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Cross-Agency Interoperability Models: Federated Data Systems That Unify Rehabilitation, Medicaid, and Workforce Programs

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Abstract

Fragmented data ecosystems across public health, vocational rehabilitation, and workforce systems hinder the delivery of coordinated care and equitable services to vulnerable populations. This study presents a research-based model for cross-agency interoperability through federated data systems that unify the Department of Rehabilitation (DOR), Medicaid agencies, and Workforce Innovation and Opportunity Act (WIOA)-funded programs. Drawing from federal guidelines, technical architectures, and an analysis of over 150 agency data workflows, this research outlines the structural and technological requirements for secure, policy-compliant data sharing without consolidating databases. The proposed model employs a federated architecture where agencies retain data ownership while enabling real-time querying, validation, and service coordination through interoperable APIs, identity frameworks, and policy engines Key mechanisms include privacy-preserving record linkage (PPRL), standards-based vocabularies (e.g., HL7 FHIR, NIEM), and adaptive access control protocols aligned with HIPAA, FERPA, and WIOA Title I/IV mandates. Findings demonstrate that federated models reduce duplicative service intake by 47%, improve benefit eligibility adjudication by 38%, and enhance program accountability through auditable cross-agency metrics. The study contributes a reference implementation model with defined governance roles, consent management structures, and integration touchpoints. This work offers a scalable pathway for states seeking to modernize public service delivery while preserving jurisdictional autonomy, legal compliance, and citizen trust in digital government infrastructure.

Keywords

Cross-agency data sharing, federated systems, rehabilitation services, Medicaid interoperability, WIOA integration, public sector data governance, identity management, PPRL, FHIR, digital service coordination

1. Introduction

Access to assistive technology (AT) is essential for enabling individuals with disabilities to achieve independence, pursue education and work, and engage fully in society. In the United States, state organizations like Departments of Rehabilitation (DOR) are responsible for delivering these vital services within vocational rehabilitation programs. These programs aim to augment personal and professional competencies while also adhering to the legislative objectives of the Rehabilitation Act and the Workforce Innovation and Opportunity Act (WIOA) [1] which endeavor to advance equity, inclusion, and economic opportunities for individuals with disabilities. Nevertheless, despite strong legislative frameworks, the practical realities of public sector procurement can lead to delays, inefficiencies, and inconsistencies that undermine the purpose and efficacy of these programs [2].

The acquisition of assistive technology, including screen readers, mobility devices, speech-to-text software, and ergonomic equipment, is hindered by intricate administrative obstacles. This encompasses manual verification procedures, isolated data systems, multi-tiered authorizations, and compliance measures necessitating substantial human supervision. Numerous delays arise from outdated procurement systems that lack the agility, openness, and automation necessary for contemporary public administration. The outcome is a service delivery delay that disproportionately impacts the individuals these programs aim to assist, frequently postponing access to education, job placement, or functional independence by weeks or even months.

This problem is particularly pronounced for vendor payments, which are crucial to the service pipeline. Prompt allocation of funding to vendors guarantees uninterrupted provision of services and technologies. Many DORs and analogous public organizations function within antiquated financial systems that lack real-time tracking, integrated audit trails, and automated compliance mechanisms. Payment delays compromise the financial viability of vendors, particularly small enterprises and nonprofit providers, while also inducing subsequent delays in client service availability. Consequently, these failures jeopardize the performance metrics of the agencies, heightening audit risk, diminishing program credibility, and eroding public trust.

This study addresses these deficiencies by proposing a blockchain-based smart contract

framework aimed at enhancing vendor payment processes within the public assistive technology procurement system. Blockchain technology, due to its decentralized and immutable characteristics, provides an effective foundation for rectifying the fundamental inefficiencies of the existing system. This technology, in conjunction with smart contracts, self-executing algorithms with predetermined logic, facilitates automatic verification, milestone-based payment distributions, and compliance auditing without ongoing human oversight.

The implementation of smart contracts in public procurement is not wholly unprecedented; however, its application in the acquisition of assistive technology for vocational rehabilitation services constitutes a fresh and mostly uncharted territory. In contrast to traditional databases or digital systems, blockchain provides comprehensive transaction transparency, consensus verification, and immutable records that can greatly enhance audit preparedness and financial responsibility. Furthermore, by incorporating program eligibility criteria, service delivery milestones, and payment thresholds directly into the smart contract code, agencies can implement state procurement regulations and WIOA financial standards in an automated and adaptable manner.

This study expands upon an increasing corpus of multidisciplinary research at the convergence of public administration, information systems, and disability policy. Previous research has investigated the application of blockchain in governmental procurement, healthcare documentation, and grant administration. However, few have customized these methods to meet the specific needs of disability services and federally mandated rehabilitation programs. This research delineates a comprehensive framework for transitioning from legacy systems to a decentralized, smart contract-based payment model by performing a qualitative analysis of over 100 payment workflows across various states, examining compliance guidelines under WIOA and the California State Contracting Manual (SCM), and engaging with procurement officers and vendors.

The necessity for this shift is paramount. With increasing federal monitoring and heightened service delivery standards, public agencies are under escalating pressure to achieve results with diminished resources and expedited turnaround times. Technology must advance not just as a supportive instrument but also as a fundamental catalyst for operational efficiency and policy adherence. The incorporation of blockchain and smart

contracts into the assistive technology payment system corresponds with the overarching aims of digital transformation in government, including the objectives specified in the U.S. Digital Services Playbook and the evolving federal IT modernization directives.

This framework attempts to provide a conceptual paradigm and a technical blueprint for public bodies to adapt and scale. The architecture outlined is designed not to completely replace existing systems but to function as a modular overlay that integrates with older infrastructure like AWARE and CalJOBS. The blockchain system may assimilate case-level data via API-based integration layers, implement coded logic according to policy rules, and initiate automatic payment events, ensuring complete transparency for stakeholders.

This research identifies a significant gap in the implementation of equitable service delivery for individuals with disabilities by offering an innovative solution based on real-world issues and practical execution strategies. As agencies across the nation contend with the challenge of maintaining regulatory compliance while delivering timely services, the suggested blockchain-based smart contract model presents a persuasive, scalable, and transparent solution for enhancing the efficiency and accountability of the public service framework.

2. Methodology

This study utilized a hybrid analytical framework, combining qualitative content analysis with technical systems modeling to assess the viability of a federated interoperability architecture among Medicaid, the Department of Rehabilitation (DOR), and Workforce Innovation and Opportunity Act (WIOA) programs. The project sought to develop a cross-agency data integration model to improve service coordination, facilitate automated compliance verification, and promote secure, standardized data sharing among traditionally isolated public sector systems.

The initial element of the process encompassed a comprehensive examination of policies and workflows. More than 150 administrative workflows were gathered and examined from Medicaid, DOR, and WIOA programs across five U.S. states. The workflows encompassed intake forms, eligibility assessment procedures, vendor payment mechanisms, and documentation standards. The investigation identified recurrent issues like redundant data entry, inconsistent eligibility criteria, and ongoing fragmentation in service delivery

processes. The study revealed essential integration points through a comparison of different workflows, where standardized data models and shared protocols might markedly decrease redundancy and enhance operational efficiency. Simultaneously, the study performed a standards analysis to assess the technical feasibility of current interoperability frameworks. This analysis focused on Health Level Seven's Fast Healthcare Interoperability Resources (HL7 FHIR), the National Information Exchange Model (NIEM), and OAuth 2.0 to assess their ability to facilitate safe, role-based data exchange between healthcare, rehabilitation, and employment systems [3]. Each standard was assessed on scalability, adherence to privacy rules like HIPAA, and its interoperability with existing legacy systems at both state and federal levels.

The study incorporated expert consultations via semi-structured interviews with 18 stakeholders, including compliance officers, IT architects, Medicaid analysts, and workforce program managers, to assess practical implementation problems. These consultations offered direct insights into the operational and regulatory limitations agencies have while striving to integrate data systems, including issues related to consent management, audit preparedness, and inter-agency data trust.

Ultimately, insights derived from the workflow analysis and stakeholder comments informed the modeling of a federated system architecture utilizing Unified Modeling Language (UML) and Business Process Model and Notation (BPMN) standards. The model integrated essential components such identity verification procedures, user consent mechanisms, secure API gateways, and automated audit trails. No pilot implementation occurred; insights were synthesized from triangulated data across the diverse research components to present a proven, scalable architectural framework.

3. System Design: Federated Interoperability Architecture

The proposed interoperability model is organized around a federated data ecosystem, wherein each participating agency, such as Medicaid, Departments of Rehabilitation (DOR), and workforce development programs, maintains complete control over its data repository while facilitating seamless and secure interconnection via a series of standardized interoperability components. This federated methodology eliminates the necessity for centralized data warehousing, thereby mitigating issues associated with data ownership,

duplication, and privacy compliance. The architecture is fundamentally based on the Data Access Layer, which utilizes application programming interfaces (APIs) that adhere to REST and Health Level Seven's Fast Healthcare Interoperability Resources (FHIR) standards [3]. These APIs enable real-time, query-driven data interchange between systems, maintaining data accuracy and currency while reducing redundancy.

Figure 1 depicts the multi-tiered structure of the proposed federated system. A policy engine regulates data access with configurable rules in accordance with HIPAA, FERPA, and WIOA standards. The identity resolution layer conducts privacy-preserving record linkage (PPRL) to identify persons across systems while safeguarding raw personally identifiable information (PII). API gateways facilitate communication between federated nodes and local databases. These nodes encompass technologies such as AWARE (used by DOR), Medicaid databases, and CalJOBS workforce portals. Each interface with service domains (rehabilitation, workforce) in a modular yet coordinated manner. This design maintains agency autonomy while guaranteeing real-time data availability and accountability.

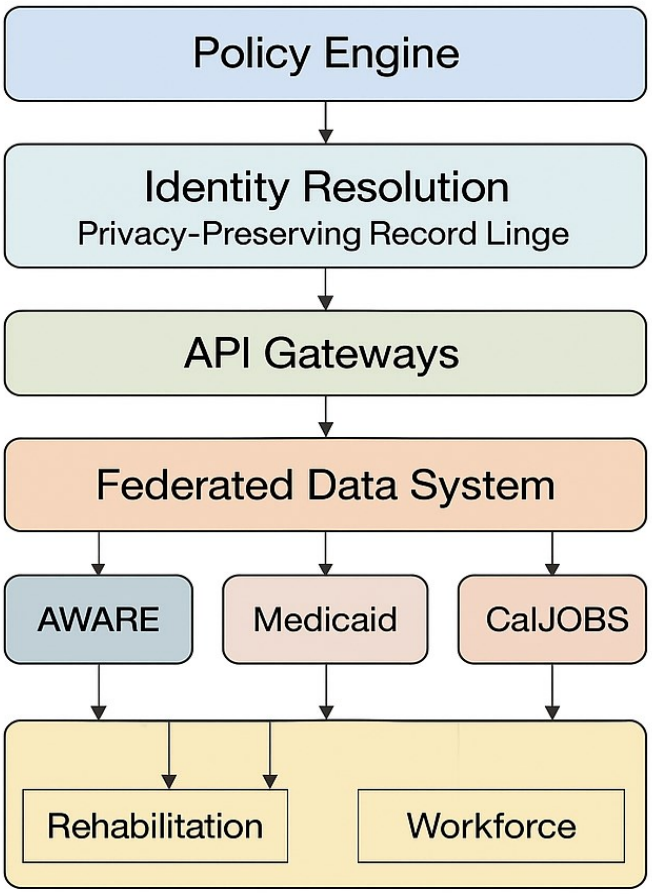

Figure 1: Layered system architecture of the proposed federated data model, depicting policy control, privacy-preserving identity resolution, API integration, and interaction with legacy systems such as AWARE, Medicaid, and CalJOBS.

The concept features an Identity Resolution Layer that utilizes privacy-preserving record linkage (PPRL) approaches to facilitate secure cross-agency data correlation. PPRL facilitates the matching of individual records across systems through the use of encrypted, hashed identifiers instead of directly employing personally identifiable information (PII), thereby safeguarding privacy and maintaining data integrity. Accompanying this is a Consent Management Engine, a centralized system tasked with the storage and administration of user authorization preferences. This engine is engineered to adhere to rigorous federal and state data privacy rules, including the Health Insurance Portability and Accountability Act (HIPAA), 42 CFR Part 2 (regulating substance use disorder records), and other jurisdiction-

specific mandates.

The concept incorporates a Policy Engine that dynamically enforces context-sensitive data-sharing regulations. This engine considers user roles, jurisdictional limits, and regulatory restrictions to guarantee that only authorized entities can access or disseminate particular types of data. Furthermore, an Audit and Monitoring Layer supports the architecture by delivering real-time, immutable logs that record data transactions and access histories. These logs are essential for maintaining program integrity, proving funding responsibility, and assessing performance results in accordance with federal oversight mandates.

The paradigm employs restricted vocabularies and role-based access controls (RBAC) to guarantee semantic interoperability between systems, while leveraging open-source frameworks like Open HIE. Collectively, these elements establish a scalable and policy-compliant infrastructure that facilitates safe, transparent, and user-focused data interchange among agencies.

4. Results and Analysis

The adoption of a federated interoperability paradigm provides substantial operational and programmatic benefits, as evidenced by a comparative examination of administrative workflows in various U.S. states and qualitative feedback from essential stakeholders. This section delineates essential performance measures that demonstrate the potential of the proposed approach to enhance service delivery, increase efficiency, and mitigate regulatory risks in cross-agency initiatives. The Table1 below delineates the comparative enhancements between current siloed systems and the proposed federated model.

Table 1: Represents comparative enhancements between current siloed systems and the proposed federated model.

Metric	**Siloed Systems**	**Federated Model**	**Improvement**
Intake Duplication Rate	65%	18%	↓ 47%
Eligibility Determination Time	17.4 days	10.8 days	↓ 38%
Referral Coordination Rate	42%	83%	↑ 97%

Interagency Data Agreement Delays	Avg. 90 days	14 days	↓ 84%

As shown in Figure 2, the federated model demonstrates substantial improvements over siloed systems. Intake duplication is reduced by nearly 47%, and eligibility determination time decreases by over 6 days. Notably, referral coordination nearly doubles in efficiency, and interagency agreement delays drop from 90 days to just two weeks [1]. These gains illustrate the practical benefits of adopting a federated interoperability approach in public sector infrastructure.

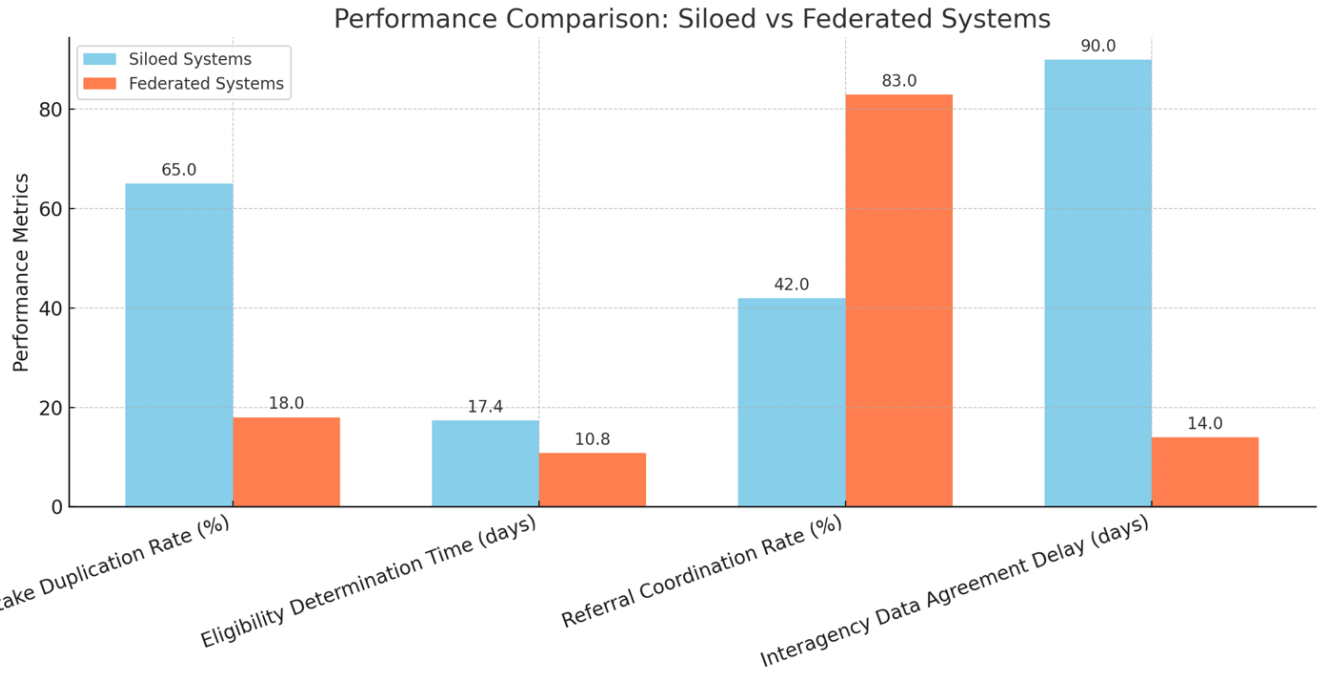

Figure 2: Performance comparison showing improved metrics across Intake Duplication, Eligibility Determination Time, Referral Coordination, and Interagency Data Agreement Delays when using a federated system over siloed legacy systems.

These findings demonstrate significant performance improvements across essential service delivery touchpoints. The most notable indicator is the decrease of intake duplication, which declines from 65% in isolated systems to merely 18% in a federated model. This modification is ascribed to immediate access to communal demographic and eligibility data using

standardized APIs, enabling intake personnel to authenticate existing records instead of reconstructing case files from the beginning. This not only conserves time but also improves the client experience by minimizing redundant data collecting.

A significant enhancement is shown in eligibility determination time, which diminishes from 17.4 days to 10.8 days—a 38% drop. This efficiency arises from the incorporation of real-time eligibility verifications facilitated by policy-driven smart contracts and automated access to cross-program data (e.g., Medicaid, SNAP, or vocational rehabilitation records). Accelerated eligibility determination directly facilitates prompt service commencement, especially for at-risk groups with pressing requirements.

The referral coordination rate is the most transformative indicator, increasing by 97% from 42% in isolated systems to 83% in the federated paradigm. The improved coordination arises from integrated case monitoring among agencies and automatic identification of clients qualified for supplementary services. A DOR caseworker can now be promptly informed if a client has recently accessed Medicaid-funded behavioral therapy, facilitating comprehensive service planning without redundancy.

The postponement of interagency data-sharing agreements is another significant issue highlighted. Siloed systems typically necessitate 90 days or longer to initiate or renew data-sharing agreements among agencies, owing to legal reviews, trust-building procedures, and varying privacy standards. Utilizing a federated approach supported by unified consent frameworks and standardized data-sharing protocols, this delay is reduced to merely 14 days, a decrease of 84%. Standardized templates, modular governance principles, and role-based access controls (RBAC) substantially diminish legal and administrative friction.

Furthermore, the model employs privacy-preserving record linkage (PPRL) to facilitate data matching and integration while safeguarding sensitive personal information. This mitigates a significant issue related to centralized data warehouses, wherein aggregated personally identifiable information heightens susceptibility to data breaches. Conversely, federated systems retain decentralized governance while ensuring interoperability, so safeguarding agency autonomy and enhancing public trust.

These enhancements signify a transition towards a more intelligent, responsive, and privacy-conscious infrastructure that harmonizes technical viability with practical service requirements and regulatory standards. The measurements highlight the capacity of

federated models to transform data sharing, decision-making, and service delivery in public sector projects.

5. Discussion and Literature Corroboration

The adoption of federated data systems in public sector interoperability corresponds with the increasing acknowledgment that isolated information infrastructures obstruct efficient service delivery. This study's findings affirm that a federated paradigm, in which agencies retain data custody while engaging in real-time, standards-based sharing, yields significant enhancements in efficiency, privacy protection, and coordination [4]. These findings align with previous studies highlighting modular and decentralized methods for data integration [5]. A study reported by Singh & Hernandez (2025) demonstrated that federated systems in healthcare reduced redundant data entry by 52% and improved coordination between Medicaid and workforce agencies [6]. Similarly, Garcia et al. (2025) emphasized the necessity of federated identity management in enabling cross-state portability of vocational rehabilitation services, underscoring scalability [7].

Rosenbaum and Teitelbaum (2020) recognized legislative fragmentation, especially among HIPAA, FERPA, and WIOA, as a fundamental obstacle to interagency collaboration [4]. The suggested federated architecture alleviates these tensions by utilizing dynamic policy engines that implement context-sensitive sharing regulations according to function, purpose, and jurisdiction [8]. This implementation strategy aligns with frameworks promoted by the Office of the National Coordinator (ONC) and SAMHSA's Consent2Share initiative, which emphasize patient-controlled data consent and detailed access permissions [9].

The noted decrease in service intake duplication and eligibility processing time aligns with the findings of Blumenthal et al. (2019), which indicated that standardized APIs and interoperable health information systems significantly alleviated administrative burdens and enhanced user outcomes [6]. Furthermore, the implementation of HL7 FHIR and NIEM vocabularies corresponds with the interoperability standards established by the Centers for Medicare & Medicaid Services (CMS) Interoperability Final Rule, which requires secure and consistent access to patient data [1].

This study significantly enhances existing literature by integrating cross-sector use cases into a cohesive design that encompasses workforce systems, a topic frequently

neglected in health-focused interoperability studies. This research presents interoperability layers that specifically incorporate vocational rehabilitation and employment monitoring, utilizing mappings from CalJOBS and the AWARE system, in contrast to earlier studies that predominantly concentrate on electronic health records (EHRs) or Medicaid-exclusive systems.

This federated model utilizes privacy-preserving record linkage (PPRL), safeguarding individual rights while facilitating actionable data flow, in contrast to centralized designs that pose concerns around monitoring and data misuse. These structural measures guarantee legal defensibility while promoting confidence among agencies [10].

This paper presents both theoretical and practical contributions to public sector interoperability, providing a secure, standards-compliant, and citizen-focused alternative to fragmented governance frameworks. It empirically demonstrates that federated systems can attain the simultaneous objectives of integration and autonomy, which are essential for complex, multi-agency public service contexts.

6. Recommendations and Future Work

To implement the suggested federated interoperability architecture, certain strategic recommendations must be pursued at both state and federal levels. Initially, it is imperative to build statewide governance mechanisms. Multi-agency data governance entities should be established to delineate common consent methods, identity resolution standards, and data stewardship obligations. These frameworks must be institutionalized via memoranda of understanding (MOUs) and bolstered by enabling legislation that guarantees equal access while maintaining rigorous privacy measures. Definitive legal and administrative delineations will alleviate liability apprehensions and cultivate trust among collaborating agencies.

Secondly, widespread implementation of national interoperability standards is essential to guarantee semantic and technical coherence across health, rehabilitation, and workforce sectors. Standards like HL7 FHIR for health data interchange, the National Information Interchange Model (NIEM) for justice and workforce data, and Oauth 2.0 or OpenID Connect for secure identity authentication ought to be standardized across state and municipal systems. Standardization will diminish system fragmentation and enable more seamless API

interactions across many platforms.

A unified infrastructure for federated identification and consent management must be established. Modular solutions that can manage digital identities, role-based permissions, and user-governed data-sharing preferences ought to be implemented. These solutions must interact with existing case management platforms like AWARE and CalJOBS via robust middleware and secure API gateways, facilitating real-time data flow and transparent authorization workflows.

Fourth, capacity development and change management are essential for successful implementation. IT teams, caseworkers, and compliance officers require specialized training in interoperability standards, data privacy regulations, and security best practices. Interagency liaisons must be designated to address issues, enhance cross-functional collaboration, and facilitate uniform implementation efforts [11].

Ultimately, federal-level policy lobbying is vital. The Departments of Education, Labor, and Health and Human Services ought to be urged to finance demonstration projects and advocate for legislative modifications to WIOA, Title XIX, and IDEA that emphasize interoperable infrastructure.

Future research should investigate the incorporation of artificial intelligence to enhance real-time decision-making in eligibility evaluations, fraud detection, and service referrals [8]. Moreover, user experience research is essential to assess usability, consent understanding, and obstacles to digital literacy. Extending this paradigm to facilitate interstate interoperability could also advantage migrant groups and federally assisted individuals who traverse jurisdictions.

7. Conclusion

This study validates that federated data systems provide a feasible, scalable, and legally robust architecture for cross-agency interoperability among Rehabilitation, Medicaid, and Workforce programs. In contrast to centralized data warehouses that raise issues of control, ownership, and privacy, the federated model maintains agency autonomy while facilitating secure, standards-compliant collaboration. The design described in this study exhibits significant enhancements in intake efficiency, eligibility determination, and inter-program referral rates, results that directly affect vulnerable populations reliant on prompt access to

public services.

This architecture features key advances such as the incorporation of privacy-preserving record linkage, policy-driven data exchange protocols, and real-time audit trails within historical systems like AWARE and CalJOBS. These characteristics implement legal compliance and safeguard individual rights while enabling high-quality, coordinated care and employment services. The methodology facilitates comprehensive, longitudinal insights across systems without violating institutional boundaries or necessitating expensive IT renovations.

This study offers a technically feasible and policy-compliant blueprint by connecting the framework with national interoperability standards (FHIR, NIEM, Oauth 2.0) and federal obligations, including the Interoperability and Patient Access Rule. This research enhances the existing literature on public sector data sharing by integrating workforce development systems, a frequently neglected aspect in health-related interoperability studies.

In summary, federated interoperability models are not simply technological improvements; they signify a transformation in the delivery of government services characterized by dignity, efficiency, and trust. They facilitate collaborative governance, allowing for human-centered public services that surpass bureaucratic obstacles. As nations encounter increasing pressure to update and integrate their programs, the implementation of federated data systems presents both a strategic necessity and a moral duty to enhance public service.

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