sustained use of interoperable EHR systems.

3.1. Policy Perspectives

The policy perspectives theme critically examined the intricate relationships between policy oversight, strategic decision-making, and organizational culture, highlighting how these factors collectively influenced EHR interoperability within healthcare systems. Despite significant legislative efforts, such as the HITECH Act and the 21st Century Cures Act, substantial gaps remained in the effectiveness of these policies. These gaps, often rooted in the inconsistency and inflexibility of policy frameworks, resulted in uneven progress toward achieving comprehensive EHR interoperability (Dixon & Luckhurst, 2021; Hansen & Baroody, 2020; Rudin et al., 2014).

The HITECH Act was a foundational policy aimed at driving EHR interoperability by compelling healthcare organizations to adopt systems that complied with specific interoperability standards. However, the Act's implementation revealed considerable variability across different healthcare settings, exposing critical gaps in policy effectiveness. Research by Hansen and Baroody (2020) and Dixon and Luckhurst (2021) illustrated the Act's profound impact on aligning organizations with federal interoperability goals. However, these studies also highlighted the disparate outcomes resulting from its implementation, suggesting that the Act did not sufficiently account for the varied capabilities and needs of different healthcare organizations. This variability led to uneven progress in achieving

interoperability, indicating that the policy was not flexible enough to address the diverse challenges faced by healthcare providers.

Wager et al. (2021) examined organizational responses to the HITECH Act's mandates, advocating for greater policy foresight and strategic flexibility to enhance healthcare delivery under varied conditions. Their findings emphasized that while the Act was instrumental in setting initial goals for interoperability, its rigid implementation framework failed to adapt to the dynamic and diverse conditions of U.S. healthcare systems. This lack of adaptability hindered the effectiveness of the policy in achieving its intended outcomes. Dixon and Luckhurst (2021) further noted that the Act's rollout exposed significant disparities, particularly in under-resourced areas, suggesting that the policy was not fully aligned with the operational realities faced by many healthcare providers. These disparities highlighted the ongoing need for policies that were not only well conceived but also adaptable to the unique circumstances of different healthcare settings, a need that remained unfulfilled.

The 21st Century Cures Act of 2016 sought to address some of these gaps by focusing on reducing information blocking and enhancing data exchange (Rai, 2025). However, despite these efforts, challenges persisted. The persistent variability in outcomes across different healthcare settings suggested that the policy frameworks established by the HITECH Act and its successors still required substantial refinement to better support the diverse needs of healthcare organizations and ensure more consistent progress toward EHR interoperability (Dixon & Luckhurst, 2021). This ongoing misalignment between policy goals and organizational realities underscored the continuous need for more responsive and flexible policy frameworks (Rudin et al., 2014).

Table 1 summarizes fundamental studies, presenting their research focus, methodologies, findings, and limitations.

Table 1. Policy perspectives summary (created by authors).

Author(s) & Date	Focus of Research	Sample, Design, Methods	Analysis Approach	Findings	Limitations
Dixon and Luckhurst (2021)	Healthcare administrators' role in EHR interoperability	Case studies	Qualitative analysis	Effective leadership leads to improved EHR functionality	Case studies may not generalize
Hansen and Baroody (2020)	Approaches to EHR interoperability	Literature review	Qualitative synthesis	Success in integration varies based on administrative prioritization	Review-based, limited empirical data
Parrish (2025)	Transition to interoperable EHR systems and TECCA alignment	Case-based policy review and implementation study	Qualitative case analysis	Identifies vendor lock-in and organizational barriers; outlines policy measures for compliant data migration	Case-specific context; limited generalizability
Wager et al. (2021)	Leadership support for EHR systems	Survey	Descriptive statistics	Top-down support crucial for fostering interoperability	Survey limitations, response bias
Xie et al. (2020)	Value co-creation in EHR systems	Literature review	Qualitative synthesis	Identifies value co-creation dimensions and challenges in EHRs	Broad overview, lacks specific examples
McCormack et al. (2021)	EHR and pulmonary function data interoperability	Workshop report	Expert opinion	Develops an interoperability roadmap for pulmonary data	Limited to pulmonary data, specific context
Happer (2025)	FHIR-based interoperability standards for Medicare and Medicaid	Policy and system analysis of CMS and ONC frameworks	Qualitative policy analysis	Examines implementation of FHIR-based interoperability standards in cloud environments and compliance under the Cures Act	Limited to U.S. public health programs; focuses on policy framework rather than empirical provider data
de Mello et al. (2022)	Semantic interoperability in health record standards	Systematic literature review	Qualitative synthesis	Reviews standards for semantic interoperability, emphasizing administrative decisions	Focus on standards, less on implementation

Table 1. Cont.

Author(s) & Date	Focus of Research	Sample, Design, Methods	Analysis Approach	Findings	Limitations
Carter et al. (2022)	EHR and genomics interoperability	Expert opinions	Qualitative content analysis	Discusses EHR interoperability's role in clinical genomics from a leadership perspective	Expert opinions, may not reflect all perspectives
Sun et al. (2021)	Health information exchange networks in the U.S.	Literature review	Qualitative synthesis	Maps the landscape of health information exchange networks, emphasizing administrative roles	Secondary data, may overlook nuanced challenges
Rogers (2025)	Framework for interoperability across legacy EMR systems under Cures Act standards	Applied policy and system framework development	Mixed-methods policy and technical evaluation	Proposes a compliance framework aligning legacy systems with ONC and CMS standards to improve data exchange	Focused on framework design; does not include broad implementation data
Sonkamble et al. (2021)	Blockchain-based EHR interoperability framework	Literature review	Conceptual framework	Proposes a blockchain-based framework for EHR interoperability	Conceptual, lacks practical implementation data
Adler-Milstein et al. (2015)	EHR interoperability within the U.S. healthcare system	Literature review	Qualitative synthesis	Analyzes the substantial investments and policy failures hindering EHR	Focus on U.S. context, may not generalize internationally
Kelly et al. (2020)	Variability in the implementation of EHR interoperability policies	Case studies and policy analysis	Qualitative synthesis	Highlighted inconsistent outcomes in policy implementation across different organizations	Case studies may not be generalizable
Amar et al. (2024)	Semantic interoperability issues in EHR using FHIR	Systematic mapping review	Literature on FHIR and semantic interoperability	Key semantic issues in interoperability and the role of FHIR in addressing these challenges	Literature up to early 2024, potentially missing later developments
Perugu et al. (2023)	Barriers to healthcare data and global information sharing	Case study analysis	International case studies to find common barriers and solutions	Strategies and practices in overcoming interoperability barriers	Not generalizable due to differing healthcare systems and regulations
Rai (2025)	Patient-owned health records and policy framework for data sovereignty	Policy analysis of U.S. and EU regulatory frameworks (Cures Act and EHDS)	Qualitative policy analysis	Proposes a patient-centered data-ownership framework for interoperability across systems	Conceptual framework; limited empirical validation
ONC's Cures Act Final Rule (2020)	ONC Final Rule and its impact on EHR interoperability	Government report and policy analysis	Policy analysis	The ONC Final Rule aimed to enhance data sharing and reduce information blocking	Government-focused analysis, may lack broader external validation
Rudin et al. (2014)	Policy's role in EHR system fragmentation	Policy analysis	Qualitative analysis	Economic inefficiencies due to policy failures	Focus on U.S. healthcare
Centers for Medicare & Medicaid Services [CMS] (2020)	CMS Interoperability and Patient Access Rule and its implications	Government report and policy analysis	Policy analysis	Introduced specific measures to enhance PHI and improve data sharing	Government-focused, with potential gaps in applicability

Note. Researcher generated.

3.2. Economic and Financial Challenges

The pursuit of EHR interoperability within the U.S. healthcare system was shaped by considerable economic challenges, which were deeply intertwined with the development and enactment of relevant policies. Achieving interoperability demanded significant financial investments in infrastructure upgrades, workforce training, and system integration, imposing burdens on healthcare organizations, especially those with constrained budgets and limited capital ([Kelly et al., 2020](#); [Sorace et al., 2020](#)). These economic barriers influenced the effectiveness of policies designed to promote interoperability, often limiting their impact across diverse healthcare settings ([Parrish, 2025](#); [Rogers, 2025](#)).

Federal legislation such as the HITECH Act of 2009 played a pivotal role in initiating widespread EHR adoption and promoting interoperability standards. However, economic disparities among healthcare organizations led to uneven implementation and effectiveness across regions (Kadakia et al., 2021). Variations in financial resources and technological readiness exacerbated these disparities, making uniform interoperability challenging to achieve (Kelly et al., 2020).

Subsequent legislative efforts, including the 21st Century Cures Act of 2016, targeted issues like information blocking and emphasized transparency in EHR practices. Nonetheless, the act's impact was constrained by financial realities, particularly the challenge of scaling interoperability efforts across diverse healthcare settings. Smaller and rural institutions, often limited by tight budgets, struggled to meet the costs of federally mandated changes (Rogers, 2025). Studies indicated that without scalable financial support, these organizations faced barriers to fully participating in interoperability initiatives, undermining the act's intended outcomes (Kadakia et al., 2021; Parrish, 2025).

More recent policy efforts, such as the [ONC's Cures Act Final Rule \(2020\)](#) and [Centers for Medicare & Medicaid Services \[CMS\] \(2020\)](#), introduced compliance requirements aimed at improving data-sharing standards and patient access to health information. While beneficial in theory, these requirements added financial burdens to providers, who had to adapt their systems to meet the new standards (Rai, 2025; O'Reilly-Shah et al., 2020). These financial mechanisms, although integral to advancing policy goals, did not address the deeper economic challenges impeding widespread interoperability, especially in under-resourced settings (Kelly et al., 2020; Sorace et al., 2020).

Table 2 concisely summarizes fundamental studies, presenting their research focus, methodologies, findings, and limitations. This comparative overview provides a framework for identifying key scholarly insights and gaps in addressing economic and financial challenges in EHR interoperability.

Table 2. Economic and financial challenges summary (created by authors).

Author(s) & Date	Focus of Research	Sample, Design, Methods	Analysis Approach	Findings	Limitations
Jha et al. (2020)	EHR usage in U.S. hospitals	Survey data analysis	Statistical analysis	EHR adoption increased post-HITECH	Limited to U.S. hospital data
Sorace et al. (2020)	EHR market competitiveness	Market analysis	Economic analysis	Competitiveness affects interoperability	Market-centric analysis
Kelly et al. (2020)	EHR accessibility for dialysis patients	Case study	Qualitative analysis	Enhanced accessibility improves care	Specific to dialysis care
Kadakia et al. (2021)	Public health data system modernization	Policy analysis	Review of HITECH Act outcomes	HITECH Act's impact on data improvements	Limited to HITECH Act
O'Reilly-Shah et al. (2020)	Healthcare informatics infrastructure	Opinion and analysis	Review and call to action	COVID-19 informatics shortcomings	Opinion-based
Anderson et al. (2023)	Blockchain in U.S. healthcare exchanges	Case study analysis	Literature and case analysis	Interoperability challenges in HIEs	Focused on HIEs, not general EHRs
Rogers (2025)	Interoperability framework across legacy EMR systems and financial performance under CMS compliance	Applied policy and systems framework evaluation	Mixed-methods policy and economic analysis	Finds that modern interoperability frameworks improve resource use and lower administrative costs in legacy EMR systems	Focused on framework validation; does not include long-term financial outcome data
Li et al. (2022)	EHR interoperability in high-income countries	Systematic review	Analysis of literature	Interoperability impact on patient safety	Limited to high-income countries
Mehta et al. (2020)	Blockchain for EHR accessibility	Theoretical exploration	Analysis of blockchain application	Potential for improved EHR interoperability	Theoretical approach

Table 2. Cont.

Author(s) & Date	Focus of Research	Sample, Design, Methods	Analysis Approach	Findings	Limitations
Sonkamble et al. (2021)	Blockchain EHR framework	Proposed framework	Framework design analysis	MyBlockEHR framework for interoperability	Framework not empirically tested
Zhang and Saltman (2022)	Telehealth outcomes and EHR interoperability	Review and analysis	Telehealth service analysis	Interoperability enhances telehealth outcomes	Focused on telehealth
Adler-Milstein et al. (2015)	Interoperability in U.S. healthcare	Literature review and analysis	Economic and policy analysis	Economic impact of EHR interoperability	Primarily U.S.-focused, may not apply globally
Rudin et al. (2014)	EHR system fragmentation due to policy limitations	RAND Corporation study	Policy and economic analysis	Critiqued the fragmentation caused by HITECH and related policies	Focused on U.S. policy impacts, may not be broadly applicable
Kawamoto et al. (2021)	Interoperable EHR innovations	Case study of academic center	Implementation analysis	Initiative for EHR innovations at medical centers	Specific to one institution
Happer (2025)	FHIR-based interoperability standards and payment integration in U.S. public health programs	Policy analysis of Medicare and Medicaid interoperability initiatives	Qualitative policy and economic assessment	Identifies how FHIR implementation supports data exchange and cost efficiency under CMS and ONC payment reform programs	Focused on policy and framework analysis; lacks provider-level economic outcome data
Rai (2025)	Patient-owned health records and policy implications for data access and cost efficiency	Comparative policy analysis of U.S. and EU data-sovereignty frameworks	Qualitative regulatory and economic assessment	Patient-centered data ownership improves transparency in health data exchange	Conceptual framework; limited empirical data on implementation costs

Note. Researcher generated.

Financial concerns highlighted the role of leadership engagement, emphasizing that effective organizational adoption of interoperability standards depends on strategic support, cultural alignment, and policy-informed leadership capacity across institutions.

4. Discussion and Conclusions

This study evaluated the barriers to achieving EHR interoperability within the U.S. healthcare system and proposed actionable policy modifications to address these challenges. The investigation was guided by two research questions:

- What are the major barriers hindering successful EHR interoperability within the U.S. healthcare infrastructure?
- What policy modifications could address these barriers and improve EHR interoperability within the U.S. healthcare system?

The findings offered detailed insights into the systemic issues obstructing EHR interoperability, including inconsistent policy enforcement, financial constraints, and leadership challenges. These barriers were analyzed in the broader context of healthcare policy, financial sustainability, and leadership capacity, providing a comprehensive understanding of their interconnected nature. The following subsections summarize the findings for each research question.

4.1. Summary of the Research Question Findings

This section summarizes evidence-based answers to the research questions guiding this study, focusing on the barriers to EHR interoperability and actionable policy recommendations to address them. For Research Question 1 on the barriers, the analysis identified inconsistent policy enforcement and financial constraints as primary obstacles. These factors underscored a fragmented healthcare system where smaller providers struggled to meet national standards due to resource limitations and insufficient support mechanisms.

For Research Question 2, on the policy modifications, the findings led to targeted policy recommendations to address these barriers. Proposed solutions included adaptive enforcement strategies, sustained financial assistance, and specialized leadership development initiatives to promote equitable solutions. These recommendations, supported by the data, provided actionable pathways to enhance data-sharing capabilities, particularly for under-resourced providers, and foster a unified approach to achieving interoperability across the U.S. healthcare system.

4.2. Discussion

The findings of this study revealed interconnected barriers to EHR interoperability within the U.S. healthcare system. This section evaluates their significance, examines broader implications, and considers potential unintended consequences of proposed interventions. By emphasizing the systemic nature of these barriers, this discussion highlights their cumulative impact on data sharing, explores viable pathways to a unified healthcare information system, and situates these findings within the international context of successful interoperability frameworks.

4.2.1. Policy Enforcement Challenges: Reflecting on Compliance and Equity

The analysis of inconsistent policy enforcement revealed disparities in compliance capabilities across healthcare providers, disproportionately affecting smaller, under-resourced organizations. Although the HITECH Act and the 21st Century Cures Act established foundational goals for EHR adoption, their uniform enforcement perpetuated inequities.

Uniform penalties often strained rural and small hospitals lacking the financial and technical capacity for full compliance, at times leading to service reductions or closures. A tiered enforcement model, adjusting penalties and compliance timelines to provider capacity, could mitigate these disparities. Recognizing that implementing such a model, however, may increase administrative complexity and oversight demands, certain measures and structures may need to be developed. For example, a body comprising clinicians, technologists, and administrative staff could be consulted on the development. Also, a national body comprising multiple stakeholders, such as regulators, payers, providers, vendors, and patients, could oversee the administration. Furthermore, such a body may encourage the development of a national or shared services platform. That in turn would facilitate the gathering of needed metrics, such as staff FTE, and those metrics could then be used to refine policies and procedures.

Inconsistent enforcement also eroded trust in regulatory frameworks, particularly among smaller providers frustrated by unclear expectations. Greater transparency and predictable enforcement supported by technical assistance could foster cooperation, reduce resistance, and promote equitable compliance.

4.2.2. Financial Constraints: Sustaining Progress Without Reinforcing Disparities

Financial limitations remain a persistent barrier, especially for providers relying on outdated systems that impede interoperability. While the HITECH Act provided initial funding for EHR adoption, the absence of sustained financial support created ongoing challenges for system upgrades and compliance.

Proposed strategies such as tiered funding and tax incentives address these needs but pose risks if not equitably structured. Targeting high-need areas might exclude moderately resourced organizations, and tax incentives offer limited relief to providers operating at a loss. Without continued investment in technology and workforce training, small and rural facilities risk isolation from national health information exchanges, reinforcing systemic fragmentation. Policies must therefore ensure equitable, long-term financial support that balances immediate needs with sustainable interoperability goals.

4.2.3. Broader Implications

The barriers identified have significant implications for the U.S. healthcare system. Achieving interoperability is not merely a technical task but essential for advancing value-based care, improving patient outcomes, and enhancing public health preparedness.

HL7 and FHIR standards provide a path toward consistent data exchange, yet resource disparities and technical challenges slow widespread adoption. Smaller providers without the means to implement FHIR risk exclusion from advanced health information exchanges, perpetuating disparities in care coordination. Coordinated financial and legislative strategies, including revitalized Regional Extension Centers, could provide technical guidance, leadership training, and fiscal support to help all providers meet national interoperability objectives.

4.2.4. International Policy Lessons: Denmark and Finland

International experience shows that large-scale interoperability depends on coherent policy direction, consistent governance, and sustained investment. Finland and Denmark exemplify these conditions through long-term national programs achieving full EHR integration.

In Finland, the Kanta Services form the backbone of national health information exchange. A 2025 evaluation by the Ministry of Social Affairs and Health confirmed that Kanta functions as essential infrastructure supporting secure, standardized, and interoperable data sharing across organizations. The report identified strong governance, transparent funding, and clear legislation as critical success factors (Palojoki & Vuokko, 2025). Long-term analysis verified the reliability and continued use of the Kanta patient and prescription repositories (Jormanainen, 2024), while other studies showed ongoing alignment with EU standards and the General Data Protection Regulation (Fagerholm, 2024).

Denmark achieved similar outcomes through its national health data portal, Sundhed.dk, integrating public and private healthcare information in a unified system. The Nordic Council of Ministers' 2025 benchmarking report ranked Denmark and Finland among the highest globally for interoperability, attributing this success to centralized governance, standardized data architectures, and stable public investment (Koch et al., 2025).

Recent research on Nordic and European data governance underscores that future progress will depend on balancing data sovereignty and privacy requirements within the evolving European Health Data Space (Rahman & Kaskinen, 2024). The Finnish and Danish cases demonstrate that interoperability arises from sustained policy execution, structured governance, and public confidence in national digital infrastructures.

5. Recommendations

This section presents actionable recommendations to address barriers to EHR interoperability within the U.S. healthcare system. These recommendations include legislative reforms, financial strategies, leadership development, and HIT advancements, providing targeted solutions rooted in the study's findings and aligned with the systemic issues identified throughout the research.

5.1. Legislative Reforms: Strengthening Policy Enforcement Mechanisms

To mitigate inconsistent policy enforcement, comprehensive reform of legislative frameworks such as the HITECH Act and the 21st Century Cures Act is essential. Smaller healthcare providers continue to face disproportionate compliance challenges due to limited resources. Key reforms include:

- **Tiered Compliance Mechanisms:** Implement a graduated enforcement approach in which penalties, incentives, and timelines are scaled to provider size and resources.

Smaller providers could receive extended deadlines and incremental requirements, promoting steady progress rather than penalties.

- **Mandatory Participation Mandates:** Strengthen regulations to ensure all providers comply with data-sharing standards while receiving federal assistance to meet requirements. This approach would reduce fragmentation across the healthcare system.
- **Unified Oversight Structures:** Establish a centralized federal entity to oversee interoperability standards, ensuring consistent enforcement and clearer guidance for providers.

5.2. Financial Support Strategies: Bridging the Economic Divide

Addressing financial constraints requires sustained federal funding and innovative financing models. Smaller providers often rely on outdated technology incompatible with national standards such as HL7 and FHIR. To close this gap:

- **Federal Grants and Subsidies:** Expand programs like the Rural Health Care Program to offer ongoing financial assistance for system upgrades and maintenance. Priority should be given to underserved areas to mitigate regional disparities in interoperability capabilities.
- **Tax-Based Incentives:** Implement tiered tax credits to encourage investment in compliance with interoperability standards. Smaller providers could receive higher credits proportional to their financial constraints, easing their economic burden.
- **Sustainability Funds:** Create a dedicated federal fund to ensure the long-term adoption of interoperable systems. This fund should support routine updates, staff training, and compliance efforts to promote sustained progress.

5.3. Leadership Development: Equipping Leaders for Change

Leadership deficiencies remain a major barrier, particularly in under-resourced organizations where leaders often lack HIT and compliance expertise. To strengthen leadership capacity:

- **HIT Leadership Training Programs:** Develop federally funded training to build skills in HIT management, change implementation, and resource allocation, prioritizing leaders in rural and underserved areas.
- **Mentorship and Knowledge-Sharing Networks:** Establish national networks to facilitate collaboration among healthcare leaders. These networks would enable the exchange of best practices, resource sharing, and collective problem-solving to navigate interoperability complexities.
- **Leadership Incentives:** Introduce policy-driven incentives, such as financial grants or performance-based rewards, for leaders who successfully implement interoperable EHR systems within their organizations.

5.4. Integrating HIT Advancements: Leveraging Technology for Change

This study emphasized the critical role of aligning interoperability initiatives with technological advancements, including HL7, FHIR, and emerging HIT innovations. The following recommendations are proposed to leverage technology effectively for enhanced EHR interoperability:

- **Mandating HL7 and FHIR Standards:** Require adoption of HL7 and FHIR across healthcare settings to standardize data exchange, with targeted support for smaller providers to ensure equitable implementation.
- **Supporting AI and Blockchain Integration:** Promote research and pilot programs focused on artificial intelligence (AI) and blockchain technologies to improve the security and efficiency of data-sharing processes. These innovations offer significant potential for addressing interoperability barriers while safeguarding privacy, even

given some ethical challenges (Mulligan et al., 2026; Russ-Eft & Alizadeh, 2024; de Faria Santos & Coryell, 2024).

- Regional Support Centers: Revitalize federally funded Regional Extension Centers (RECs) to provide localized technical support for EHR integration, system updates, and ongoing interoperability efforts.

5.5. Broader Implications: Achieving a Unified Healthcare System

The recommendations outlined in this study aim to foster a cohesive and interoperable healthcare system, supporting seamless data exchange while addressing systemic barriers. Achieving these outcomes requires:

- Collaborative Policymaking: Federal agencies must engage stakeholders from across the healthcare spectrum, particularly smaller and under-resourced providers, to co-develop policies that accommodate diverse needs and operational realities.
- Long-Term Evaluation Frameworks: Establish continuous evaluation processes to monitor the effectiveness of legislative and financial strategies, ensuring they adapt to the rapidly evolving healthcare landscape and remain relevant over time.

By advancing legislative reform, sustainable funding, leadership development, and technological integration, these recommendations offer a comprehensive roadmap to enhance interoperability and equity across the U.S. healthcare system.

6. Limitations of the Study

This study acknowledges several limitations that could influence the interpretation of its findings and the broader generalizability of its conclusions. Recognizing these constraints is essential for understanding the scope of the research and its implications for policy and practice.

6.1. Methodological Constraints

This research employed a qualitative meta-synthesis design using existing academic and policy literature to analyze electronic health record interoperability within the U.S. healthcare system. The study did not include interviews or primary data collection. Instead, it synthesized findings from previously published studies, government reports, and policy analyses. While this approach enabled a comprehensive and evidence-based review of existing knowledge, it is inherently limited by its reliance on secondary sources.

Potential bias may exist in the selection of literature, as some studies may not capture emerging perspectives or unpublished findings. Although multiple coding rounds and triangulation were used to enhance reliability, the reviewed sources might not fully represent every dimension of the topic. Future research could strengthen this work by combining meta-synthesis with primary methods such as interviews or case studies to obtain real-time insights from healthcare providers and policymakers.

6.2. Data Source Limitations

Because this study relied exclusively on secondary data, including peer-reviewed publications, government reports, and policy documents, it may not reflect the most current changes in health information technology policy or implementation. This reliance may have constrained the ability to assess dynamic challenges faced by healthcare providers, particularly smaller or rural institutions with limited resources. Cross-referencing multiple studies improved the validity of the findings, but it cannot substitute for firsthand accounts from organizations directly involved in EHR adoption and compliance. Future research using primary data could complement these results and capture current barriers, progress, and policy impacts in real time.

6.3. Generalizability of Findings

The findings and recommendations of this study apply primarily to the U.S. healthcare system. The research intentionally focused on U.S. policy, regulation, and organizational contexts and was not designed for international comparison. Differences in infrastructure, regulatory models, and funding mechanisms limit the transferability of these findings to other nations. The emphasis on smaller, under-resourced providers within the United States also means that the challenges of larger or technologically advanced organizations may not be fully represented. While international perspectives were acknowledged in the discussion for context, this study's purpose and analysis remained specific to the U.S. policy environment. Future comparative research could extend this framework to other countries, examining how similar policy principles perform under different healthcare models.

6.4. Influence on Policy and Practice

These limitations may affect how the proposed policy recommendations are interpreted and implemented. Methodological constraints, including possible selection bias in reviewed studies, may have influenced which barriers and solutions were emphasized. Additionally, the exclusive use of secondary data means that the analysis cannot fully address real-time policy dynamics or stakeholder perspectives. Policymakers applying these findings should account for these constraints and consider supplementing them with empirical data. Broader stakeholder engagement and ongoing data collection will be necessary to ensure that policy responses remain evidence-based and adaptable to evolving healthcare needs and technological changes.

6.5. Refining Policy Recommendations

The limitations outlined above highlight the complexity of developing and implementing effective interoperability policies. While this study proposes practical and targeted strategies such as strengthening legislative frameworks, expanding financial support mechanisms, and improving leadership capacity, these recommendations should be continuously refined as new evidence becomes available. Ongoing evaluation, stakeholder input, and data collection are essential for maintaining relevance and ensuring that policies evolve alongside technological innovation and changes in healthcare delivery. Sustained monitoring will help ensure that EHR interoperability efforts remain responsive, equitable, and aligned with national healthcare priorities.

7. Implications for Future Research

Future research should continue to build on this study by focusing on adaptive policies, sustainable financial incentives, and effective leadership strategies to create a robust and interoperable health information ecosystem. The following areas highlight key directions for future investigation.

7.1. Confirm and Expand upon These Findings

Through a literature review approach, the current work identified several policy issues. Future studies could be undertaken to gather primary data. One approach would be to undertake a Delphi study with selected healthcare policy experts. Such a study would begin with an open-ended survey to identify the major issues. It would then survey these same experts two or three times to gather ratings of importance of the identified issues.

Another future study could gather interview data with healthcare providers to confirm and possibly expand upon the current findings. In such a study, it would be important to interview and possibly contrast those from large urban providers with those from small rural entities. These interview data could be supplemented with the gathering of archival records.

7.2. Explore and Integrate Advanced Technologies for EHR Interoperability

Emerging technologies such as blockchain and AI offer significant potential for addressing persistent challenges in electronic health record interoperability, including data security, accuracy, and seamless information exchange. Future studies should evaluate the feasibility, scalability, and integration of these technologies across different healthcare environments.

Blockchain provides a secure and distributed method for managing patient records, reducing risks related to data breaches and unauthorized access. However, implementing blockchain in under-resourced settings requires additional study, particularly regarding financial and technical feasibility and compatibility with existing EHR systems. Research could explore cost reduction strategies or infrastructure support models tailored to smaller providers.

AI has the potential to automate administrative tasks, enhance data reconciliation, and enable real-time data sharing. At the same time, it may introduce some ethical challenges (i.e., [Russ-Eft & Alizadeh, 2024](#); [de Faria Santos & Coryell, 2024](#)). Research should investigate how AI can streamline workflows while examining ethical considerations such as bias and discrimination, as well as patient privacy. Other ethical issues may involve a lack of transparency and accountability ([Beheshti & Kerridge, 2025](#)). Policies supporting AI adoption should emphasize equitable access, possibly through federal funding or grants for smaller and rural healthcare systems. By studying these technologies, future research can provide actionable insights into how innovation can improve EHR interoperability, efficiency, and inclusivity.

7.3. Address Rural and Urban Disparities in EHR Implementation

This study found persistent disparities between rural and urban healthcare organizations. Urban systems often benefit from advanced infrastructure, while rural providers face challenges including limited funding, insufficient IT capacity, and gaps in leadership. Future research should develop targeted interventions to address these specific barriers.

Studies could assess the effectiveness of tiered funding models that prioritize financial support for rural and underserved communities. These models might include grants for infrastructure modernization, compliance assistance, and leadership training. Focusing resources on the most affected regions could substantially reduce disparities in EHR adoption.

Researchers should also explore how state and federal policy can foster partnerships between urban and rural organizations. Such collaborations could promote shared technical support, training, and data resources. These cooperative models may help rural providers leverage urban advancements, ensuring that all healthcare systems benefit from national interoperability goals.

7.4. Develop Customizable EHR Systems for Diverse Healthcare Settings

A key finding of this study was the misalignment between standardized EHR systems and the unique needs of smaller or specialized healthcare organizations. Future research should emphasize the development of customizable EHR platforms that accommodate varied clinical and operational environments while remaining compliant with interoperability standards such as HL7 and FHIR.

Investigations could identify essential system features required by smaller providers, including simplified interfaces, lower maintenance demands, and cost-effective integration options. Researchers might also examine modular EHR designs that allow organizations to implement only the components necessary for their operations. Policymakers could further support this by encouraging vendors to develop customizable solutions at competitive prices.

7.5. Examine the Historical Adoption of Interoperable Systems in Other Countries

Existing evidence from [Black Book Research \(2026\)](#) highlights successful interoperability strategies in countries such as Estonia, Finland, and Denmark. Future research should analyze the policies, technologies, and sociocultural factors that have contributed to these achievements.

National mandates and centralized governance models in these countries encouraged uniform standards and consistent data exchange. Future research could explore how these structures balance national oversight with flexibility to address regional needs. Lessons from these international examples may help U.S. policymakers design strategies that improve interoperability while maintaining the flexibility required in a federal system.

Researchers should also assess how other nations addressed provider resistance and compliance barriers. Understanding these mechanisms could help the United States develop effective policies to overcome similar institutional and technical challenges.

7.6. Evaluate the Successes and Failures of Interoperability Efforts Abroad

Future studies should also examine the limitations of international interoperability initiatives. Some nations have experienced difficulties such as vendor lock-in, data silos, and privacy concerns that hindered progress. Research should evaluate these failures to identify potential risks and strategies that could help U.S. policymakers avoid comparable setbacks.

Particular attention should be paid to the balance between technological innovation and data security. Comparative studies could provide insights into how global health systems manage this balance and inform U.S. efforts to create a resilient, adaptable interoperability framework.

7.7. Broader Implications for Policy Innovation

Future research must continue to emphasize the role of legislation and policy as key drivers of healthcare transformation. Policies such as the HITECH Act and the 21st Century Cures Act demonstrate that achieving interoperability requires mandates, funding, and effective enforcement. Future studies should evaluate adaptive policy strategies such as tiered compliance, regular program evaluations, and public-private partnerships to address evolving challenges in health information technology.

Encouraging a culture of continuous innovation through policy is equally important. Mandating regular updates to interoperability standards, including HL7 and FHIR, would help ensure that the U.S. healthcare system remains responsive to technological change. Future studies should also assess the long-term impacts of such policies to sustain progress and guide future innovation.

8. Summary

This study provided a comprehensive examination of the challenges, implications, and actionable strategies related to EHR interoperability within the U.S. healthcare system. The findings addressed the research questions guiding the study, identifying inconsistent policy enforcement and financial constraints as the primary barriers to interoperability. These barriers were analyzed to uncover their interconnected nature and systemic impact on data-sharing capabilities and healthcare equity. The discussion evaluated the broader implications of these barriers, highlighting their effects on healthcare outcomes and organizational sustainability.

Based on these findings, the recommendations section proposed targeted solutions to overcome these barriers. Legislative reforms were recommended to promote equitable policy enforcement, along with financial strategies designed to provide sustained support for smaller and under-resourced providers. Leadership development initiatives were em-

phasized as critical for equipping healthcare leaders with the skills needed to navigate the complexities of HIT. Additionally, integrating advanced technologies, such as HL7 and FHIR standards, was underscored as essential for achieving interoperability.

The implications for future research called for continued exploration of advanced technologies, tailored interventions to address rural and urban disparities, and insights drawn from international interoperability efforts. These directions emphasized the importance of adaptive policies and innovative approaches to sustain progress in creating a cohesive and interoperable healthcare system.

The final sections culminated the study's findings by presenting evidence-based insights, practical recommendations, and future research perspectives. It reinforced the potential for transformative change in the U.S. healthcare system, advancing equity, efficiency, and improved patient outcomes through enhanced interoperability.

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