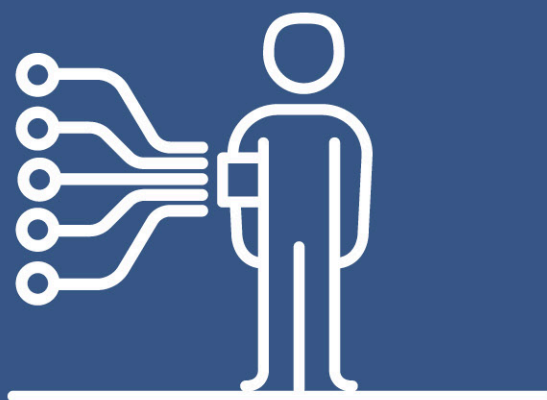




Nordic Council
of Ministers

NORDIC EHEALTH BENCHMARKING

TOWARDS A DIGITALLY SUPPORTED HEALTH ECOSYSTEM



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<https://pub.norden.org/temanord2025-548>

Preface

The Nordic Council of Ministers (NCM) eHealth Group was established in 2011 and has, across the years, been involved in the dissemination of knowledge, interventions and collaborations.

The shaping of initiatives within eHealth and the exchange of knowledge and experiences around digital health infrastructures and eHealth, will strengthen the Nordic leadership in eHealth. All Nordic countries have successfully digitalized their healthcare systems and been active at the European and global levels. The group is of significant importance especially at the time, when the Regulation for the European Health Data Space (EHDS) enters into force by early 2025.

The Nordic eHealth Research Network (NeRN) was established in 2012 as a forum for policy makers and researchers to jointly work towards measurable policy goals and data that can be exploited to steer decision making related to goals and their implementation. Under the leadership of the NCM eHealth Group, NeRN has published a number of reports and scientific publications.

In this report, the NeRN has carried out a study for identifying, structuring, analysing and following up on health indicators. The report describes access to health data, and the status of the Nordic countries in the work of digitizing health data and related policies.

When health data is digitized and structured, opportunities for the use of the data emerge in new ways. Digital health technology has potential to improve citizens' access to health services, increase the quality and efficiency of care, manage personalized services and, in general, support research and innovation. Extra efforts are required to ensure that everyone has equal access to health care and that everyone has the same opportunities to live good and healthy lives.

Health indicators help to anticipate future risks and opportunities. Well-developed indicators, when analysed over time, can identify preventable events. Political determination, decision-making, and consideration of ethical and legal implications are needed to ensure that health data is used safely, for the individual, and to create new knowledge, and thus, to enable development, research, and new innovations with the highest possible quality.

Annemieke Ålenius, Chair

The Nordic Council of Ministers eHealth group

Summary

The Nordic Committee of Senior Officials for Health and Social Affairs (ÄK-S) of the Nordic Council of Ministers (NCM) established the eHealth group (the Nordic Council of Ministers' eHealth group) in 2011 to ensure knowledge transfer between the Nordic countries, and help to strengthen the global leadership position of the region in the eHealth area. The NCM e-health group supports a Nordic e-Health Standardization group and the Nordic e-health Research Network (NeRN)^[1]. The mandate of NeRN is to work on eHealth indicators in order to advance the eHealth monitoring activities and systems in the Nordic countries. As of 2025, the Nordic countries rank among the foremost in taking e-health / digital health solutions into use.

In this report we have analysed national-level e-health policies and found what these have in common. We have also analysed the 2021 NCM Action plan: "The Nordic Region – towards Being the Most Sustainable and Integrated Region in the World: Action Plan for 2021 to 2024".

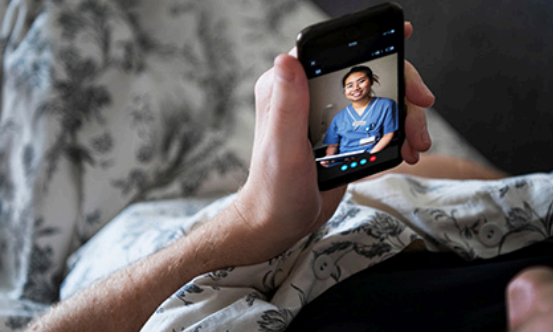
The policy analysis shows that the Nordic countries have begun to leverage their installed base of health-related information systems by putting them front and center in their healthcare reforms. The national-level policies are wider in scope in that they now seek to engage, empower and activate the patient / citizen to take a greater responsibility for their health. This includes preventive measures. The policies are also wider in scope in that they now encompass research and innovation workflows. Now that health information systems are in use across the entire sector, there is greater concern of the impact of IT-systems on the worklife of the health professionals.

Compared to earlier e-health policies, the current e-health policies hints towards a deeper concern for research and innovation as well as for professional development and the work-life of healthcare professionals. To reflect this we have used a system-theoretic approach in the development of areas for indicator development. Another principle is that healthcare information systems shall be evaluated as to how they contribute to value-creation. We describe healthcare systems and health ecosystems and their value chains. In addition to the healthcare value chain, we relate the areas of indicator development to the research and innovation value chain and to education and training of health professionals.

This report ends with a description of the suggested areas for indicator development which again is to be used to propose new indicators and refine

1. <https://thl.fi/en/research-and-development/research-and-projects/nordic-ehealth-research-network-ner-n>

indicators that already are in use. The suggested indicator development areas are meant as a contribution towards a more comprehensive assessment of the outcomes of e-health / digital health policies in the Nordic countries. Given the ongoing development of many powerful generic technologies (e.g. machine learning, large language models and other forms of artificial intelligence) it is our belief that monitoring the effects and side effects of digital health policies will become even more important in the years to come.



CHAPTER 1



Photos: Jens Lindström/imagebank.sweden.se and iStock

Background and analytic approach

Background

Healthcare systems in the Nordic countries resemble each other in that they largely are owned, funded and operated by the public. The countries also resemble each other in that they have the same demographic challenges and struggle with educating and retaining health personnel. As in any country with fiscal responsibility, the Nordic countries try to contain costs as more expensive remedies for diagnosis and therapy come out of the research and innovation pipelines. At the same time, the Nordic countries nurture an ecosystem of enterprises that are active in developing medical devices, medicinal products and other health-related technologies for an increasingly globalised marketplace.

Since the advent of digital tools for storing and managing information, health authorities in the Nordic countries have embraced, and taken an active role in supporting the development and implementation of information systems to enhance their healthcare systems. Table 1 provides an overview of systems and implementation status.

Table 1. Status of information system implementations in the Nordic countries.

	Denmark	Finland	Iceland	Norway	Sweden
Health record systems	✓	✓	✓	✓	✓
Health registries	✓	✓	✓	✓	✓
National patient portals	✓	✓	✓	✓	✓
Laboratory information systems	✓	✓	✓	✓	✓
Imaging information systems	✓	✓	✓	✓	✓

The Nordic Committee of Senior Officials for Health and Social Affairs (ÄK-S) of the Nordic Council of Ministers (NCM) established the eHealth group (the Nordic Council of Ministers' eHealth group) in 2011 to ensure knowledge transfer between the Nordic countries, and help to strengthen the global leadership position of the region in the eHealth area.

The NCM e-health group supports a Nordic e-Health Standardization group and the Nordic e-health Research Network (NeRN)^[2]. The mandate of NeRN is to work on eHealth indicators to advance the eHealth monitoring activities and systems in the Nordic countries. In the current mandate period, the work is to be shaped by the objectives and actions described in the NCM action plan for 2021 to 2024: The Nordic Region – towards being the most sustainable and integrated region in the world.

The primary objective for the current mandate period is to develop and pilot an updated set of indicators that can be used to assess and compare the impact of national-level digital health programmes in the Nordic countries.

2. <https://thl.fi/en/research-and-development/research-and-projects/nordic-ehealth-research-network-ner-n>

Analytic approach

The previous policy analysis and indicator development activities^{[3], [4], [5], [6]} were inspired by an evaluation framework developed by Price and Lau. Price and Lau^[7] described their Clinical Adoption Meta-Model (CAMM) as “a temporal model with four dimensions: availability, use, behaviour changes, and outcome changes”. Implicit in the model is that the value of the system lies in its ability to support the work of individual clinicians.

There are however many other professional roles and groups that are to benefit from Health information systems and the healthcare data that accumulates in them. In our 2012 and 2016 reports we introduced the terms ‘stakeholder’ and ‘stakeholder engagement’, and assessed each country's eHealth policy according to which stakeholders were mentioned and how they were to benefit from the activities and objectives described.

In our 2020 report^[8], we expanded the work on stakeholders by developing Personas. Personas is a widely used method in user experience research and consists of creating detailed, fictional representations of target users and user groups. In the context of indicator development, we asked (page 68): Who can benefit from the indicators we develop? and stated that the target group for policy strategies and evidence of status is very broad and complex. We came up with nine different personas, each of which were given a biographical description. We then described their key interests, technology proficiency, goals, fears, challenges and candidate indicators.

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3. Hyppönen H, Faxvaag A, Gilstad H, Hardardottir G, Jerlvall L, Kangas M, et al. Nordic eHealth Indicators. TemaNord 2013 522. 2013.
 4. Hyppönen H, Faxvaag A, Gilstad H, Hardardottir GA, Jerlvall L, Kangas M, et al. Nordic eHealth Indicators: Organisation of Research, First Results and Plan for the Future. Stud Health Technol Inform. 2013;192:273–7.
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Table 2. Personas identified (extract from the 2020 report)

Personas	Goals (examples)	Fears / challenges (examples)
Citizen	Access to own data and to the data of next-of-kin. Access to treatment and appointments.	Fears missing valuable information concerning the treatment of family members. She does not fear loss of privacy but is more afraid of losing overview of her data.
Patient	To feel safe. To experience as few healthcare handovers as possible.	Easily confused, the patient has a low confidence in data safety and IT in general. Fears losing ability to live independently and taking care of herself.
Clinician	Reliable health information systems – high stability, security and confidentiality. To deliver the best possible quality of services – medical measures, access to clinical guidelines.	That patient data in different health sectors are not being shared and used to provide the best possible treatment for patients. To be unjustifiably accused of malpractice by patients squeezed by the healthcare system. To mishandle his management responsibilities due to lack of insight.
Policy Maker	Wants clear messages and need focused information. Need for knowledge about things that work. Requires knowledge-based facts – e.g. knowledge about international trends.	Lack of overview into how the policy goal implementations are progressing, what are the differences between regions. Afraid of being misunderstood and making decisions based on misinformation.
Industry CEO	Develop a deep understanding of health systems. To create a competitive, market-leading, product. To obtain some of the value that lies in the data that are stored in the system.	Losing market shares. Bad publicity for products deployed at customer sites.
Politician	Wish to initiate changes in the use of ICT in a good way. Wants that every deviation and breach in security must be documented. Wants an overview of safety cultures, resources spent on safety and security	Holistic use of ICT solutions – system integration. The effects of using eHealth – dissemination. Reducing travel and transport expenditures for patients and health providers. Reducing the length of stay in hospitals. Improve empowerment of patients.
Health institution manager	Analytics of indicators – used as decision support. Staff perception of useful systems. Balance staff and customer satisfaction.	Regulatory concerns (IT-security). Report upwards (regional administration and politicians). Budget cuts and whimsical politics. High cost of IT employees.
Researcher	To publish scientific papers and reports on his research work. To keep up to date with recent developments within his field.	Violating the confidentiality of the research data he has access to. Basing his work on obsolete data.
IT-professional	To manage his projects successfully, including sharing information regarding the capability and strengths of the delivered solution. To understand the expectations and needs of the project stakeholders.	Failure to reach project deadline. Failure to meet stakeholder expectations. Delivery of a system that does not comply with requirements, including those of legislative and cyber/information security character. He is challenged in understanding the clinical work context of the users.

Since our 2020 report, it has become increasingly clear that the value of an information system extends beyond its value for the users of the system. The information that accumulates through use of the system has a value in itself, a value that should be preserved when one EHR system is replaced by a newer system. State of the art in healthcare information system engineering is now to enhance the value of the information that accumulates by structuring the information and in using terminology systems such as ICD-10 and Snomed-CT. Another major trend is that EHRs not only are used to document care and store care recordings but increasingly used to distribute relevant knowledge to the clinician user at point of care. This means that EHR-systems contain representations of the knowledge that is to be applied, representations that need to be governed and maintained. A third development is the introduction of new means of analysing data (e.g. machine learning) and new entities that are to learn from the data (i.e. machines). Taken together, these advancements in health information system engineering point towards a future where these systems become more and more integral to the healthcare system they are to serve. These developments will further add to the value. In the near future we will see health information systems that are capable of transforming how health problems are approached, surveilled, analysed, solved and followed-up as virtualized care is becoming a realistic alternative to consulting the patient in a consultation room.

In the current round of policy analysis and indicator development we shall also use a system theoretic approach. We shall use system theory to describe healthcare systems and health ecosystems and to define areas where new indicators might be needed. We shall stick to the principle that an information system tool shall be evaluated as to how it contributes to value-creation. We shall think of the system as a tool that has value for practitioners at all levels in a healthcare system. That includes the new and emerging roles that relate to knowledge management (e.g. configuration of workflows, clinical decision-support, digitised care pathways, population health and health operations management). The same relates to entities, practices and routines that relate to working with healthcare data to assess the value of the care that was provided, to validate the knowledge that was used in knowledge-based care and to enable contributors to learn by assessing the actual outcome of their work.

System theory and its relevance to healthcare systems

According to the Merriam-Webster dictionary, a system can be described as "a group of interacting or interrelated elements that act according to a set of rules to form a unified whole". A system, surrounded and influenced by its environment, is described by its boundaries, structure and purpose and expressed in its functioning. Systems are the subjects of study of systems theory and other systems

sciences^[9] Just like any other system, a healthcare system has emergent properties – properties that cannot be understood by observing the arrangement and interaction of its parts but instead how the parts enable the system to achieve the purpose for which it was designed (WHO). We can think of continuity of care, patient safety and citizens' trust in their healthcare system as such important emergent, macro-level properties of healthcare systems. (Effects on users, impact on emergent properties (properties of the system as a whole)).^[10]

Healthcare systems, health ecosystems and their value chains

The goal of any healthcare system is to protect its users when their health is impacted by damage, disease or aging. They achieve this by applying knowledge, medicines, medical devices and health personnel's skills. As in any system with a finite amount of resources, healthcare systems must optimize its activities so they get the most value out of the resources. Healthcare systems have ethics. They are goal-directed and therefore have value chains. Healthcare systems interact with institutional entities in a surrounding health ecosystem. Irrespective of practice and location in the system, you cannot aspire to contribute anything of value unless you have a knowledge-based approach, state your intended outcomes and organise the work so that you get to learn from the outcomes that actually were achieved.

The model outlined here is illustrated with examples from the healthcare sector but also holds for the social care setting. The main difference is the risk exposure (explained below) both on the patient/client side and on the side of the health or care professional.

The healthcare value chain

If we define a **health problem** as a problem that affects, or might affect someone's health, most jurisdictions define a **patient** as a person that asks a health professional for help with a health problem. In this context, **healthcare** is an activity that is restricted to health professionals. A **health professional** is then a person that is authorised or licensed to provide healthcare. Possessing a health problem is associated with **risk**. Asking a health professional for help with the problem is then a means of dealing with the risk by sharing it with another person (the health professional). Carrying out healthcare then implies that the patient assigns a **care mandate** to the health professional that the health professional subsequently accepts. Healthcare is then a mandated activity that is carried by a health professional to analyse, explain, mitigate and possibly eliminate the health problem. A care mandate can be implicit. Healthcare also includes activities that the patient carries out in an agreement with a health professional such as turning up for a

9. https://en.wikipedia.org/wiki/Systems_theory

10. Adam T. Advancing the application of systems thinking in health. Health Res Policy Syst. 2014 Aug 26;12(1):50.

consultation, taking a prescription, reporting on side effects or reporting an outcome. The term **self-care** should denote other health-related activities that are initiated and fully controlled by the citizen or next-of-kin.

In the context of (professional) care, problem solving can be described as an iterative, decision-centred process that starts with collecting (patient-specific) data about the problem.



Figure 1. The problem-solving cycle.

Problem-specific data illuminates the problem and are subsequently used to search for, choose and present the best explanation. Assessing the problem, developing and subsequently presenting an analysis is described as **medical problem-solving** or in the scientific literature^[11]. Lawrence Weed describes it as **problem-knowledge coupling**.^[12]

Deciding on the knowledge that is to be applied to eliminate or mitigate the problem is described as **clinical decision-making**^[13] Clinical decision-making involves engaging the patient problem owner in what is described as shared decision-making in the literature^[14]. Carrying out (executing) the decision(s) that have been made is to apply the chosen knowledge on the problem. This activity aims at

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11. Elstein AS, Schwarz A. Clinical problem solving and diagnostic decision making: selective review of the cognitive literature. *BMJ*. 2002 Mar 23;324(7339):729–32.
 12. Weed LL. Medical records that guide and teach. *N Engl J Med*. 1968 Mar 14;278(11):593–600.
 13. Elstein AS, Schwarz A. Clinical problem solving and diagnostic decision making: selective review of the cognitive literature. *BMJ*. 2002 Mar 23;324(7339):729–32.
 14. Gulbrandsen P, Clayman ML, Beach MC, Han PK, Boss EF, Ofstad EH, et al. Shared decision-making as an existential journey: Aiming for restored autonomous capacity. *Patient Educ Couns*. 2016 Sep 1;99(9):1505–10.

achieving the favourable outcome(s) that made decision-makers choose the knowledge in the first place (Figure 1). Valuable health outcomes can only be achieved by **applying** the chosen knowledge. Knowledge can be applied as a drug, a medical device or by means of a health professionals' clinical skills (Figure 2). Knowledge application means additional exposure to risk. That's why the patient problem-owner should be involved in the decision-making.

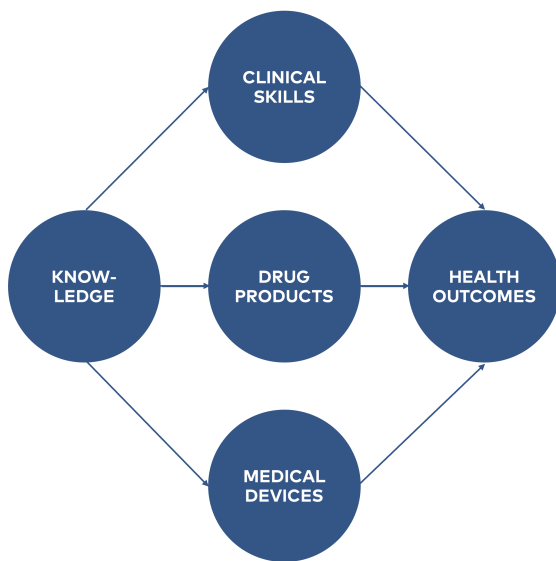


Figure 2. Application of knowledge to achieve valuable health outcomes.

For some health problems, the problem is access to health professionals that are trained in recognising that particular problem and possess the clinical skills that are required to provide knowledge-based care to the patients (e.g. access to speciality care). For other health problems, the problem is that there are no truly valuable knowledges to apply. In the case of grave and immediate risk, the best chance for the patient can be to test out of experimental therapy in an ongoing clinical trial. Here, access to a knowledge development infrastructure and services is paramount. A third group of patients are those that have or are about to develop a rare disease. Since the patients are so few, clinicians never get enough training in recognising them. Likewise, it is notoriously hard to team up with other clinicians to develop new knowledge about the disease by establishing and populating a sufficiently large disease-specific registry.

Table 3. Overview of value chains in healthcare systems and health ecosystems

Value chain	Input	Outcome	Reaps the value	Main constraint
Healthcare	Health problem	Years to life Life to years	Citizen	Availability of expertise
Research and engineering	Data about the health problem	Applicable knowledge, medicines and medical devices	Knowledge user Vendor of product	Availability of data from the domain
Education and training	Situations where the health problems are dealt with by health professionals	Competence	Health Institutions	Availability of situations

The research value chain

Biomedical research and development (R&D) can be described as the use of the scientific method to develop knowledge that can be applied to understand, explain or mitigate a health problem. Carrying out a biomedical R&D project always requires access to data from patients that possess the health problem and / or biological specimens sampled from the same patients. When the scientific investigation is a randomized clinical trial, those who carry out the experiment also need to interact with the patient. Carrying out a scientific investigation from defining the research problem to publishing a valid scientific result is usually an undertaking of a university or another research institution. The Covid pandemic clearly demonstrated that international collaborations are required to build sufficiently large cohorts, plan and realize the R&D that will bring about the vaccine products and other knowledges that were needed.

In general, knowledge that comes out of a biomedical R&D project can a) be applied to better understand the nature of disease; b) incorporated in guidelines, expressed in decision rules or clinical workflows; c) incorporated in methods or devices that can be used to portray the nature of a disease in greater detail (e.g. a diagnostic or prognostic test); d) applied to develop a candidate new drug product or medical device or e) applied as documentation that a drug product or medical device is of sufficiently large value to be taken into regular clinical use. Since working with health problems is dealing with risk, and mitigating risk by exposing the patient to drug or medical device products adds new risks, the true (realised) value of the product cannot be assessed without obtaining outcome data.

The knowledge development value chain is constrained by several factors. Many of them have to do with limited access to data about individual patients' health problems and how these are dealt with by health professionals.

The education and training value chain

A health professional is a person that is authorised or licensed to provide healthcare. Elstein^[15] describes clinical competence as the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and the community being served. To fulfil the qualifications for a license or authorisation, health professionals must develop competence through education and training. A large part of education and training relates to developing the insights, attitudes and skills that are required to be able to find, explain and apply the knowledge that is relevant to the health problem at hand. A competent health professional is familiar with and knows how to apply scientific knowledge. Health professionals also develop experience-based knowledge and the ability to apply experience- and science-based knowledge when practicing clinical skills.

Most jurisdictions recognize around 30 different kinds of health personnel and educational programs. Basic health professional education takes place at universities. The educational programs provide a theoretical basis on top of which the students start developing their own experience-based insights. Exposure to real patients and their health problems occurs through bedside training in health institutions. Health institutions therefore also count as educational institutions. There are around 50 different medical specialities. A medical doctor that undergoes speciality training has acquired the right to develop a deeper insight in a particular subset of the biomedical knowledge base (e.g. Infectious diseases), develop the clinical skills that are specific for the specialty and develop experience-based knowledge on the same patient groups. Most of the learning occurs through supervised exposure to a sufficiently large number of patients with a relevant health problem.

From a systems and HR perspective, there are many problems with developing and maintaining a competent workforce. Once health professionals have become fully capable at what they are doing, keeping them competent requires a commitment to lifelong learning, both from the employer and the employee side. The professionals' need for training is real, because careers in healthcare can be long. At the moment, after the middle-aged healthcare professionals' graduation several new treatments have been introduced to achieve health benefits, for example, biological drugs have created new treatment options for rheumatoid arthritis patients, and many surgical treatments have been omitted from the treatment as

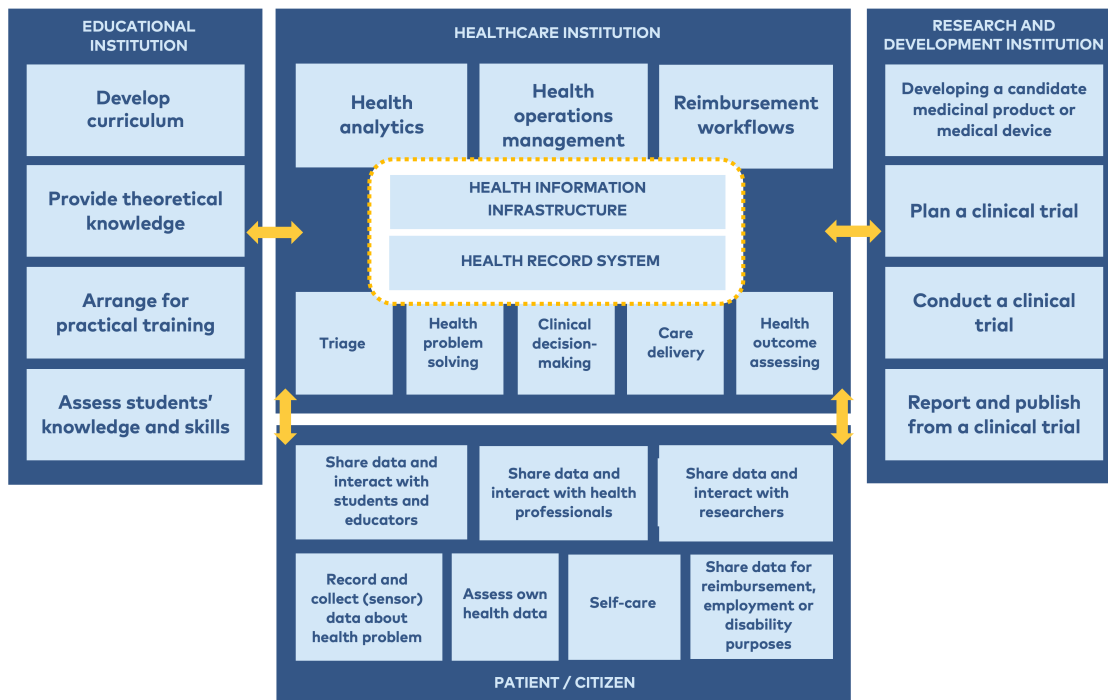
15. Epstein RM, Hundert EM. Defining and Assessing Professional Competence. JAMA. 2002 Jan 9;287(2):226–35.

the treatment of the disease can be influenced already at an early stage. Changes in evidence-based care also affect healthcare professionals other than physicians, therefore evolving training throughout the different professional groups is essential. Changes in care practices have an impact on workflow and, ideally, EHRs are modified to support the healthcare professionals' workflows.

A health system is also a system for matching health problems to professionals with the right expertise. For some health problems, there aren't enough cases for professionals to develop the experience-based knowledge that is needed. Also, the need for (continuous) education and training is heavily influenced by what happens in the knowledge development value chain. Research and development may bring about a new kind of medical device (e.g. stents for blocking out stenoses in coronary arteries), but this therapy cannot be applied on the relevant patients unless professionals undergo the required training.

EHRs and other digital health systems undoubtedly influence learning. Health professionals both develop and practice their problem-solving and decision-making skills by means of the EHR. As they learn while they practice, they embed their skills with the EHR tool at hand. The EHR is also key to learning from data on the true outcomes of your work (e.g. patient-reported outcomes). Finally, decision-support and knowledge-support tools in the EHR are also sources of learning.

Figure 3. Illustration of a Health ecosystem. Adapted from Hasselgren^[16]



A healthcare system will always be constrained by the resources that are available. There will never be enough funding. There will always be knowledge that a healthcare system cannot afford to apply. There will always be healthcare situations devoid of knowledges to apply. There will always be limitations to professional training and availability of expertise. As a system of entities that are networked to each other, there will be additional problems at the outermost parts of the network (e.g. attracting and retaining personnel at the most remote healthcare organisations).

Correspondingly, there are high-level healthcare system problems and challenges where information system infrastructures and tools are the only solution. Given the rapid advancements in the field, we must now expect a rollout of ever-more capable health information systems. This development has implications for digital health policy making as well as for how we are to evaluate this next generation of systems and infrastructures.

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CHAPTER 2



Photos: iStock

Updated analysis of the national e-health / digital health policies

Introduction

The healthcare systems in the Nordic countries rank among the best in providing equitable, safe and effective care. Cooperation between the governments is achieved through the Nordic Council of Ministers (NCM)^[17]. Cooperation also includes the field of e-Health / Digital healthcare, where the Nordic countries stand out as pioneers: As of 2024, all countries have established national patient portals, health record systems, health registries, health information exchange, laboratory and imaging information systems^{[18], [19]}.

Despite Nordic cooperation and the use of international standards, each country's e-health solutions have largely had a national scope. This is now beginning to change as the European Union has begun its work on the regulatory framework for an European health data space (EHDS). In the foreseeable future, patients will be able to bring along with them their electronic prescriptions when they travel. The development pipeline also includes a summary of care records. This development might ultimately end in a unified European care provision space. There is also a budding commercial market for video consultations on demand and other digital-first healthcare services.

An e-Health / Digital health policy is a macro-level instrument to shape the development within a healthcare system. It must build on what has been achieved when it comes to existing services and existing digital health infrastructure. It must also aspire to leverage the potential in enabling technologies while keeping risk at acceptable levels. As a sector-specific policy it will also have to comply with generic

17. <https://www.norden.org/en/nordic-council-ministers>

18. The Nordic Council of ministers. THE NORDICS – a sustainable and integrated region? Baseline report for Our Vision 2030 [Internet]. 2021 [cited 2024 Mar 18]. Available from: <https://www.norden.org/en/publication/nordics-sustainable-and-integrated-region-baseline-report-our-vision-2030>

19. Eriksen J, Monkman H, Adler-Milstein J, Tornbjerg Eriksen K, Nöhr C. Citizens' Access to Online Health Information – An International Survey of IMIA Member Countries. In: MEDINFO 2023 – The Future Is Accessible [Internet]. IOS Press; 2024 [cited 2024 Mar 18]. p. 1297–301. Available from: <https://ebooks.iospress.nl/doi/10.3233/SHTI231174>

national policies on digitalisation (e.g. on national policies on the use of machine learning and AI) as well as with relevant supranational policies from the United Nations, EU and NCM.

The objective of this policy analysis is to assess and compare the scope, ambitions and extent of accountability in national-level digital health policies in the Nordic countries. By **scope** we mean what the policy intends to change when it comes to a) **infrastructure development** (i.e. regulatory groundwork, standardisation activities, work on the technical infrastructure and on the infrastructure to maintain cybersecurity) and b) **business support** (to include preventive care, healthcare delivery, knowledge development, building a competent workforce). By **ambition** we mean the value of the stated policy outcomes if achieved, and (implicit), the degree of risk taken. By **extent of accountability** we mean the extent to which the underlying assumptions also are described in the policy documents and the extent to which the descriptions of the intended outcomes are so that their achievement, and hence the fulfilment of the policy objectives can be accounted for in the future.

Materials (policy documents)

The policy documents that were to be included in the policy analysis were obtained from the e-health groups and from the members of NeRN research network. Table 4 enlists the policy documents that were included. Their front pages are illustrated in Figure 1.

Table 4. National e-Health policies included in the analysis.

Country	Policy document
Denmark	<p>Sundhedsdatastyrelsen: A Coherent and Trustworthy Health Network for All. Digital health strategy 2018-2022 (2018). Available from sundhedsdatastyrelsen.dk</p> <p>The Danish Government: Denmark's digitisation strategy (2023) (in Danish). Available from digmin.dk</p>
Finland	<p>Ministry of Social affairs and Health: Strategy for digitalisation and information management in healthcare and social welfare (2024) urn.fi/URN:ISBN:978-952-00-5404-5. Available from stm.fi</p> <p>Ministry of Social affairs and Health: Information to support well-being and service renewal. eHealth and eSocial strategy (2020) urn.fi/URN:ISBN:978-952-00-3575-4. Available from julkaisut.valtioneuvosto.fi</p>
Iceland	<p>Directorate of health: National eHealth strategy 2016-2020.</p> <p>Ministry of Health: Health Policy, A policy for Iceland's health services until 2030 (2019). Available from: stjornarradid.is</p> <p>Ministry of health: Digital healthcare policy (2021). Available from government.is</p>
Norway	<p>Directorate of eHealth: National eHealth strategy (2023). Available from ehealthresearch.no</p> <p>Ministry of health: National Health and collaboration reform 2024-2027 (2024) (In Norwegian). Available from regjeringen.no</p>
Sweden	<p>Ministry of Health and Social Affairs: A strategy for implementing Vision for eHealth 2025 (2020). Available from: ehalsa2025.se</p> <p>E-hälsomyndigheten: Genomförandeplan 2020-2022 Bilaga till Strategidokument Vision e-hälsa 2025 Available from: ehalsa2025.se</p>

Figure 4: Front pages of the national e-health and healthcare policies to be analysed.



Methods

The policy analysis was carried out by means of document analysis^[20] using the NVIVO software tool^[21]. Statements in the policy documents were labelled according to whether they described today's situation within the field, challenges, opportunities, policy objectives, the intended policy outcomes and how the policies should be implemented. We also found statements that described how the policy was developed and how it should be monitored and managed once in the implementation phase. These statements were labelled accordingly.

Results

Scope and objectives of the policies

The scope of the policies from the five countries were largely centred around a) empowering and activating citizens; b) a shift towards prevention and digital first; c) supporting health operations; d) doing the groundwork; e) making health data more available in research and innovation workflows and f) supporting health personnel.

Empowering and activating citizens: All countries have established portals through which patients can view their own health records and carry out self-service tasks such as asking for prescription renewals and schedule appointments. Most countries envision an even more active patient role:

20. Prior L. Researching Documents. Emergent Methods. In: Hesse-Biber SN, Leavy P, editors. Handbook of Emergent Methods. Guilford Press; 2010. p. 111-26.

21. <https://lumivero.com/products/nvivo/>

"To support patients and their relatives in taking greater ownership of their own illness in their daily lives and enabling them to actively participate in their own treatment"
(Denmark).

"Self-management services will include clinical decision-making support for the use of citizens, risk tests, self-assessment methods as concerns the need for assistance required in referral to treatment, online health checks and reminder and calendar solutions to support self-management" (Finland)

Shifting towards prevention and digital first: Building on the assumption that digital health tools can make patients more empowered and activated, most countries envision the patient to do more when it comes to taking preventive measures and using the digital portal as the preferred gateway into the healthcare system. The emphasis on this was most prominent in the policies from Iceland and Finland, where a relatively large proportion of citizens live in rural areas. The Icelandic policy was perhaps the most crisp and clear:

"By 2030 citizens of Iceland in Iceland will be in a position to improve and maintain their own health through the use of digital solutions in a safe and integrated care environment" (Iceland)

The policy from Finland is also ambitious in this regard. They aim to transform their health system by means of digitisation:

"In all wellbeing services counties, digital channels are the primary choice whenever appropriate or for customers that are able to use digital services (Finland)

Supporting health operations: Health operations is about how to deliver high-quality care in a consistent, efficient manner. Health operations include capacity planning, workflow support (e.g. care coordination, digital care pathways, order sets, clinical decision-support, documentation support), quality and safety monitoring. Strengthening the digital support of health operations is an important objective of e-health policies in all countries. Both patient safety, quality of care and continuity of care are highlighted as they always have been. Increasingly, workflow management, digital care pathways, clinical decision-support and other means of distributing knowledge to point of care are being mentioned. Sweden shall have a "National knowledge-support". According to the Norwegian e-health policy.

"Health personnel shall have access to user-friendly digital tools that [...] provides good decision-support and support their workflows" (Norway)

Likewise, an entire section of the Danish policy is entitled "Knowledge on time". Decision support for patients in the portals such as support for citizens making preventive care decisions also relates to the empowering and activating citizens theme.

Doing the groundwork: All countries leverage achievements from the past while continuing to do work on digital infrastructures, standardisation, cybersecurity, other information security and legislation work.

Making health data more available in research and innovation workflows: By research and innovation workflows we mean activities that aim to develop new knowledge, medicinal products, medical devices or other health-related technologies. Such activities are motivated by unsolved problems in the healthcare value chain, and are informed by data from the domain and are carried out by public institutions as well as by privately owned companies.

The policy analysis revealed that all countries have become more aware of the potential value of their health data sets. The Danish policy simply states that:

“The digital development is supported by the world’s best health data for research and innovation i.e. through the “Vision for better use of health data” (Denmark)

Iceland states that:

“Databases and biobanks in the health services will be open to those with the requisite licences to carry out scientific work” (Iceland)

Whereas Norway wants more research as well as innovation and service development:

“ .. systematic cooperation between the [healthcare] sector, commercial Companies and research to exploit health data for service development, Innovation and development of commercial products.” (Norway)

Supporting health personnel: Healthcare institutions are obliged to keep a record of the care that their clinician employees provide. This has to do with the legal function of the health record: Health personnel have an individual responsibility for the care they provide, and the health record can be used to hold them accountable. At the same time, the health record system is a tool for its clinician users - it is a means to achieve clinical tasks. The health record system is also turning into a tool for the institution. It is used by non-clinician users to develop reimbursement claims and for the mandatory reporting for management and administrative purposes. Clinicians increasingly talk about the burden of documentation, and about the impact of documentation work on physician burnout.

The Finnish policy states that it wants to ease the workload of health personnel:

“The workload of healthcare and social welfare personnel has been eased by making better use of information and by introducing advanced technological solutions” (Finland)

This is also a focus in the Norwegian policies. Both countries also seem aware that health information systems have usability issues.

In sum, the e-health policies from the Nordic countries between 2018 and 2024 are **wider in scope** in that they now seek to engage, empower and activate the patient / citizen to take a greater responsibility for their health including preventive measures. The policies are also wider in scope in that they now encompass research and innovation workflows. There is greater concern of the impact of IT-systems on the work life of the health professionals. Work on regulations, information security, standardisation and cybersecurity are prioritized as before. All policies are **ambitious**, but the Finnish and Icelandic e-health policies more than the others as they put patient portals and other national e-health systems front and centre in their healthcare reforms. Compared to the policy analyses this research network has carried out before (e.g.^{[22], [23]}), we see a trend towards **increased accountability**. There is more transparency in how the policy documents were developed, which outcomes are to be achieved and how this is to be evaluated.

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22. Hyppönen H, Faxvaag A, Gilstad H, Audur Hardardottir G, Jerlvall L, Kangas M, et al. Nordic eHealth Indicators: Organisation of research, first results and the plan for the future (2013) [Internet]. Nordic Council of Ministers; 2013 [cited 2023 Aug 17]. Available from: <https://urn.kb.se/resolve?urn=urn:nbn:se:norden:org:diva-675>
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Hyppönen H, Koch S, Faxvaag A, Gilstad H, Nohr C, Hardardottir GA, et al. Nordic eHealth benchmarking: From piloting towards established practice (2017) [Internet]. Nordisk Ministerråd; 2017 [cited 2023 Aug 17]. Available from:

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Prior L. Researching Documents. Emergent Methods. In: Hesse-Biber SN, Leavy P, editors. Handbook of Emergent Methods. Guilford Press; 2010. p. 111–26.

Analysis of the 2021 NCM action plan

The Nordic Council of Ministers (NCM) have published an updated action plan: “The Nordic Region – towards Being the Most Sustainable and Integrated Region in the World”^[24]. The document describes 12 objectives. These are linked to three strategic areas:

- A green Nordic Region
- A competitive Nordic Region
- A socially sustainable Nordic Region.

Here follows an analysis of the NCM Action plan from a healthcare and health policy making perspective:

A green Nordic Region

The action plan states that the NCM will “work to make the Nordic Region a leader in circular, climate-neutral, and sustainable business models for the business sector” (Objective 3). This could relate to healthcare in that institutions will have to incorporate sustainable business models due the need to interact and collaborate with the private sector and developing secure and state of the art technology to advance service and knowledge in healthcare.

The action plan on a green Nordic Region also states that the Nordic Council of Ministers will “make it much easier and more attractive for Nordic consumers to prioritise healthy and environmentally and climate-friendly choices”. This relates to healthcare in the Nordic countries in that a patient-centred digital interface to the healthcare systems will reduce the number of time-consuming, costly and climate-unfriendly travels to hospitals and other healthcare centres. Making it easier and

24. The Nordic Region – towards Being the Most Sustainable and Integrated Region in the World: Action Plan for 2021 to 2024, 2020. <http://urn.kb.se/resolve?urn=urn:nbn:se:norden.org:diva-7139>.

more attractive to prioritise healthy choices (a healthy food consumption is also a sustainable food consumption). (Objective 4) can also be seen as a means to prevent the development of disease in the population.

A competitive Nordic Region

The action plan for a competitive Nordic Region relates to healthcare in that healthcare works in symbiosis with the institutions that provide the knowledges tools and competences that are needed. The mandate of any healthcare system is to take care of health problems. As was demonstrated during Covid, a sustainable healthcare ecosystem is also good at utilising health problems for R&D and education. A Nordic Region that excels at creating structures that foster cross-country collaborations in Life sciences R&D, pre- and post-graduate education will develop a more prosperous bioeconomy and a healthcare workforce that is more receptive to change. Competition can be strengthened and citizens in the Nordic countries will get access to more knowledge- and competence-based healthcare services by helping to a) build up shared knowledge and research in the health domain, b) equip Nordic health technology companies so that they can utilise data and digital technology for innovation and smart solutions and c) make it possible to share health data between the Nordic countries quickly and securely.

A Nordic region that helps to give everyone the opportunity to learn and develop throughout life (objective 7) will contribute to a more resilient healthcare workforce. Objective 8 (leverage digitalisation and education to bind the Nordic countries even closer together) could motivate a Nordic educational programme for advanced digital skills in the healthcare sector.

A socially sustainable Nordic Region

The action plan on a socially sustainable Nordic Region states that NCM will contribute to good, equal, and secure health and welfare for all (objective 9). This part of the action plan should motivate the further development of digital health services across borders. Given the overall concern of equality, efforts to minimise the impact of vulnerability ('vulnerable children, young people and adults') and geography ('sparsely populated areas') could translate into a further broadening of the spectrum of services that are provided through a digital interface. As the set of vulnerable citizens overlaps with those on the wrong side of the digital divide^[25], care must be taken to use knowledge on vulnerability, health and digital illiteracy to personalise the services that are offered. Portals that citizens increasingly use to

25. Statistics Norway: Digital divide: Who are at risk of being excluded (In Norwegian, English summary available on page 5) <https://www.digdir.no/rikets-digiale-tilstand/digitalt-utenforskap/3568>

interact with their healthcare providers can also be used to stratify the population and direct preventive healthcare measures to those at a larger risk.

The emphasis on 'further developing Nordic co-operation on health to ensure better health for all' and 'the exchange of Nordic knowledge, research and innovation' (objective 9) could also motivate a research and service improvement agenda for patients with rare diseases and others that are left in poor health simply out of lack of relevant knowledge.

That the NCM will work to improve healthcare preparedness illustrates the need to go beyond the structures that are needed for epidemiologic surveillance and capacity for instantaneous, problem-driven development of new knowledges and vaccines. Supply chain security and logistics of food and medicine are also important parts of a secure health and welfare system. The action plan on strengthening and expansion 'of Nordic leadership in relation to trust and responsibility in the digitalisation of societal functions' (objective 10) should further motivate the development of shared structures (e.g. a Nordic health data space) and service interfaces that would enhance the ability of health systems to learn (e.g. services that enables patients to provide data on the outcome of healthcare services). Finally, 'NCM will maintain trust and cohesion in the Nordic Region' (objective 12) could relate to healthcare in that 'a study that will help to increase legal security for individual residents and public authorities in the digitalisation of the public sector' could be carried out in the Nordic healthcare sectors.



Photos: iStock

Areas for indicator development

Introduction

In the previous chapters, we have argued that the value of e-health systems extends far beyond its value for clinician end-users providing care. In the first chapter, we introduced the concept of healthcare systems, health ecosystems and value creation and that a health ecosystem has at least three value chains that are intertwined with each other. Compared to previous analyses, the analysis that we present in [chapter 2](#) of this report, we show that policy makers now place a greater emphasis on leveraging the value of healthcare data in research and innovation workflows. This means that research and innovation must be an area for indicator development. The current policies are also shaped by a concern for usability, documentation burden and (implicit) the well-being of healthcare professionals. This concern ultimately relates to professional development, how to build and maintain the competences that are needed and therefore to the education and training value chain.

In this chapter we also present the indicator development areas that were mentioned in the Finnish "Strategy for digitalisation and information management in healthcare and social welfare (2024)" before we outline our suggestion for indicator development areas to cover the scopes of the Nordic e-health policies between 2018 and 2024.

Areas for indicator development mentioned in the national policies

One of the national policies stood out when it comes to describing areas for indicator development to monitor the progress of the implementation of the policy. Table 4 enlists the indicator areas from the Finnish "Strategy for digitisation and information management" and how these relate to the scope of the national policies described in [chapter 2](#).

Table 4. Indicator development areas mentioned in the Finnish Strategy for digitisation and information management.

Area in the Finnish strategy document	Relation to scope in the Nordic e-health policies
Digital health and social services centre and customer and service counselling	Relates to Shifting towards prevention and digital first
From digitalisation of information to digital operating models	Relates to Supporting health operations
Giving customers access to their own data	Relates to Empowering and activating citizens
Customer participation in services	Relates to Empowering and activating citizens
Digital wellbeing operating models and service task	Relates to Empowering and activating citizens
Ensuring data quality	Relates to Supporting health operations and Making health data more available in research and innovation workflows
Interoperability policies and selection of data models	Relates to Doing the groundwork
Evaluating and updating the Kanta information system services	Relates to Supporting health operations
Strengthening the benefits of Kanta data	Relates to Supporting health operations
National and regional steering and management of the service system by developing secondary use of health and social services data	Relates to Supporting health operations and Making health data more available in research and innovation workflows
Use of information in research, development and innovation activities	Relates to Making health data more available in research and innovation workflows
Developing a management and steering model for digitalisation and information management	Not relevant outside Finland
Digital security	Relates to Doing the groundwork

Areas of indicator development to cover the scope of the national e-health policies

By and large, the scope of the policies from the five countries are centred around a) empowering and activating citizens; b) a shift towards prevention and digital first; c) supporting health operations; d) doing the groundwork; e) making health data more available in research and innovation workflows and f) supporting health personnel. Table 5 presents the suggested areas for indicator development and how these relate to the scope of the national policies and to the value chains.

Table 5. Areas for indicator development.

Area for indicator development	Value chain		
	Health-care	Education and training	Research and innovation
Scope: Empowering an activating citizens			
Patients scheduling and rescheduling of appointments for consultations	x		
Patients bringing self-measurements to the consultation	x		
Patients' collection and use of digital health data	x		x
Patients' belief in own ability to access, understand and make use of digital health data	x		
Patients bringing knowledge and reasoning services to the consultation room	x		
Patients access to decision support tools including tools for shared decision making	x		
Patients' interaction with digital care pathways in which they are enrolled and are to benefit from	x		
Patients' discovery, inquiry and engagement in clinical trials	x		x
Patients' attitudes towards the digital healthcare system			
Scope: A shift towards prevention and digital first			
Citizens and patients use of knowledge sources that are curated and published by health authorities and made available in patient portals	x		
Synchronous and asynchronous digital consultations	x	(x)	
Next generation digital consultation tools	x		x
Building down the barriers between health information silos that are constrained by geography or by healthcare subsector (for primary use)			
Provision of relevant knowledge at Point of care. Knowledge-support Clinical decision support	x	x	
Helping health professionals gain an overview of the situation of the patient	x	x	
Availability and use of order sets	x		
Repertoire of digital care pathways that are available to clinicians and their value as tools to improve quality, completeness and continuity of care	x		
Documentation support	x	x	

Outcome assessment	x	x	x
Supporting for interprofessional collaboration	x	x	
Support for quality and safety monitoring of healthcare performance (including cohort-specific aggregation of healthcare data on national, Nordic and European levels).	x		x
Unresolved health problem to research workflows (e.g. discovery, inclusion into and conductance of clinical trials in oncology)	X		x
Scope: Doing the groundwork			
Development, maintenance and expansion of IT-infrastructure and information infrastructure that is specific to the health domain.	x	x	x
Development and implementation of service models that reimburse digitized care	x		
Standardisation work	x	x	
Work on legislation (e.g. to allow for secondary use of health data)	x	x	
Improving procurement practices	x		
Information security, cybersecurity.	x	x	x
Scope: Making health data more available in research and innovation workflows			
Increasing availability and quality of data (e.g. structured documentation, use of terminology systems)	x	x	x
Data to knowledge workflows, e.g. Number of ethically approved biomedical research projects that utilize data that originates from healthcare or self-care.	x		x
Knowledge to innovation workflows (e.g. multicenter international clinical trials of medicinal products or medical devices).	x		x
Siloed health data to aggregated health data workflows (nationally and internationally) e.g. Nordic or European research registries dedicated to a particular patient cohort such as long Covid, patients with rare diseases.	x		x
Scope: Supporting health personnel			
Implementing Healthcare information systems that are easy to learn, easy to memorize and that does not require the development of workarounds	x	x	
The governing of knowledge content in Clinical decision-support systems to optimize the relevance of CDS and minimize alert fatigue	x	x	
IT support for representing the state of the patient and the care that was provided to ease the documentation burden for health personnel.	x	x	
Sufficient and competent IT-support for healthcare personnel	x	x	

Refine existing and optionally develop new indicators, conclusion and future work

The existing indicators

Asking users (e.g. personnel at health institutions and citizens / patients) is a well-established means of assessing the value of e-health / digital health systems. The National Usability-Focused HIS-Scale (NuHISS) questionnaire was developed in Finland^[26]. Hannele Hyppönen, the first author in the publication describing NuHISS is the founding mother of NeRN. NuHISS has been translated to many languages and used to assess the outcome of EHR procurement and implementation processes as well as to assess the value of EHRs from the perspective of health professional societies. The Finnish representatives in NeRN rank among the most prominent experts in using this questionnaire.

There is no reason to move away from using NuHISS in the forthcoming monitoring activities. We must however consider the possibility to develop indicators that can be collected by tapping into the information systems themselves. Also, indicators suggested in the national policies must be taken into account. Finally, as the rest of Europe aspires to take down barriers that prevent citizens from obtaining healthcare services from any European country and, at the same time, enable biomedical research and innovation by improving access to health and healthcare data, we must also consider the indicators that are suggested as part of EHDS initiatives.

26. Hyppönen H, Kaipio J, Heponiemi T, Lääveri T, Aalto AM, Vänskä J, et al. Developing the National Usability-Focused Health Information System Scale for Physicians: Validation Study. *J Med Internet Res*. 2019;21(5):e12875.

Indicators suggested in the national policy documents

The Strategy for digitisation and information management from Finland describes indicators for the following areas: h) Evaluating and updating the Kanta information system services, i) Strengthening the benefits of Kanta data, j) National and regional steering and management of the service system by developing secondary use of health and social services data, k) Use of information in research, development and innovation activities, l) Developing a management and steering model for digitalisation and information management, j) Digital security.

Area	Indicator constructs and method of collection
Digital health and social services centre and customer and service counselling	Percentage of digital service use, usage of the digital health and social services centre, customer feedback, percentage of customers for whom a service needs assessment has been made
From digitalisation of information to digital operating models	Job satisfaction, customer satisfaction, number of automated processes
Giving customers access to their own data	Use of wellbeing data in service processes, customer satisfaction
Customer participation in services	Customer satisfaction, number of digitally performed tasks, application usage and usability
Digital wellbeing operating models and service task	Healthcare measures (Avohilmo), number of people doing physical activity, etc. (Healthy Finland)
Ensuring data quality	Data quality monitoring indicators
Interoperability policies and selection of data models	Number of solutions using international/eU standards and interoperable data structures
Evaluating and updating the Kanta information system services	Purchasing the light user interface, number of users, satisfaction of users, percentage of information transferred on the basis of data
Strengthening the benefits of Kanta data	Kanta data transfer volumes, customer satisfaction, analysed register data, etc.
National and regional steering and management of the service system by developing secondary use of health and social services data	Realisation of information base development needs, timeliness and level of automation in information production, customer satisfaction
Use of information in research, development and innovation activities	Development of research and innovation activities, number of data permits, customer satisfaction, process turn-around time (Findata)
Developing a management and steering model for digitalisation and information management	Model and new steering structures in use, utilisation of the results of the evaluation of the benefits generated by development projects
Digital security	No separate indicators.

e-health relevant indicators in supranational policies

In the EHDS legislative framework^[27], we find the following suggestions for indicators:

Areas (abbreviated)	Indicators of performance
Citizens control over and use of their own data (Objective nr 1).	Number of healthcare providers of different types connected to MyHealth@EU calculated a) in absolute terms, b) as share of all healthcare providers and c) as share of natural persons that can use the services provided in MyHealth@EU.
	Volume of personal electronic health data of different categories shared across borders through MyHealth@EU.
	Percentage of natural persons having access to their electronic health records.
	Level of natural persons satisfaction with MyHealth@EU services.
Suppliers and manufacturers of EHR systems will relate to one set of requirements on interoperability and security (Objective nr 2).	Number of certified EHR systems and labelled wellness applications enrolled in the EU database.
	Number of non-compliance cases with the mandatory requirements.
Natural persons should benefit from a wealth of innovative health products and services that are provided and developed based on health data primary and secondary use, while preserving trust and security (Objective nr 3).	Number of datasets published in the European data catalogue.
The primary and secondary use of health data by researchers, innovators, policymakers and regulators (Objective nr 3).	Number of data access requests, disaggregated in national and multi-country requests, processed, accepted or rejected by health data access bodies.

27. The EHDS regulative Section 1.4.4. Indicators of performance. Available at eur-lex.europa.eu.

Conclusion

This chapter ends the report from NeRN for the current mandate period. If we are allowed to continue this work, we will proceed with refining existing and suggesting a bundle of new indicators for testing at the national level in the Nordic countries. By then, the Nordic countries should be equipped with a monitoring tool that both reflects the achievements of the past as well as taking into account the new, emergent and potentially disruptive technologies that soon will pervade all healthcare systems and health ecosystems.

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Nordic co-operation

Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland and Åland.

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