

Barriers and Facilitators for Federated Health Data Networks: Lessons Learned from a Nordic-Baltic Experience

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Abstract. The era of artificial intelligence (AI) and big data presents significant opportunities for implementing federated health data networks across national borders. However, these opportunities are accompanied by substantial challenges. This study documents barriers and facilitators identified during the early phases of establishing the Nordic-Baltic Federated Health Data Network, prior to technical implementation. Utilizing a mixed-methods approach, we identified and prioritized key factors affecting consortium formation. Our findings reveal five key facilitator clusters that drive the project forward, including strong motivation, interdisciplinary collaboration, and regulatory alignment. Additionally, we identified six major barrier clusters, with security and privacy concerns and technical infrastructure challenges emerging as the most critical. These barriers impact both human collaboration and technical aspects, emphasizing the dual nature of network development. By providing a prioritized list of barriers and actionable strategies for addressing them, this study offers pre-implementation guidance for future consortia. These strategic insights can help teams better prepare for establishing cross-border federated health data networks.

Keywords. Federated Learning, Health Data Networks, Cross-border Collaboration, Implementation Barriers, Organizational Factors

1. Introduction

Creating cross-border federated health data networks requires rigorous planning and alignment among partners before any technical implementation can begin [1]. Our study documents critical barriers and facilitators identified during the early phases of establishing the FederatedHealth² (a Nordic-Baltic Federated Health Data Network),

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² <https://www.nordicinnovation.org/news/press-release-new-project-will-discover-innovation-potential-data-nordic-patient-records>

providing insights and guidance that can benefit future consortia even at the proposal and formation stages.

The potential of artificial intelligence (AI) in healthcare has raised interest in collaborative data-sharing initiatives. Federated learning (FL) has emerged as a promising approach to enabling collaborative model training without centralizing sensitive patient data [2]. The FederatedHealth project seeks to establish a secure Nordic-Baltic health data space for secondary use by leveraging FL technologies. The project brings together 6 institutions across 5 countries through an interdisciplinary approach and aligns with established principles of ethical data sharing and transparency [3].

Through workshops and surveys conducted prior to technical implementation, we identified and analyzed the barriers and facilitators encountered in establishing such a network. We documented our insights throughout the process, beginning with the proposal writing and consortium formation phases. These early-stage findings subsequently informed the technical network architecture and functionality that we later described in our technical feasibility study [4].

While the technical paper [4] later demonstrated the network's operational feasibility, this study delves deeper into the human factors and social and organizational issues that must be addressed when establishing a consortium. The insights help align consortium partners with the goals and objectives while highlighting the critical gaps that must be addressed before technical development begins. These lessons can help future consortia better prepare for implementation challenges while also contributing to the broader discourse on establishing successful federated networks in healthcare.

2. Methods

We employed a mixed-methods approach to comprehensively assess the barriers and facilitators involved in implementing a federated health data network. Data collection took place several months after the official project kick-off, allowing the consortium to develop initial familiarity with the project goals and roles.

First, we conducted a one-day online workshop with twelve consortium partner stakeholders, employing the "sailboat"³ technique to identify the driving forces and obstacles in establishing the network. This participatory visual method helps participants conceptualize a project trajectory. Building on the workshop findings, we developed a self-assessment survey to evaluate the consortium's preparedness and competence across clinical, technical, ethical, legal, UX/UI, and organizational domains, recognizing that the network's success depends on complementary multidisciplinary expertise. The survey design and data collection process took approximately three months, ensuring comprehensive coverage of the identified themes.

We applied thematic analysis to the workshop data, categorizing barriers and facilitators into coherent themes. Survey responses were analyzed using descriptive statistics to map competencies and guide prioritization efforts. The Consolidated Framework for Implementation Research (CFIR) [5] was employed to structure and interpret these findings, supporting a robust, theory-informed analysis over a three-week period. This multi-step process provided an evidence-based foundation for informed decision-making prior to technical implementation.

³ <https://miro.com/agile/how-to-run-sailboat-retrospective/>

3. Results

Our analysis has revealed a complex landscape of facilitators and barriers affecting the implementation of the Nordic-Baltic Federated Health Data Network. Through the workshop discussions and self-assessment surveys, we have identified five key facilitator and six barrier clusters, detailed in [Table 1](#) and [Table 2](#). These findings have provided a strategic framework for addressing challenges while leveraging existing facilitators in implementing cross-border federated health data networks.

Table 1 Key facilitators supporting the implementation of the FederatedHealth: a qualitative analysis of the consortium partner perspectives

Facilitator cluster	Key elements
Motivation and Global Interest	Strong motivation among consortium members, increasing global interest in FL, and relevance and potential impact garner the EU attention.
Regulatory Compliance and Ethical Approvals	Alignment with existing regulatory frameworks and prior ethical approvals for dataset use.
Enhancing Awareness and Engagement	Increasing awareness among decision-makers and healthcare providers, strategies for simplifying FL descriptions, and benefits strengthen reach.
Leveraging Technological Innovations	Utilization of advanced technologies (LLMs) and privacy-preserving methods for health data.
Multidisciplinary Collaboration	Diverse expertise (legal, ethical, health sciences, data sciences), collaborative environment, and comprehensive, innovative solutions.

Table 2 Prioritized barriers to implementation of the FederatedHealth: the results from the gap analysis and stakeholder self-assessment

Priority	Barrier cluster	Key challenges
1	Security and Privacy	Cybersecurity of EMRs, the complexity of data anonymization, breach risk, and varied security policies across sites.
2	Data, Technology, and Infrastructure	Diversity of organizational and technical landscape, and complexity of infrastructures and secure processing environments.
3	Coordination, Management, and Collaboration	Cultural and working practice differences, communication barriers, and interdisciplinary gaps.
4	Regulation and Ethics	Complex legal landscapes with a need for continuous legal assessment and data sharing uncertainties.
5	Knowledge and Competence	IT/data management and cybersecurity expertise needs and clinical expertise variations.
6	Financial Limitations	Limited funding constraints, resource allocation challenges, and long-term sustainability concerns.

4. Discussion

This study shows that developing a federated health data network across borders relies on human collaboration and technical infrastructure. Organizational relationships and coordinated governance form its foundation. By examining key facilitators ([Table 1](#)) and barriers ([Table 2](#)), we illustrate how strong partnerships support technical solutions

while acknowledging ongoing challenges. This dual perspective informs both immediate implementation and longer-term sustainability.

Strong motivation, interdisciplinary collaboration, advanced technologies, and pre-approved datasets support the federated network implementation. Inclusive communication strengthens stakeholder engagement, enabling the consortium to tackle the identified key barriers (**Table 2**).

Security and privacy, the top identified priority barrier, presents a dual challenge: protecting health data while enabling model training [6]. Addressing this requires a combination of human and technical solutions and collaborative governance to foster trust and enable standardized anonymization protocols and aligned security policies.

Technical and infrastructural challenges ranked second, underscoring that successful technical implementation hinges on strong, reliable human networks [1], [7]. Each site should integrate diverse IT systems and harmonize preprocessing protocols, but trust-building and collaboration come first. This human element is especially critical in distributed networks/consortiums and requires more complex coordination than centralized approaches. The established working relationships are crucial for developing an effective common data model and selecting a suitable FL framework that accommodates heterogeneous local systems, ensures reliable network-wide operation, and balances standardization with local autonomy.

Coordination and management challenges ranked third, emphasizing the need for effective human networks to enable technical integration. Regular cross-disciplinary dialogue and shared terminology help bridge differences in professional languages and working practices while supporting technical coordination across sites. This human-technical alignment is essential for operating effectively as a distributed network.

Though ranked fourth, regulatory compliance and ethical considerations, with the varying regulations across the consortium sites, remain vital in health data networks [7]. Strong inter-organizational relationships enable collaborative data protection impact assessments (DPIAs) development, motivating the partners to identify and mitigate data risks and inform technical safeguards. This underscores how human networks support systematic regulatory compliance.

Competency gaps ranked fifth, prompting the consortium to address human and technical needs through knowledge-sharing initiatives and targeted IT, data management, and cybersecurity capability development. This intentional focus recognizes that foundational skills and knowledge among consortium members are critical for effective collaboration and problem-solving, thereby supporting the sustainable growth of the network.

Although ranked last, financial constraints can significantly impact human and technical network development. Limited funding restricts the exploration of federated network potential and limits robust implementations, but strategic resource allocation can partially address immediate needs while keeping long-term sustainability in view.

This early-stage study provides a crucial roadmap, helping the consortium move forward and demonstrate the technical feasibility of a federated health data network, as presented elsewhere [4].

5. Conclusions

The successful implementation of the FederatedHealth (Nordic-Baltic Federated Health Data Network) demonstrates the importance of building strong human networks as a

foundation for technical infrastructure development. Our study reveals that establishing trust, shared understanding, and collaborative frameworks between organizations is a prerequisite for addressing technical challenges in cross-border federated learning networks.

Our findings underscore that cross-border networks are inherently socio-technical endeavors, where early alignment of organizational relationships and clear governance frameworks creates an environment conducive to effectively addressing technical challenges [8]. This aligns with the emphasis on accountability, transparency, and ethical principles outlined by Pitkänen et al. [3]. By documenting the barriers and facilitators encountered during our network formation, we provide valuable insights for future initiatives from their early planning stages – insights that we ourselves would have greatly benefited from when starting this project.

As interconnected health systems become increasingly important, these pre-implementation insights can help future consortia better prepare for establishing cross-border federated learning networks in healthcare. Our experience shows that successful implementation requires careful attention to human factors and organizational alignment before technical development begins, contributing to evolving practices in this field.

Future work in the FederatedHealth project will expand stakeholder engagement to include patient representatives and policymakers, ensuring network development aligns with diverse needs and perspectives, including data quality, and equity considerations. We acknowledge that assessing barriers and facilitators is iterative and will benefit from a deeper examination of comparable initiatives within the European and international communities [7], [8].

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