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ORIGINAL ARTICLE

Overcoming the historical fragmentation of data in the SUS: Interoperability in Recife and EBSERH

Superando a histórica fragmentação de dados no SUS: interoperabilidade em Recife e na Ebserh

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ABSTRACT This study aimed to describe and analyze the integration of experiences developed by Recife-PE and EBSERH, which created the first federation of data from electronic health records between two enterprise service Bus. In both cases, data were integrated and made available to patients and healthcare professionals. In Recife, interoperability was achieved through Connected Health, which incorporated an electronic platform from a technological order implemented in 2019 by the State Family Health Foundation of Bahia. At EBSERH, 45 hospitals began to interoperate the data of more than 25 million users through their own platform, with technology similar to that incorporated by Recife. In June 2023, the two platforms began to interoperate. In addition to receiving national awards for its originality, effectiveness, scope, and efficiency, the case shows solutions and paths, including the interoperability project and its technological model. In addition, the fragmentation of data across different systems, electronic medical records, and other applications was overcome, improving the integrality of care, the capacity for data analysis, and decision-making.

KEYWORDS Digital health. Health information interoperability. Health information systems. Health information exchange.

RESUMO *Este estudo teve por objetivo descrever e analisar a integração das experiências de desenvolvidas por Recife-PE e pela Ebserh, que criou a primeira federação de dados de Registro Eletrônico de Saúde entre dois barramentos de interoperabilidade. Em ambas, há integração das informações clínicas, com disponibilização para o usuário e para profissionais de saúde. Em Recife, a interoperabilidade foi possível mediante a Plataforma Saúde Conectada, que incorporou uma plataforma eletrônica de uma Encomenda Tecnológica realizada em 2019 pela Fundação Estatal Saúde da Família da Bahia. Já na Ebserh, os seus 45 hospitais passaram a interoperar os dados de mais de 25 milhões de usuários por meio de uma plataforma própria, com tecnologia semelhante à incorporada por Recife. Em junho de 2023, as duas plataformas passaram a interoperar. Além do recebimento de prêmios nacionais pelo ineditismo, efetividade, abrangência e eficiência, o caso mostra soluções e caminhos, incluindo o projeto de interoperabilidade e seu modelo tecnológico. Além disso, a fragmentação das informações nos diferentes sistemas, prontuários eletrônicos e outras aplicações foi superada, melhorando a integralidade do cuidado, a capacidade de análise de dados e a tomada de decisão.*

PALAVRAS-CHAVE *Saúde digital. Interoperabilidade da informação em saúde. Sistemas de informação em saúde. Troca de informação em saúde.*

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Introduction

Digital transformation raises many challenges, promises, and concerns despite being essential for achieving Sustainable Development Goals and strengthening health systems, especially in the context of epidemiological transition and rising health costs[1,4]. Solutions are presented daily, affecting the ability of managers of the Unified Health System (SUS) to incorporate technologies in a critical, cost-effective manner[2,5] and to be aware of the legal obligation to protect personal data[6]. Can digital health policies and strategies be formulated and implemented to improve the performance, strengthening, and sustainable development of the SUS, while being cost-effective and compliant with legislation?

This study aimed to analyze the implementation of an interoperability strategy in Recife-PE and in the Brazilian Hospital Services Company (EBSERH), and the interface between them to encourage reflections on the theme.

In the 20th century, innovations led to significant advances in the diagnosis and treatment of various diseases. The development of new vaccines, drugs, and medical devices has expanded therapeutic options for conditions considered intractable, increasing life expectancy. This process was accelerated in the 21st century, with the development and use of Information and Communication Technologies (ICT), including Artificial Intelligence (AI), which changed patient care, surveillance, disease control, and the management of health services and systems[2,7,8].

Despite the benefits of scientific and technological advances, new technologies increase healthcare costs, causing inequalities in access to services across different socioeconomic groups and challenging the sustainability of these systems[2,5]. This rise in healthcare costs is exacerbated by inflation that exceeds general levels, the adoption of technologies without evaluating their benefits for users and healthcare systems, and the ongoing epidemiological transition.

The rise in life expectancy, population aging, changes in work habits and lifestyle, associated with the increased prevalence of chronic diseases and increasing costs in the healthcare system, requires a more personalized care model. This model must be continuous and comprehensive, encouraging patient engagement in self-care and interprofessional action and coordination between healthcare services.

ICT solutions in healthcare have grown significantly, with offers that target these needs. The solutions vary in relevance, effectiveness, efficiency, and price. Therefore, managers and operators of health systems and services must seek viable, cost-effective innovations that improve the efficiency and performance of the health system and reduce inequalities[1,2,5].

In this context, interest and investment in interoperability, integration, and information exchange among healthcare professionals and institutions were increased alongside the growing availability of remote care, self-care, care coordination solutions, and the increasing use of data intelligence and AI[9].

The computerization of healthcare services has converted data from physical to digital. However, these data remain highly fragmented due to the coexistence of several public and private systems, often designed for specific levels of care and services, and dozens of systems within a healthcare system that must encompass the entire country[10].

When clinical data does not follow the patient across different levels of care, care regulation, or surveillance, it hinders the effectiveness and efficiency of care, the qualification of timely clinical decisions, and also affects the effectiveness of telehealth strategies and care coordination. Integrating these data into large, standardized databases is essential to expand the use, capacity, and results of analysis tools, generate knowledge, and develop and apply predictive and AI solutions.

Data integration requires interoperability, which is the ability of two or more systems or components to exchange and use data

effectively[11]. Connecting databases and ICT solutions is fundamental to enhancing integral healthcare, improving SUS management, and accelerating scientific and technological development[3,7]. In 2011, the Ministry of Health (MH) regulated the use of interoperability and clinical data for systems within the SUS, at municipal, district, state, and federal levels, and for private and supplementary systems[12].

In this context, Recife and EBSERH have developed interoperability initiatives that have received awards and national prominence; they integrate clinical data, making it accessible to patients and healthcare professionals across different services. In August 2022, EBSERH began interoperating clinical data from its University Hospitals (UH), and in September 2022, Recife started integrating clinical data across exams, medications, immunizations, regulation, and surveillance.

Suppose a citizen undergoing treatment at the UH in Brasília needs to be seen at the UH in Recife. In that case, the healthcare professional can access their clinical history, including exams and prescriptions, through the Management Application for University Hospitals (AGHU), the electronic medical record from EBSERH. In Recife, healthcare professionals have access to all the clinical data through the Electronic Health Record (RES), which interoperates data from twelve systems and applications, including four electronic medical records (public and private), and eight information systems and applications, municipal and federal.

Interoperability in Recife was established by the Electronic Health Platform (iPES), renamed as 'Connected Health', managed by the state-owned Municipal Information Technology Company (Emprel). The first version of iPES was developed through a Technology Order (TO) to manage integrated, unequivocal information and foster an innovative ecosystem for healthcare technological development[13]. This TO was conducted in 2019 by the State Family Health Foundation (FESF-SUS), a public entity created by 69 municipalities with the participation of the Bahia government.

The TO developed a platform, with intellectual property shared between FESF-SUS and its technological partners. The platform provided interoperability between data from information systems, medical records, and healthcare applications within a federative entity or region, to improve integrated care, data analysis capabilities, and decision-making in management and care. Furthermore, the platform enabled the creation of a startup by the technology partners, in accordance with the innovation framework from Brazil, which assumed responsibility for developing, maintaining, implementing, and offering the platform. In partnership with FESF-SUS and the Consórcio Nordeste, this startup implemented the platform in several states and municipalities in the Northeast region to combat the COVID-19 pandemic[13,14].

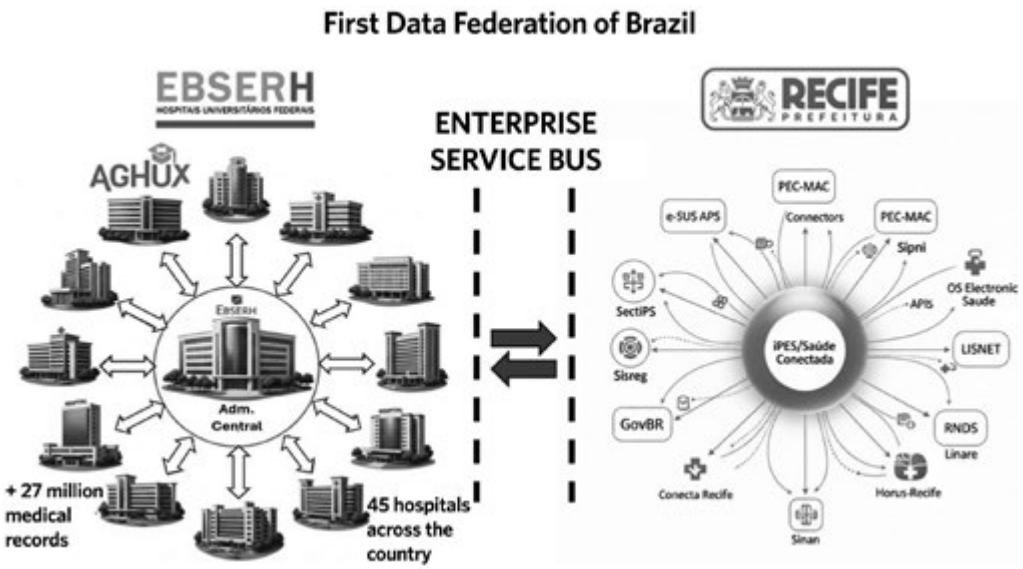
EBSERH, a public company dedicated 100% to SUS services, began interoperating data from 25 million patients across its 45 federal UHs through its own platform, which utilizes technology and architecture similar to Connected Health.

An agreement between Recife and EBSERH enabled the federation of their platforms, and in June 2023, both systems began exchanging data. At an event with the MH and EBSERH, Recife city hall launched access to the Connected Health platform RES (RES-Recife) for all residents through the 'Connect Recife' app, which offers over one hundred services; the city hall also signed a cooperation term between Recife and EBSERH to enable the federation of the two platforms. With the federation, healthcare professionals at any Health Care Network (RAS) in Recife treating a patient with a medical record at the Hospital das Clínicas of the Federal University of Pernambuco (HC-UFPE), managed by Ebserh, can directly view this data in RES-Recife. Likewise, HC-UFPE professionals can access all data from both

platforms through the 'unified medical record' tab in AGHU, which provides access to RES-EBSERH.

The experiences of the Recife and EBSERH enabled the creation of the first data federation between two interoperability platforms in the country, one municipal and the other federal (*figure 1*). From 2023 to 2024, Emprel received ten awards: two for innovative projects; one specifically for the project with EBSERH, recognized as the initiative that generated the greatest value for citizens in 2023 and 2024; five for fostering the innovation ecosystem in Recife, which led to the title of smartest city in Brazil in 2024; and three for management and entrepreneurial excellence. These awards were granted by the public entities, such as the National School of Public Administration; organizations within the S System, such as SEBRAE; state-level IT associations like the Smart Cities Association; and international ICT support associations, such as HDI.

Figure 1. EBSERH data federation. RECIFE-PE



Source: Prepared by the author.

This study aimed to describe and analyze the experiences of Recife and EBSERH, which created the first federation of RES data between two interoperability networks and has received national recognition for its innovation, reach, and efficiency.

Material and methods

This case study described and analyzed the experience, focusing on its motivations and choices, implementation, and initial results. Data were collected using documents, semi-structured interviews with key informants, and a literature review.

The literature was reviewed to identify innovative policies in the health field, and national and international experiences with ICT and AI platforms, focusing on interoperability standards, implementation, and the evaluation of results.

To analyze this specific case, documents produced by FESF-SUS, the municipality of Recife-PE, Consórcio Nordeste, EBSERH, and the Brazilian federal government were

reviewed, including policies, standards, terms of reference, project plans, technical documents, and reports from 2016 to 2024.

Interviews were also conducted with 12 developers of electronic platforms, managers, and health and IT workers in Recife (*table 1*).

Table 1. Interviewee profile

Interviewee	Profile	Interviewee	Profile
E1	Recife manager	E7	Platform developer
E2	Manager of HC-UFPE	E8	Platform developer
E3	Recife manager	E9	Recife manager
E4	Recife manager	E10	Recife service manager
E5	Platform developer	E11	Recife service manager
E6	Platform developer	E12	Recife healthcare worker

Source: Prepared by the author.

The results were presented in the following sections, which outlined steps from the case study (*table 2*).

Table 2. Correlation between research sources and results sections

Section	Analysis
Problem identification and motivations (Section I – the problem, the solution, and the decision)	Documents and interviews with key informants (E.1, E.3, E.4) revealed that fragmentation of clinical information within the SUS is a central problem, hindering comprehensive care and decision-making. The interviews highlighted the objective of Recife of having 100% of its network computerized and integrated. EBSERH documents and interviews (E.2) demonstrated the need of interoperability among the university hospitals themselves and with the local Health Care Networks (RAS).
Choice of solution and design implemented (Section II – the design implemented in recife and the university hospitals)	Interviews with managers (E.3, E.4) clarified the decision to implement an interoperability platform rather than a 'single medical record,' highlighting its cost-effectiveness, service specificity, and data governance. The documents of EBSERH detailed the development of its own platform. The documents and interviews revealed the similarity of the designs, with interoperability in Recife covering a greater diversity of applications due to the need to track the users across the entire RAS. The interviews (E.1, E.3) also highlighted infrastructure challenges and connectivity with units managed by Social Organizations. The analysis of documents and interviews enabled the description of the use of connectors for systems and application programming interface (API), facilitating integration with federal services, and the federation process between the Recife and EBSERH platforms.
Technological model and architecture (Section III –technological model and architecture used in the experiences)	Document and interviews with platform developers (E.1, E.3, E.5, E.6) clarified the architecture and technological model used. This included identifying cloud architecture, service orientation, the interoperability bus with API management, and the use of international standards, such as HL7 FHIRv4 and OpenEHR. The documents also revealed the use of data lakes with native FHIR databases and hybrid data architecture for primary and secondary purposes. One of the developers (E.5) reinforced the innovative nature of the web API-based architecture.

Source: Prepared by the author.

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Results and discussion

Section I – the problem, the solution, and the decision

Managing integral care in the RAS is essential for SUS, given the problems that exceed the capacity of a single service or subnational entity to solve. Therefore, an articulated, interdependent, and cooperative system is needed, with integration between different subsystems[16].

To address these challenges and needs, the SUS is organized into RAS, which, according to the MH, are:

> [...] organizational arrangements of health actions and services, of different technological densities that, integrated through technical, logistical, and management support systems, seek to guarantee integrated care[17](1).

According to some authors, RAS should be polyarchic and provide longitudinal and integrated care that is timely, accessible, humanized, and equitable[17,18].

Establishing effective, equitable, and efficient RAS systems is challenging. Improving the flow of data between services and subsystems is essential for healthcare professionals to understand the patient through previous consultations, exams, diagnoses, and treatments. Sharing clinical data among professionals and services is essential for ensuring safety, enabling timely and appropriate treatment for a patient, and advancing coordinated, continuous care[3,18,19].

For quality data to flow promptly across RAS, several key elements must be in place. These include the computerization of services, proper use of electronic records and information systems, ensured interoperability between services and information systems, and the synthesis of data in a shared, real-time RES. The Recife Health Department (RHD) set this as a key goal for the connected health project, as explained by a manager:

> *[...] we only had the Family Health Strategy computerized [...]. The rest of the network was manual, everything was on a form, filled out, without any integration, without any conversation... So, at that moment, we decided that we wanted 100% of the network computerized, that we wanted an electronic medical record across our entire network, integrated, and integrated with other systems as well.* (E1).

Until mid-2022, Recife used e-SUS for Primary Health Care (PHC) but lacked electronic medical records for specialized outpatient and hospital care. HC-UFPE used AGHU, while hospitals managed or contracted by Social Organizations (SO) relied on several systems. According to Recife managers, instead of adopting a single medical record (an application that needed to be contracted and implemented in all RAS services), the city implemented a platform that interoperated data from all solutions in use: public, in-house, private, free, paid, medical records, information systems, or other applications (E3, E4).

Several factors influenced this decision: combining free and contracted public solutions was far cheaper than implementing a single system for all RAS services, even including the cost of interoperability. The services have specificity: 1) choose the most suitable application is better than being obliged to use the same, 2) the platform interoperated not only data from medical records but also from SUS and municipal systems and applications, 3) the city retained governance over its data, avoiding vulnerability; 4) the data could

be used across multiple applications (E3, E4). A RHD director summarized the decision based on the chosen model and solution:

> *iPES represents the light that we needed at that moment when we needed to computerize 100% of the network, have electronic medical records across the entire network, integrate our data and information [...].* (E1).

The EBSERH has a dual challenge: facilitating information flow between hospitals to strengthen networking, and, as a tertiary care provider, accessing data from patient care within the RAS where its UHs are located.

Between February and August 2022, the first need was addressed by developing an interoperability platform. This platform standardized and shared information across all UH, allowing professionals to access data throughout the entire EBSERH network. An interviewee from HC-UFPE management commented on this integration:

> *I think that the circulation of these people's information, initially, in the 42 HU, and later, with this recent opening that has been made in recent months, with the possibility of state and municipal health departments joining the application, to AGHU, y ou empower the system so that it can communicate, have more support to communicate with other applications that coexist.* (E2).

The second challenge is being addressed through interoperability. Launched in June 2023, the data federation between RES-Recife and RES-EBSERH enables information to follow users from the municipal system to UH-UFPE and vice versa. Interviewees from UH-UFPE and RHD management highlighted, respectively:

> *I think interoperability is a path of no return. [...] It was the pilot here in Recife, with the HC medical records and the municipal medical records. And I think this is something that needs to happen across the entire network.* (E2).

> *And then, as the important result of this is Minha Saúde Conectada, which we have here in the municipality, which was everything we talked about from the beginning, what we wanted [...]. And we managed to launch it in June of last year, so both professionals can see the patient's journey, where they've been in the network, where we already have this integration, including with Ebserh, right, which is outside the municipal network, which was also very good... And the patient also has their journey through the network in the palm of their hand.* (E1).

This encounter marks the interoperability of EBSERH UH with Recife, allowing the city to integrate its RAS services. For EBSERH, the initiative expanded the original project, now integrating the RAS of the regions of its UH. This new perspective will be explored in the next section, which analyzes the implemented designs and the technological model that enabled this interoperability.

Section II – the design implemented in Recife and at the UH

Documents and interviews indicated that Recife and EBSERH implemented similar designs. In Recife, however, interoperability covers a wider range of applications to ensure that information follows patients across the entire RAS.

At EBSERH, the aim was to enable communication between UHs. From the federation between its RES and that of Recife, the interoperability was extended to the RAS in the regions where the UH operates. The challenge of Recife was to integrate three levels of care, including its own and contracted services, as well as regulation, immunization, and pharmaceutical assistance.

In both cases, the aims were to ensure the right to information for citizens, support clinical decision-making, and aid care, service, and system management. In Recife, an additional aim was to foster new solutions within the innovative ecosystem of the city.

In 2024, Recife completed the computerization of its system using the e-SUS PHC of the MH. This solution was also implemented

in its telehealth service, the 'Atende em casa' (i.e., care at home), and in psychosocial care centers. Additionally, 14 of 17 self-managed services, including emergency units, polyclinics, and hospitals, were computerized using the Electronic Medical Record for Medium and High Complexity Citizens (PEC-MAC), another platform internalized by Emprel within iPES.

> *[...] we knew that once the process was implemented* [Connected Health]*, it would be easily connected to eSUS and would already be connected to the medium and high medical records, because we ended up contracting the medium and high medical records together* [with the interoperability platform] *[...].* (E3).

Improvements to the electrical and IT infrastructure were required, causing the delay in implementation, according to Recife administration interviewees (E1, E3).

> *All our units here in the medium and high end are very old [...]. So, we first needed to do all this work on the logical and electrical network to support them.* (E3).

Another challenge was integrating units managed by the SO, which, at Recife, uses a proprietary medical record. In addition, negotiating with the SO required building an interoperability strategy with the contracted company. A Recife administration member reported:

> *We know it's difficult. Right now, we must connect this medical record, which is from the OS, which is a medical record from* [company name]*... wow! We've been doing this for months. But we won't give up. We know it's difficult, but we'll get there.* (E3).

Data from e-SUS PHC, PEC-MAC, and SO are interoperated using three connectors, one per application. Each connector is a software that extracts data from the database to fill in a standardized information model: the clinical care record (CCR) for outpatient care and the discharge summary (DS) for hospitalizations.

A federation was established to interoperate data between RES-Recife and HC-UFPE. Data are exchanged during clinical care when one platform queries data from the other. Each platform enforces its own rules, consents, and access permissions, ensuring that only authorized data is shared. Access rules differ between Recife and EBSERH, and each platform applies these rules internally and across the federation. Thus, EBSERH rules govern its data when viewed via RES-Recife, and vice versa. In federation, in addition to CCR and DS data, test results are also interoperated.

A connector was built in Recife to interoperate with almost all electronic records, with the only exception being the AGHU, where the data is exchanged by federation between platforms.

To integrate healthcare regulations, which in Recife uses the National Regulatory System (Sisreg) of the MH, the Sisreg application programming interface (API) was used. To build the Healthcare Regulation Information Registry, data were extracted from the Sisreg API in an interoperable format following MH standards, along with other key transactional data. The same was done for immunization data from the National Immunization Program Information System. API also enabled interoperability for test requests, results from LISNet, data from gov.br, the National Health Data Network of the MH, including the SUS card and the National Registry of Healthcare Establishments, and from the Connect Recife app, which provides citizens access to their own data.

For pharmaceutical care and Notifiable Diseases Information System, a connector was built with Horus-Recife, a system developed and used in Recife (precursor of the Horus-MH).

The system implemented at the UH allowed professionals to access data from a patient through RES-EBSERH, even if care occurred at another UH or within the Recife RAS. Cooperation between platforms enables the exchange of technologies and solutions,

forming a collaborative development process. However, differences exist. Unlike Recife, EBSERH does not need to interoperate with the mentioned solutions. Instead, its platform integrates with the AGHU app and the Catarinense Integrated Telemedicine and Telehealth System, developed by the Federal University of Santa Catarina.

The Recife and EBSERH cases show that interoperability projects must be tailored to meet the specific needs and objectives of each service, service network, and RAS. Technology should be adopted and guided by a perspective of digital transformation, using ICT solutions to achieve clear objectives and outcomes, and intentionally change care, management, education, engagement, and participation. Consequently, the design of care models, lines of care, telehealth initiatives, and regulation interfere with the design of the interoperability project.

For instance, if a regulation of the second generation is adopted instead of a traditional one, as proposed in the National Policy for Specialized Health Care[20], the project must provide solutions for this model and its specific implementation, such as in Recife.

Regulation of the second generation differs from the traditional one by being person-centered and guided by care coordination. It accesses clinical information to apply prioritization criteria and protocols, decides whether a referral should proceed or be adjusted, determines if other procedures are needed, or whether the case can be resolved via guidance, teleconsultation, or teleinterconsultation. This regulation also manages shared queues and implements strategies for patient information and engagement, including confirming, rescheduling, or canceling procedures to reduce nonattendance. Additionally, it seeks to promote equity and transparency among professionals, individuals, and society[20].

Traditional regulation relies solely on basic user data and available service slots. Regulation 2.0, implemented in Recife, requires broader interoperability, including RES data for professionals to take clinical decisions (PHC reference professional, responsible for the regulation itself and those who will perform any of the actions of presential or remote attention mentioned), completed and scheduled exams, procedures, and status of regulatory processes. The regulation also integrates data that feeds tools to reduce absenteeism, such as user attendance confirmation, AI models predicting absences and suggesting overbooking, and systems that migrate scheduling data across platforms without reentry.

The Recife case illustrates how the model directly shapes the interoperability design, evidencing that the design must stem from clear analyses and decisions on the intended objective, the processes to be digitally transformed, how these processes should be redesigned with specific ICT solutions, which tools will be required, and how they will be implemented.

However, for an interoperability project to be viable, effective, and efficient, the technological architecture and model on which it is built are essential, which is the focus of the next section.

Section III – architecture and technological model used

The architecture and technological model can define the costs of an interoperability project and shape its objectives, effectiveness, scope, speed, and overall impact. Document analysis and interviews (E1, E3, E5, E6) revealed significant variations in these aspects between different interoperability projects.

Documents showed that the architecture and technological models used by EBSERH in Recife and in the federation between the two networks are similar. Both platforms offer a longitudinal RES with a cloud-based architecture and are fully service-oriented. They utilize an enterprise service bus that includes API management, access control, and identity management, as well as specialized services for master patient index, clinical document

repository, consent, terminology, and metadata management. This setup enables the sharing of data across systems in a standardized and consent-based manner. Their architecture follows international standards, such as HL7 FHIRv4 and OpenEHR, ensuring adaptability to diverse clinical and administrative contexts.

Another key element is data storage in data lakes with native FHIR databases, offering API that allow other applications to access normalized and structured data, either identified or anonymized. As noted, these platforms are fully service-oriented.

Thus, an architecture of hybrid data is employed, in which is considered, for primary use by healthcare professionals: 1) indexing and retrieval (document registry and repository), 2) summarization, 3) consented access (all authorizations are logged and visible to users), 4) anonymization (persisted data is anonymized), and 5) clinical decision support. For secondary, analytical use, data is anonymized, de-identified, enriched with other sources, aggregated, and made available via an analytics API. A member of the development team for both platforms emphasized:

> *Everything on the platform is done with web API, services, and microservices that perform discrete functionalities, but when combined, implement the service as a whole, [...] both to receive data from iPeS and to return data from iPeS to applications. So, it's an innovation that is implemented as a whole [...].* (E5).

Therefore, beyond the context, objectives, and circumstances of an interoperability project, a thorough technical analysis is essential to ensure that the architecture and technological model are effective in achieving the objectives. The model described is similar across the platforms but differs substantially from other projects in Brazil.

To support managerial decisions, studies of other Brazilian cases are essential to ensure transparency in the designs of interoperability projects, technological models, and achieved outcomes, particularly given the urgent need to enhance integrated care, strengthen management, integrate the RAS, and improve the effectiveness and efficiency of the SUS.

Conclusions

The development and intensive use of ICT, including AI, in healthcare have advanced rapidly this century, changing service management, care delivery, and disease surveillance, considering population aging and the epidemiological transition. While the computerization of healthcare services has digitized clinical information, data remains highly fragmented due to the coexistence of over a hundred information systems within the SUS, multiple solutions for medical records, and other public and private healthcare applications across different care levels. Additional challenges include rising healthcare costs and the lack of critical evaluation in technology adoption.

In this context, the projects analyzed in Recife and EBSERH showed the development of interoperability and the implementation of a technological model. Resulting from institutional partnerships and new processes by the national innovation framework, these experiences have reduced data fragmentation and enhanced integrated care, data analysis, and decision-making in management and clinical practice. In addition, digital health policies and strategies could be successfully formulated and implemented, improving performance, strengthening, and supporting the sustainable development of the SUS cost-effectively while complying with the General Data Protection Law.

Collaborators

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