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SALUS_NET: A Transnational Research Network for AI Enabled Digital Health, Telemedicine, and Knowledge Exchange

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Abstract

Digital transformation is reshaping healthcare through the widespread adoption of artificial intelligence. However, such solutions remain uneven, particularly in emerging digital health ecosystems and cross-border regions, where fragmented infrastructures and regulatory differences still hinder implementation. SALUS_NET is a transnational research network designed to strengthen collaboration in the fields of digital health, telemedicine, and AI-based knowledge exchange across Europe, the Western Balkans, and partner regions. Particular emphasis is placed on AI-supported telemedicine, interoperable digital health platforms, the medical Internet of Things, and device monitoring, as well as the management of health data.

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Keywords: Digital Health; Telemedicine; Artificial Intelligence; International Research Collaboration; Knowledge Exchange

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1. Introduction

Healthcare systems worldwide are undergoing rapid transformation driven by digital technologies, artificial intelligence (AI), and the increasing availability of health-related data. Artificial intelligence has the potential to transform medical practice by providing comprehensive powerful analysis of heterogeneous health data, optimizing clinical decision-making, and reducing diagnostic errors and unnecessary procedures [1]. Digital health solutions such as telemedicine platforms, wearable sensing systems, and AI-based clinical decision-support tools are becoming integral to modern healthcare delivery by improving access to medical services and supporting patient-centered care. At the same time, healthcare systems face increasing pressure due to demographic change, rising healthcare costs, and shortages of medical professionals, particularly in regions with limited access to specialized care.

Telemedicine enables remote diagnosis, monitoring, and consultation and has been shown to improve chronic disease management and access to specialist care [2, 3]. The COVID-19 pandemic further accelerated the adoption of telemedical services and emphasized the need for resilient healthcare infrastructures capable of supporting remote care delivery.

Despite these advances, several challenges remain. Healthcare infrastructures are often fragmented, regulatory frameworks differ across countries, and interoperability between digital health systems remains limited. Standards such as SMART on FHIR support the integration of digital applications into electronic health record systems and enable interoperable data exchange across healthcare services [4]. In addition, federated learning approaches allow collaborative model development while preserving data privacy by avoiding the centralization of sensitive patient data [5].

These challenges are particularly evident in emerging digital health ecosystems such as the Western Balkan region, where digital health infrastructures vary significantly across countries. Therefore, Cross-border healthcare initiatives must address the legal, organizational, and technical barriers related to data protection, interoperability, and healthcare governance [6, 7]. The vision of the Global Strategy for Digital Health is to improve the health of people around the world by accelerating the development and adoption of accessible, scalable and sustainable digital health solutions centered on the needs of individuals, while also encouraging international collaboration and knowledge exchange in digital health[8]. This vision is closely aligned with current European efforts to strengthen interoperable digital health infrastructures. In particular, policy initiatives such as the European Health Data Space aim to enable secure cross-border exchange of health data and support the development of interoperable digital health services across EU member states [9, 10, 11].

International research networks provide an important mechanism for addressing these challenges by connecting researchers, clinicians, and technology experts across institutions and countries. Such collaborations facilitate knowledge exchange, joint research agendas, and the development of digital health solutions. Participatory and co-creation approaches involving researchers, healthcare professionals, and end users can further improve the usability and contextual relevance of digital health technologies [12].

The SALUS_NET initiative was established to strengthen international collaboration in AI-enabled digital health and telemedicine. The network connects universities, research institutions, and healthcare stakeholders across Europe to promote interdisciplinary research, capacity building, and cross-border cooperation.

This paper presents the conceptual framework and activities of the SALUS_NET research network and examines how transnational collaboration can support digital health innovation. Section 2 reviews related work, Section 3 introduces the SALUS_NET initiative, Section 4 presents the collaboration model, Section 5 describes capacity-building activities, Section 6 discusses emerging research themes, and Section 7 concludes the paper.

2. Related work

Recent advances in digital technologies have accelerated research on telemedicine, data-driven healthcare, and sensor-based health monitoring. These developments are closely linked to progress in artificial intelligence (AI), interoperable health data infrastructures, and ubiquitous sensing, which together shape contemporary digital health ecosystems.

Telemedicine is widely regarded as a promising approach to improve healthcare accessibility, especially in geographically distributed regions and areas with limited access to specialised services. Early studies showed that telemedicine can support chronic disease management, remote consultations, and home-based monitoring while improving continuity of care [2]. Later evaluations reported positive effects on patient outcomes and healthcare efficiency, particularly in chronic disease management [13]. However, the transition from pilot projects to routine practice remains difficult because of organisational constraints, reimbursement policies, and regulatory barriers [3].

This has led to growing emphasis on digital health ecosystems in which healthcare providers, technology developers, researchers, and policy makers collaborate to build interoperable healthcare services [14]. In Europe, initiatives such as the European Health Data Space aim to facilitate cross-border access to electronic health data and its secondary use for research and innovation [9, 10]. Yet cross-border digital health services still face legal and regulatory fragmentation across national healthcare systems [6, 7], underlining the need for coordinated international collaboration and interoperable infrastructures.

AI and machine learning have become key drivers of innovation in digital health, with applications in clinical decision support, medical imaging, disease prediction, and personalised treatment planning [1]. Their deployment depends on large volumes of medical data while ensuring compliance with privacy and data protection regulations. Standards such as SMART on FHIR support the integration of digital health applications into electronic health record systems and enable modular software architectures [4]. Federated learning further allows collaborative model training across institutions without centralising sensitive patient data, thereby supporting privacy-preserving analysis [5]. Recent studies also stress the importance of trustworthy and explainable AI in healthcare [15].

Another important research area concerns medical Internet-of-Things (IoT) systems and wearable sensing technologies for continuous monitoring outside clinical environments. Such systems can capture movement, heart rate, respiration, and sleep-related signals. For example, flexible wearable systems for three-dimensional spine pose tracking support the recognition of activities of daily living and provide insights into rehabilitation processes [16]. Research on ubiquitous health monitoring further shows how distributed sensor networks and context-aware computing support ambient assisted living and remote patient monitoring [17, 18]. In sleep medicine, unobtrusive sensing combined with AI-based analysis enables new approaches to personalised monitoring and treatment evaluation [19].

At the European level, several initiatives provide useful comparators for SALUS_NET, although none reproduces its exact combination of citizen-centred platform building, regional cluster formation, telemedicine capacity development, and cross-border consortium preparation. The *European Reference Networks* (ERNs) are official cross-border networks established under the European framework for patients' rights in cross-border healthcare and connect highly specialised healthcare providers for rare or complex conditions [20, 21, 22]. *MyHealth@EU*, formerly the eHealth Digital Service Infrastructure, enables secure cross-border exchange of health data, including patient summaries and ePrescriptions [23, 24, 25]. The *JADECARE* Joint Action focuses on digitally enabled integrated person-centred care and on transferring good practices across European health systems [26, 27]. Similarly, the *SCIROCCO* project addressed interregional knowledge transfer and the scaling-up of integrated care [28]. The *European Innovation Partnership on Active and Healthy Ageing* (EIP on AHA), especially through its *Reference Sites* and collaborative network, provides an important example of ecosystem-based health innovation [29, 30, 31].

Overall, the literature indicates that sustainable digital health transformation requires more than technological innovation alone. Successful implementation depends on interoperable infrastructures, privacy-preserving data processing, coordinated governance, and transnational collaboration. In this context, SALUS_NET can be positioned as a hybrid European network model that combines cross-border collaboration, interoperable digital health exchange, organisational learning, and ecosystem-based stakeholder integration.

3. The SALUS_NET Initiative

SALUS_NET is a transnational research network that aims to strengthen international collaboration in digital health, telemedicine, and AI-enabled healthcare systems. The initiative integrates technological research, capacity-building activities, and international knowledge exchange within emerging digital health ecosystems. Its central objective is to connect researchers, healthcare professionals, and technology developers across institutions and countries in order to support interdisciplinary collaboration and the development of innovative digital health solutions.

3.1. Origins and Conceptual Foundations

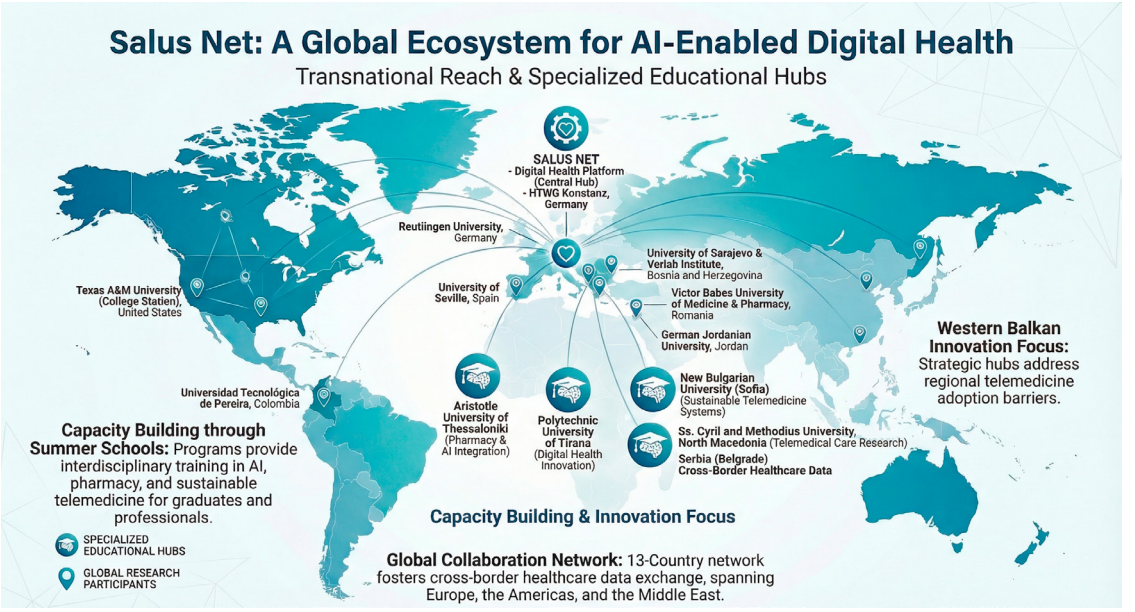


Fig. 1. The SALUS_NET network

The initiative emerged from a series of research and networking activities coordinated by HTWG Konstanz and its international partners. A key starting point was the SALUS project ("Citizen-centered health platform for cross-border regions"), which investigated digital platforms for healthcare collaboration in cross-border European regions and addressed technological, societal, and governance challenges related to citizen-centered digital health infrastructures.

Building on these activities, an international collaboration network gradually developed among universities and research institutions working in digital health, telemedicine, and health informatics. The collaboration was further strengthened through the Bridge2ERA SALUS initiative, which supported international research cooperation and the preparation of joint research proposals [32].

Today, the SALUS_NET network connects universities and research institutions from eleven countries across Europe and partner regions, including Germany, Bulgaria, Greece, Bosnia and Herzegovina, North Macedonia, Romania, Spain, Albania, Montenegro, Colombia, and Jordan.

3.2. Capacity Building and Academic Exchange

Capacity building represents a central component of SALUS_NET. Several international summer schools have been organized to promote interdisciplinary collaboration and strengthen competencies in digital health technologies, particularly in the Western Balkan region. For example, the Medical Summer School "Towards building sustainable and co-created telemedicine systems in Western Balkan countries" addressed both technological and organizational aspects of telemedicine system design and emphasized participatory system development involving researchers, students, and healthcare stakeholders [33].

Additional initiatives further expanded the interdisciplinary scope of the network. The program "Pharmacy and AI Integration in Advancing Digital Health" explored the integration of pharmaceutical sciences, artificial intelligence, and digital healthcare technologies, encouraging collaboration between computer science, healthcare, and pharmaceutical research communities [34].

3.3. SALUS_NET *Ecosystem*

The activities within SALUS_NET form an ecosystem that combines research initiatives, educational programs, and regional collaboration. Research on digital health platforms and cross-border healthcare infrastructures provides the scientific foundation of the network, while educational initiatives such as international summer schools facilitate knowledge transfer and the development of interdisciplinary competencies.

In addition, the network investigates barriers and facilitators of telemedicine adoption in the Western Balkan region and supports the formation of interdisciplinary research teams. These complementary activities contribute to joint research proposals, scientific publications, and the development of collaborative innovation projects.

Table 1 summarizes the main activities that contributed to the development of the network and highlights their key outcomes.

Table 1. Key activities and outputs of the SALUS_NET initiative

Activity	**Description**	**Outputs and Impact**
Research on Telemedical Care in Western Balkan Region	Analysis of facilitators and barriers affecting telemedicine adoption	Identification of research challenges and policy-relevant insights [33]
Medical Summer School on Telemedicine Systems	Training program addressing sustainable and co-created telemedicine systems in Western Balkan countries	Capacity building, interdisciplinary training, and academic partnerships [35]
Pharmacy and AI Integration Summer School	Educational initiative integrating pharmaceutical sciences with AI-based digital health technologies	Development of interdisciplinary competencies and research collaboration [34]
SALUS_NET Research Network	International collaboration connecting universities and research institutions	Joint research proposals, publications, and knowledge exchange [32]

3.4. Network Objectives

SALUS_NET connects researchers and institutions from several European countries and partner regions and integrates expertise from computer science, medicine, pharmacy, and health policy. The network aims to

- strengthen international collaboration in digital health and telemedicine research,
- support interdisciplinary research on AI-enabled healthcare systems and medical IoT technologies,
- promote capacity building through workshops, summer schools, and academic exchange,
- facilitate joint research proposals and collaborative projects, and
- foster knowledge transfer between research institutions, healthcare providers, and policy stakeholders.

Compared to large global networks such as HIMSS or ECHAlliance, SALUS_NET focuses specifically on strengthening research collaboration and capacity building in digital health and telemedicine within emerging digital health ecosystems, particularly in the Western Balkan region.

4. SALUS_NET Collaboration model and research framework

Building on the initiatives described in the previous section, SALUS_NET operates as a structured collaboration framework designed to support interdisciplinary research, knowledge exchange, and capacity building in digital health and telemedicine. The collaboration model integrates three complementary components: (i) thematic research clusters, (ii) capacity-building and knowledge transfer activities, and (iii) collaborative project development. Together, these elements constitute the operational framework of the SALUS_NET ecosystem.

4.1. Thematic research clusters

Scientific activities within SALUS_NET are organized into thematic research clusters that reflect the interdisciplinary nature of digital health innovation. These clusters provide a flexible structure that enables researchers from different institutions and disciplines to collaborate on specific research topics while maintaining a shared conceptual framework. Table 2 summarizes major digital health networks, highlighting their strategic foundations, stakeholder involvement, and functional impact across different healthcare contexts.

Table 2. Comparison of Digital Health Networks

Network / Entity	Strategic Mission and Foundational Basis	Stakeholders, Focus, and Impact
SALUS NET	Strengthening AI-enabled research and capacity building based on transnational academic collaboration	Universities and research institutions in the Western Balkans; focuses on bridging the regional research gap and fostering innovation ecosystems
ISfTeH	Global dissemination of knowledge through a non-profit structure with WHO recognition [36]	Global practitioners, nurses, students, and corporate members; operates as a "network of networks" across 113 countries to share best practices
NATO Tele-Health Panel	Ensuring medical support and interoperability based on NATO Standard AMedP-5.3 (STANAG 2517) [37]	Military medical commands, nations, and partners; emphasizes rapid deployment and expertise transfer in low-bandwidth environments
eHealth Network (EU)	Facilitating cross-border interoperability under EU Directive 2011/24/EU [38]	National health authorities of EU Member States; enables practical data exchange such as ePrescriptions and Patient Summaries
eHealth Exchange (US)	Providing secure health data infrastructure through a public-private partnership (Sequoia Project) [39]	HIEs, pharmacies, government agencies, and laboratories; supports large-scale real-time clinical data exchange using standards like FHIR
Telemedicine Alliance	Developing long-term telemedicine policy through collaboration between ESA, WHO, and ITU [40]	European Commission and international organizations; integrates satellite technologies, telecommunications, and public health

The main research clusters currently include:

- **AI-enabled Telemedicine Systems.** This cluster investigates the development of intelligent telemedicine platforms that integrate machine learning methods, clinical decision-support systems, and remote monitoring technologies. The goal is to enable scalable telemedical services that support diagnosis, therapy monitoring, and long-term patient management.
- **Digital Health Platforms and Interoperability.** Research in this cluster focuses on the design of interoperable digital health infrastructures that facilitate the secure exchange of medical data across institutions and national healthcare systems. Key topics include health data interoperability, platform architectures, and integration with electronic health record systems.
- **Medical IoT and Wearable Health Monitoring.** This cluster investigates sensor-based health monitoring technologies and ambient sensing systems for continuous observation of physiological signals and health-related behaviors. Application domains include wearable health monitoring, smart healthcare environments, and ambient assisted living systems.
- **Digital Health Governance and Societal Impact.** In addition to technological aspects, this cluster examines ethical, legal, and societal implications of digital health technologies, including data governance, privacy protection, and regulatory frameworks for telemedicine services.

These clusters provide a flexible organizational structure that supports both fundamental research and applied innovation in digital healthcare systems.

4.2. Capacity building and knowledge transfer

An essential component of the SALUS_NET collaboration model is the promotion of knowledge exchange and academic training. Capacity-building activities aim to strengthen digital health expertise in the participating regions and to facilitate interdisciplinary collaboration between computer science, healthcare, and related disciplines.

Key mechanisms for knowledge transfer include:

- **International summer schools and workshops.** These formats provide opportunities for students and early-career researchers to engage with current research topics in digital health and telemedicine while interacting with international experts.
- **Interdisciplinary training programs.** Educational activities combine technical, medical, and societal perspectives on digital health technologies, thereby supporting a comprehensive understanding of digital healthcare systems.
- **Academic exchange and research visits.** Short-term research stays and collaborative workshops facilitate the exchange of expertise and support the establishment of long-term research partnerships among participating institutions.

These activities contribute to the development of a sustainable research community by fostering collaboration across disciplinary and institutional boundaries.

4.3. Collaborative research and project development

Beyond training and knowledge exchange, SALUS_NET supports the development of joint research proposals and international projects. Research ideas are discussed within thematic clusters, refined through workshops and expert meetings, and translated into collaborative project concepts by interdisciplinary teams. This process helps to form consortia that combine academic expertise with input from healthcare providers, public organizations, and industry partners. In this way, the network aligns technological innovation with clinical needs, regulatory requirements, and opportunities within European and international funding programs.

Overall, the collaboration model integrates research, education, and project development into a coherent framework for sustainable international cooperation in digital health.

4.4. Methodological approach

The methodological approach of SALUS_NET follows an iterative network-development model that combines needs assessment, thematic clustering, capacity building, and collaborative project generation. First, regional and institutional needs are identified through workshops, expert discussions, and exchanges with healthcare, academic, and policy stakeholders. These inputs are used to define shared research priorities in telemedicine, AI-enabled health services, medical IoT, interoperability, and digital health governance.

Second, participating institutions are organized into thematic research clusters. Each cluster develops use-case oriented research questions, identifies relevant data, technology, and implementation requirements, and defines possible evaluation criteria. Third, capacity-building activities such as summer schools, workshops, and academic exchanges are used to transfer knowledge, train early-career researchers, and validate research priorities with interdisciplinary participants. Finally, the results are consolidated into joint publications, project proposals, and prototype-oriented research concepts. This approach enables SALUS_NET to move from networking activities toward structured research collaboration and measurable scientific outputs.

5. Capacity building and knowledge transfer

A central objective of SALUS_NET is to strengthen expertise and collaborative capacity in digital health and telemedicine through structured training, academic exchange, and knowledge transfer. Since sustainable digital healthcare innovation requires interdisciplinary competencies that combine technical, medical, and organizational perspec-

tives, the network places strong emphasis on educational formats that support such competence development across the participating regions.

- **International summer schools.** International summer schools are a central capacity-building instrument within SALUS_NET. They bring together students, early-career researchers, and academic experts for interdisciplinary learning and collaborative project work. One example is the Medical Summer School "Towards building sustainable and co-created telemedicine systems in Western Balkan countries", which addressed technological, clinical, and societal aspects of telemedicine, including telemedicine platform architectures and participatory system design in the Western Balkan context [35].
- **Interdisciplinary educational initiatives.** SALUS_NET also supported further training activities at the interface of healthcare and digital technologies. The program "Pharmacy and AI Integration in Advancing Digital Health" explored the use of artificial intelligence in pharmaceutical research and medication management. By involving participants from pharmacy, computer science, and healthcare, it fostered interdisciplinary perspectives on AI based decision support, data driven health services, and digital therapeutics [34].
- **Academic networking and research exchange.** Beyond structured training, SALUS_NET promotes knowledge exchange through workshops, networking meetings, research visits, and visiting scholar activities. These formats allow researchers to present ongoing work, discuss emerging topics, define shared research agendas, and identify opportunities for joint publications, project proposals, and long term cooperation.
- **Regional impact and community development.** Through its educational and networking activities, SALUS_NET contributes to a regional knowledge ecosystem in digital health linking universities, healthcare institutions, and policy stakeholders. In particular, cooperation with institutions in the Western Balkan region has created new opportunities for joint research and academic exchange. By combining capacity building with collaborative research, the initiative strengthens regional expertise in digital health technologies and supports the long term development of an international research network.

6. Emerging research themes and future directions

SALUS_NET has identified several priority research themes aligned with current developments in digital health and the needs of cross-border healthcare ecosystems. These themes address key challenges in the implementation, interoperability, and governance of digital health technologies.

One major research direction is the integration of artificial intelligence into telemedicine systems. AI can improve telemedical services through automated patient data analysis, clinical decision support, and personalized treatment recommendations. Within SALUS_NET, particular emphasis is placed on explainable AI approaches that provide transparent and trustworthy support for healthcare professionals.

A second theme concerns interoperable digital health platforms for the secure exchange of health data among healthcare providers, patients, and research institutions. This is especially relevant in cross-border settings characterized by heterogeneous infrastructures and regulatory frameworks. Research therefore focuses on platform architectures based on standardized health data models, secure communication protocols, and interoperability standards such as HL7 FHIR.

A further area addresses medical Internet-of-Things systems and continuous health monitoring. Advances in wearable sensors and mobile computing enable the collection of physiological and behavioral data in real-world settings, supporting preventive care and long-term monitoring. Within SALUS_NET, this includes combining wearable sensing with AI-based analytics for personalized monitoring and early risk detection. Finally, the network examines ethical, legal, and societal aspects of digital health. The growing use of AI and large-scale health data infrastructures raises challenges related to data privacy, transparency, and regulatory compliance.

Future work therefore focuses on governance models that support responsible data use and patient-centered digital health services.

The expected results of SALUS_NET include both scientific and structural outcomes. Scientific outcomes comprise joint publications, shared research agendas, interoperable telemedicine concepts, AI-enabled digital health use cases, and methodological contributions in areas such as explainable AI, wearable health monitoring, and privacy-preserving data exchange. Structural outcomes include the consolidation of thematic research clusters, the preparation

of international project proposals, the development of capacity-building formats, and the strengthening of regional digital health expertise, particularly in the Western Balkan region. In the longer term, the network is expected to contribute to scalable, patient-centered, and interoperable digital health solutions that can support cross-border healthcare collaboration.

7. Discussion and Conclusion

The development of SALUS_NET illustrates how transnational research networks can support innovation in digital health by combining technological research, interdisciplinary collaboration, and capacity-building activities. The experience gained during the establishment of the network highlights several important factors for successful international research cooperation.

First, digital health innovation requires interdisciplinary collaboration. The design and deployment of digital healthcare systems involve expertise from computer science, clinical medicine, public health, pharmacy, and health policy. Structured collaboration formats such as workshops, summer schools, and joint research meetings proved to be effective in facilitating communication between disciplines and identifying shared research priorities.

Second, capacity-building initiatives are essential for strengthening research ecosystems, particularly in regions where digital health infrastructures are still evolving. Educational programs such as international summer schools support the development of regional expertise and foster the formation of sustainable research communities. Involving students and early-career researchers in international collaboration networks further promotes long-term academic partnerships and knowledge exchange.

At the same time, cross-border collaboration in digital health faces structural challenges. Differences in healthcare system organization, regulatory frameworks, and data governance policies can complicate the exchange of medical data and the implementation of interoperable digital infrastructures. Addressing these challenges requires continued progress in interoperability standards, governance models, and privacy-preserving data-sharing mechanisms.

Overall, SALUS_NET demonstrates how integrating research collaboration with training initiatives and institutional partnerships can create a sustainable framework for international cooperation in digital health. By connecting researchers and institutions across multiple countries, the network contributes to advancing research in AI-enabled telemedicine, interoperable digital health platforms, and sensor-based health monitoring. Future work will focus on expanding collaborative research activities and strengthening partnerships with healthcare providers, industry stakeholders, and public institutions in order to support the development of scalable and patient-centered digital health solutions.

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