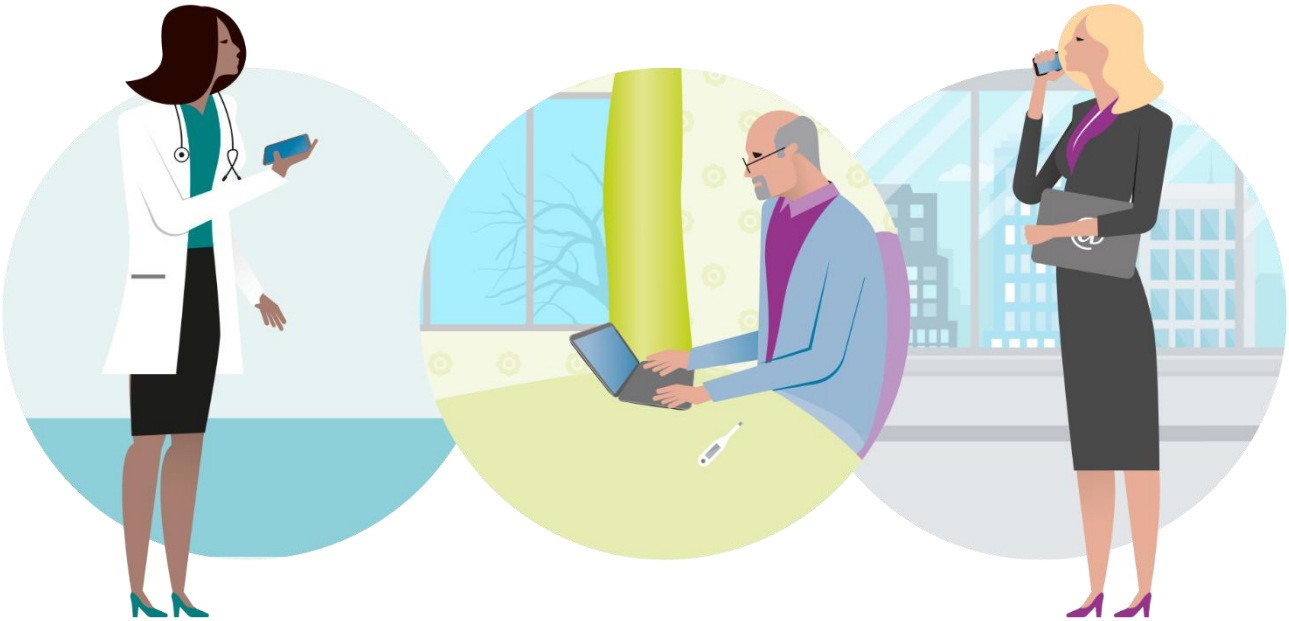
DIGITAL HEALTH VILLAGE

Scaling up digitalisation



HUS Helsinki University Hospital

Most healthcare digitalization initiatives are targeted to a specific clinical domain or group of patients, which makes the solutions difficult to scale. While a lot of clinical care is patient group specific, it is often overlooked that most of the clinical work has a similar service architecture. Helsinki University Hospital (HUS) has analysed its patient and clinician workflows and found out that most of them occur within a very similar service architecture across all patient groups. Based on the analysis, the Health Village concept builds on the commonalities in patient services.

Health Village is a digital service platform developed together with patients, healthcare professionals and patient organizations. It delivers public health services accessible for general public, digital care pathways for patients with specific diagnoses, digital guides and online training courses in eExpertise for professionals to improve working practices. Data that accumulates through Health Village, is a goldmine for research, development and quality improvement activities.

Health Village has scaled nationally in Finland. Within 4 years, it has expanded from three hubs to 32 hubs and from four digital care pathways to over 100 digital care pathways. The development of the Health Village concept accelerated in one of the key projects of Finnish government, in the Virtual Hospital 2.0 project (2016–2018). The project received funding from the Ministry of Social Affairs and Health and it was organized in collaboration with the university hospitals of Helsinki, Kuopio, Turku, Tampere and Oulu.

What are eHealth Services?

eServices are events in digital channels for collecting information and feedback between the customer and the service provider. eHealth Services represent an evidence-based healthcare service delivered via digital channels and with the aid of technology. Those comprise a multi-channel service path or a care programme delivered entirely online. They are provided alongside traditional personal visits to clinics and examinations. Technology can be used to provide healthcare expertise (e.g. chat, video appointment), or it can do some of the work that requires this kind of expertise (e.g. symptom assessment, chatbots, algorithms, support for decision-making).

Why to develop eHealth Services?

Traditional doctor centered healthcare system is slow and passive process for patients. There are lots of waiting before getting help and people who live far away from the hospital are in an unequal position. What if more patients could be treated with better quality in the same amount of resources?

Healing people has many phases and most of it is routine work. Figuring out symptoms, running tests, writing reports and repeating the same information to all patients. When patients take a more active role in their own healing process, healthcare providers have more time to focus on the most essential tasks in care. However, typical challenges related to digitalization of health care services are increasing costs and costly pilots, without guaranteed possibilities to scale them in production.

Traditional healthcare services are changing from the patient's perspective: independent data retrieval, management of personal data, self-care and undertaking self-monitoring measurements are all getting easier. The digital services allow patients to receive more psychological and holistic support to live with their illness or for rehabilitation than it is possible with traditional care paths. Professionals receive support for their decision-making when the patient produces information based on self-monitoring and symptom assessments. Digital services can help to improve the production efficiency of specialised medical care services and respond to new needs to boost quality and effectiveness from the perspective of both the patient and the professional.

What if more patients could be treated with better quality in the same amount of resources?

Challenge to implement secure, high-quality and cost-effective digital healthcare services in large scale

Health care organizations face the pressure to develop and implement digital services. The services are required to guarantee the patient security, quality of care and accessibility, as well as fulfill the requirements related to the cost-effectiveness.

Most of the existing digitalization initiatives focus on advanced patient care targeted to specific patient groups. By focusing only on a specific patient group, the potential to scale-up the services for various use cases disappears. Poor scalability leads to the situation that each digital service development project needs to be considered independently requiring more money, time and resources. In the long run, the independent projects leads to the decentralized management of the digital services and create a need for various support systems that increase the cost of the services.

Health Village concept builds on the commonalities of patient processes instead of focusing on single patient group

Helsinki University Hospital has analyzed its patient and clinician workflows and found out that most of them are very similar across all patient groups. Based on the workflow analysis, the Health Village concept builds on the commonalities of patient processes instead of focusing on single patient group. Therefore, the concept allows for the fast digitalization of ready-made and tested concept services for any patient group, for any sector or country. Naturally, process efficiency can be improved as well by following the principles of the concept. Within 4 years, Health Village has scaled nationally in Finland. It has expanded from three hubs to 32 hubs and from four digital care pathways to over 100 digital care pathways.

What is Health Village?

Health Village is a digital service platform for health care developed together with patients and healthcare professionals. Services of Health Village are built on top of the ICT-platform which consists of cloud-based IT services. The services delivered using the ICT-platform have been designed according to the eHealth Development Program (eHDP).

All the Health Village services are designed to support the traditional care path with digital services. Health Village delivers three distinct services: 1) public health services for general public, 2) digital care pathways for patients with specific diagnoses and care relationships, and 3) electronic coaching services for healthcare professionals to improve their eKnowledge. Furthermore, researchers have the possibility to recruit research subjects directly from the care pathways. In order to support research, the Health Village data is also transferred into a data lake where it can be combined with EHR data, lab results and medical imagery.

Existing Health Village services

Health Village virtual Hubs

Virtual Hubs are vast libraries of healthcare related information and service guidance. The information is written by healthcare professionals and peer reviewed by patient associations, peer support persons and experts by experience. As opposed to many similar web sites, the information

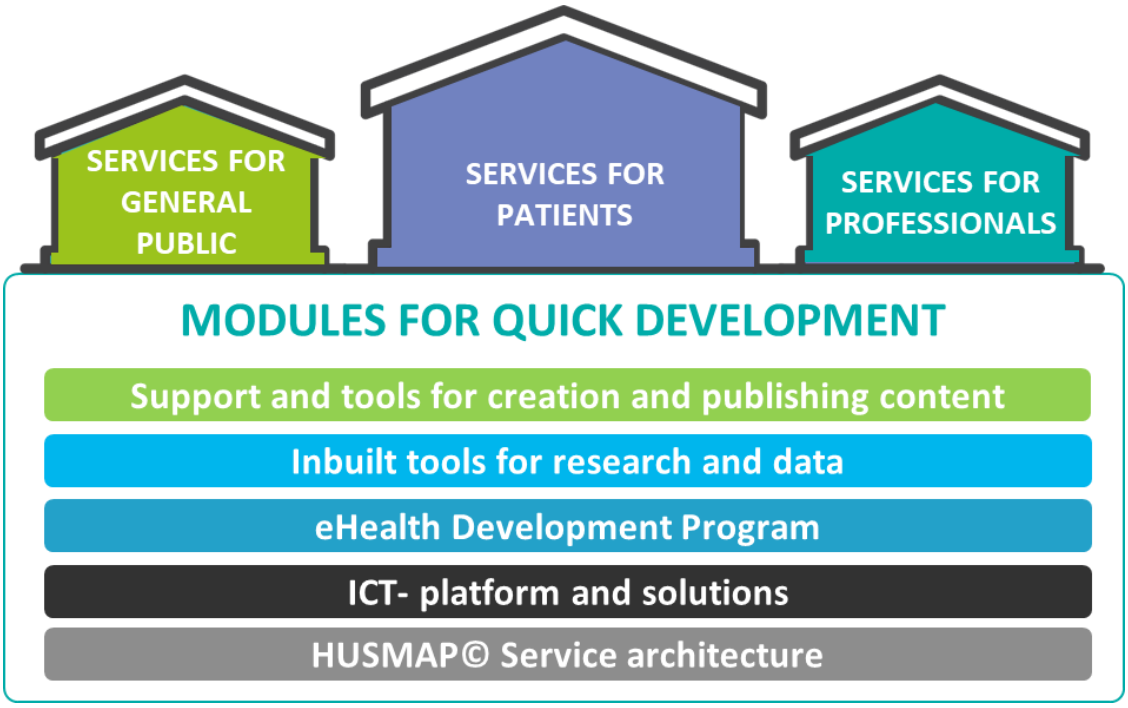


Figure 1 *Structure of the Health Village concept*

is written for general public avoiding medical terminology.

The services in virtual HUB's are anonymous and include for example chatbots, triage for acute care, acute care queue status and service directories. The diagnose specific information services are created together by the participating hospital districts, but the more advanced services are Finland and hospital district specific and need to be created for each participating hospital district.

My Path and Digital Care Pathways

The Health Village's My Path service channel allows customers to interact online with a treatment facility and provides support for self-care. Self-care may be linked to self-care programmes or digital care pathways for specific patient groups. The digital care pathway requires a doctor's referral or a health care relationship. Part of the self-care programme is open to all, while some are designed solely for patients receiving care.

Digital care pathways or self-care programmes using identifiers, allow patients to prepare themselves for procedures, recover afterwards, receive remote services on the chronic illness path, and receive the service entirely online with the aid of therapy and rehabilitation programmes. The My Path and Digital Care Pathway applications consist of:

- the generic stalk for digital care pathway
- generic, continuously developing elements
- standard interfaces for integrations
- patient, professional, content producer and researcher interfaces and knowledge leadership analytics tools.

Health Village PRO

Health Village PRO is a service designed for professionals in the social welfare and healthcare sectors. It supplements the eExpertise of social welfare and healthcare professionals and encourage them to see through to the end of operational changes associated with digital services. Furthermore, it prompts healthcare professionals to

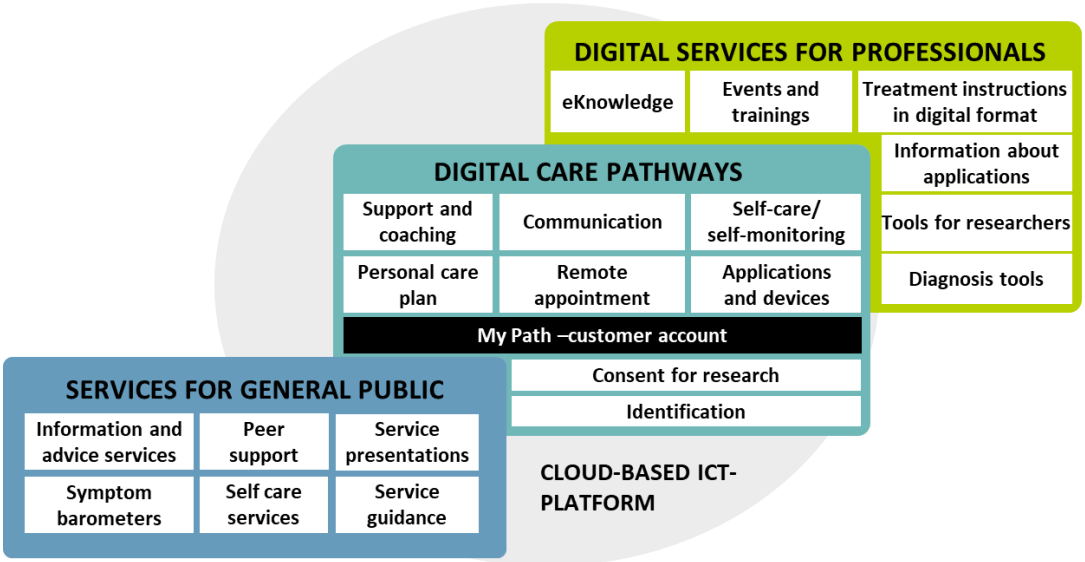


Figure 2 *Services of Health Village provided in Finland*

adopt new approaches at work. The service consists of virtual hubs, online training courses and digital service tools, support for operational and functional change, guides for individual specialisations and an expert search tool.

What is eHealth Development Program (eHDP)?

The development of the Health Village services is based on eHealth Development program (eHDP). Based on the experience of Helsinki University Hospital it is considered that the renewal in health care organization is possible to create with the support of management during the innovation process, re-design of service architecture, re-design of processes and engagement of patients and health care professionals. eHealth Development program support the realization of these crucial success factors.

eHDP provides process and methods for innovating, planning, producing, implementing and scaling the eHealth services. Each of the process phase is supported by design methods and tools. For succeeding in the implementation of the process, program offers support through consulting, workshops, coaching, trainings and guidebooks. At the heart of the program is the key ideology of the concept: Health Village supports an operational change in the health sector instead of just digitalizing old services or providing new services within the old service framework. The digital services supplement traditional care pathways and processes, and they need to be seamlessly integrated into the existing and developing service system. The integration of traditional and digital care pathways requires new approaches to working practices, management, expertise and processes.

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The Health Village ICT environment

Technical architecture of Health Village is modular with scalable and safe shared platform and many ready-made components for development, documentation, fast results, maintenance and version management.

The key technology components are Azure cloud services and Microsoft Dynamics 365. The usual

drivers for adopting cloud services, such as scalability and rapid development, are valid also in health care and Health Village. Concerns related to data privacy have been tackled by utilising service models that support hardened security, a thorough security audit and continuous vulnerability scanning.

The services are built using cloud-based IT solutions, apps and devices. For the most part they are not healthcare specific such as messaging, calendar, form building, workflow management, publishing, remote meetings and chatbots. An authoring tool is used to combine the building blocks into meaningful care paths.

The set of general services have been complemented with healthcare specific components. The first to come were symptom navigators, symptom diaries, eTriage, and wellness data integration. Currently a deployment platform for AI based prediction models is being added to the toolbox.

Health Village and eHealth services are not isolated from the more traditional care pathways. Hence it is important that the clinical data created in Health Village is relayed to the EMR systems and vice versa. The selected solution is to use an integration platform that supports international message standards like FHIR and various versions of HL7. Use of an integration platform isolates the application from the multitude of interfaces that external systems may use. As a rule, only standard message formats are supported.

Using standard interfaces, it is a simple matter to add new data sources to the core services. However, integration of 3rd party extensions like mobile care paths is not as straight forward. The problem lies within the fact that the apps are typically designed as stand-alone applications. In order to be compatible with the clinician defined workflows, the apps often need to be tweaked. One approach is to integrate only data.

How to deploy Health Village?

ICT platform is available for use as an Azure resource in the cloud. For customers who are cloud-averse the platform can be installed as an on-premise solution using the commercially available Azure stack.

Health Village relies on local services for Citizen authentication and the integration must be implemented for each country. In case no such service exists an active directory with strong authentication can be set up.

The professionals (content creators, care teams) will be logged into the system using federation techniques. The exact solution depends on the in-house authentication system.

An important part of Health Village is the eHealth development program. In the beginning HUS specialists will help in setting up the development. However, for long term success, it will require that either the hospital or a local consultant organization is trained to support further dissemination.

Future of Health Village

According to the Health Village vision for 2021, Health Village will provide a revolutionary care experience and revolutionise communication between health professionals and patients, indepedent acquisition of data, remote care, and the peer support for relatives. Patients will have the feeling that they are not alone with their symptoms and are receiving the best possible care for their situation at the time. The development toward the vision continues in the Health Village Development Project during 2020-2023 that targets to:

- Create a line of production and deployment of services that utilize artificial intelligence, machine learning, and data analytics.
- Create production process for components for digital care pathways as medical devices (ISO13485).

- Develop digital care pathways in direction of intelligent services that anticipate the patient's need for service.
- Integrate intelligent applications and new components into digital care pathways for different patient groups.
- Develop virtual assistants, symptom reviews, chat bots, speech, image and OCR services, and service components that personalize the service as a part of digital care pathways.

Global potential

Health Village offers a complete concept for fast and extensive digitization of operations. The service is globally scalable and can be tailored to the needs of patients and professionals in accordance with local care practices.

Helsinki University Hospital is looking for partner companies to take advantage of the Health Village concept around the world. Through Health Village, partners will be able to engage in revolutionary healthcare and digital service reform. A partner company is given the opportunity to develop itself as a global forerunner of digital health services and to build a global network with healthcare providers.

The experts of Helsinki University Hospital are sharing their experience as developers and users of the Health Village services as well as sharing the information related to the created impact.

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