We are getting there – Virtual Hospital 2.0 project summary

COVER SHEET

The Virtual Hospital 2.0 key project, which was realised in cooperation between Finland's university hospital districts, has achieved its goals. The project received support from the Ministry of Social Affairs and Health, and was one of the key projects of Finnish Prime Minister Juha Sipilä's Government in the period 2016–2018. Professor Kaija Saranto, chair of the project evaluation group, said that the project showed that we were all getting there.

The planning and introduction of eHealth Services requires a fundamental change to the way we do things. It was not so much an ICT project as one to reform and modernise services. The planning of digital services prompted professionals in the social welfare and healthcare sectors to rethink the needs of patients, service paths, work processes and approaches.

There is a demand for change: healthcare should be able to use its current resources to provide services in a way that is efficient for an ever-ageing population over the coming decades. Digital services give patients a better chance of obtaining care at the right time and provide better opportunities for effective and safe self-care and remote monitoring. Digital services are expected to replace telephone calls and letters from healthcare staff and repeat visits, for example, when chronic illness is being managed effectively. It is thought that the changes that are taking place in specialist medical care by means of digital services will free up capacity worth around EUR 1.3 billion cumulatively at a national level over the next five years.

Involvement

- Patients and patient organisations were involved in the planning of the eHealth Services. Experts by experience and specialist physicians sat around the same table and patients were listened to.

- A replicable and standardised eHealth Service development and evaluation model was created.

- Everyone would have access to the Health Village service, which would contain reliable information, self-care programmes, service guidance and relevant guides in 31 separate virtual houses, meeting the needs of 90 different illness/patient groups.

- *A My Path and Digital Care Path* app was produced, which the service providers could use with the aid of generic modules, to produce eHealth Services for each patient group in a cost-effective way. A total of 91 Digital Care Paths for different patient groups receiving specialist medical care were built.

- A Health Village PRO service was established for professionals in the social welfare and health care sectors. It contains virtual centres, online training courses in eExpertise and digital guides.

- A new kind of multidisciplinary network of cooperation was created for the hospital environment, which is frequently seen as being hierarchical in nature. The multi-professional partnership consisted of 1,400 professionals, including specialist physicians, nutritional therapists, nurses and chief administrative medical officers.

- A total of 1,758 professionals took part in training courses in eHealth Services development.

- Specialist medical care skills were shared digitally with the public, patients and their close relatives and healthcare professionals, and for primary healthcare patient guidance.

- The Virtual Hospital 1.0 ICT environment and its apps are scalable that makes them usable by healthcare and social service providers and that are based on the national service architecture. The solution is independent of sector of industry and is open to both private businesses and public entities.

Further information:
www.virtuaalisairaala2.0.fi
www.terveyskylä.fi

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RESULTS

The project in figures

The Health Village brand saw its value rise to €55.4 million in just three years. There are on average 300,000 visitors to the Health Village that come via the open path each month. Visitors to the 31 virtual houses in the Health Village were up by 100% from 2017 to 2018. During the period from 1 January to 20 December 2018, there were 3.4 million visits to the Health Village and the Mental Hub, with roughly two million visitors and around 16 million page views.

At the end of October 2018, the Health Village had 91 digital care paths or self-care programmes for separate patient groups, of which approximately 25 were released for broad use by the patient group in question. Other paths are at the pilot stage. By December 2018 more than 9,000 patients and over 1,000 professionals had logged in to paths. In Uusimaa a total of 89% of the target group had logged in to the pregnancy path.

Health Village PRO, the new portal for the service for professionals, was opened in October 2018, with 33 digital guides or training courses being published. In 2018 around 30,000 professionals visited the service every month.

Altogether, 318 experts have worked on the project, and 1,250 specialists in their field have produced content for the digital services or participated in project working groups as part of their own independent work. A total of 1,758 professionals took training sessions in the planning of eHealth Services during the project period.

Figure 1. The Virtual Hospital 2.0 project in figures.

A joint project of the university hospitals

In summer 2015 the Finnish Government announced the 'Digitalisoidaan julkiset palvelut' (Digitalising Public Services) key project, and Helsinki University Hospital (HUS) submitted an application for a Virtual Hospital 1.0 project. The Finnish Ministry of Finance wanted all the university hospital districts to be involved. As a result, in autumn 2015 a joint Virtual Hospital 2.0 project was planned in collaboration with the university hospital districts of Helsinki and Uusimaa, Pirkanmaa, Northern Ostrobothnia, Northern Savo and Southwest Finland. A funding decision for 50% of the €12 million project was received from the Ministry of Social Affairs and Health in September 2016. The project ended on 31 October 2018.

The university hospitals are specialist medical care and eExpertise centres, and their task is the continuous development of mainly evidence-based digital services, along with the medical and other therapeutic expertise required for them. Experts and specialists at the university hospitals are responsible for the cycle of continuous development of effective eServices in artificial intelligence, eResearch and information analytics.

Figure 2. In all, 61% of Finns are covered by the areas of special responsibility of the university hospital districts, which are responsible for specialised medical care and especially demanding care and treatment.

The project's goals were achieved

The project's development network, along with the resulting outcomes and services that were scaled up to national level in practice, emerged over a two-year period.

The Virtual Hospital 2.0 project relies on the eHealth Services development network of the university hospital districts, which supports the operational changes required for the digitalisation of service chains, the

development of operating models, and the production of content in different fields of specialised medical care, with the aid of training programmes and a standardised development model.

The project progressed well across a range of disciplines. Nearly all the set goals were achieved according to the project actors and external evaluation experts. The most successful aspects of the project were the volume and scope of service production and the multi-professional partnership that existed between experts in specialist fields and the university hospital districts.

The Virtual Hospital 2.0 project progressed towards the following goals:

1. Cutting-edge health services have been created for the public, customers and professionals. These are planned and produced specifically with the customer and user in mind.

2. Multi-channel digital health services help the customer or patient find help at the right time when they have a health-related problem, either in person at a healthcare clinic, remotely at home, or by using a digital service independently. Digital services can help supplement existing services provided in person. They can also create entirely new services through increased use of multi-channel electronic interaction and by encouraging the multi-service–provider approach.

3. Specialised medical care can be provided quickly and regardless of distance, and straight to the customer's home, if required. Multi-channel services serve to integrate approaches and ways of working nationwide.

4. eHealth Services enable service and care chains to merge in a new way in different specialised fields and in primary and specialised medical care service networks. This is also possible at the renewal stages of cooperation between those working in social welfare and healthcare and of social welfare and healthcare service structures.

5. The new eHealth Services increase customer satisfaction and the impact of the service package offered to the patient or customer while also continually gathering data for service development.

6. Digital and multi-channel services provide effective, competitive and high-quality care. The eHealth Services increase efficiency by diversifying and rationalising the distribution and production of services. Once established, they become the sources of funding for further development.

7. Digital services integrated with care paths enhance the efficiency of care and the prevention of disease, allow customer access to care at the right time, reduce the number of outpatient visits and make for a more efficient use of working time. eHealth Services mean HR resources can be allocated to more demanding service arrangements, where patient guidance and care rely on a more diverse range of professional skills than before.

8. The services are constantly improving. The use and impact of services is to be monitored by means of modern big data analytics methodology, and service paths and structures will be changed and developed continuously, depending on customer behaviour and service impact.

9. The benefit that derives from the eHealth Services will affect customers, the state and local authorities in terms of the figures for public health and finance, the organisation of healthcare, service providers, healthcare processes, professionals, patients and customers, their relatives and their workplaces.

10. Digital health services now offer the possibility of a choice of services, regardless of time or place, for the public, professionals and entrepreneurs. The continuously developing services and innovation farm operations offer private service providers and start-up companies a service innovation development platform, a network of cooperation between experts and universities, and more work for small businesses.

eServices are events in digital channels for collecting service guidance, the assignment of resources, the transmission of messages and alerts, and information and feedback between the customer and the service provider. These events are not linked to any work or skills input on the part of a healthcare professional.

eHealth Services represent an evidence-based healthcare service delivered via digital channels and with the aid of technology, which is linked to work or skills input on the part of a healthcare professional. eServices comprise a multi-channel service path or a care programme delivered entirely online. They are provided alongside traditional personal visits to clinics, examinations, procedures and dealing with adverse events. 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).
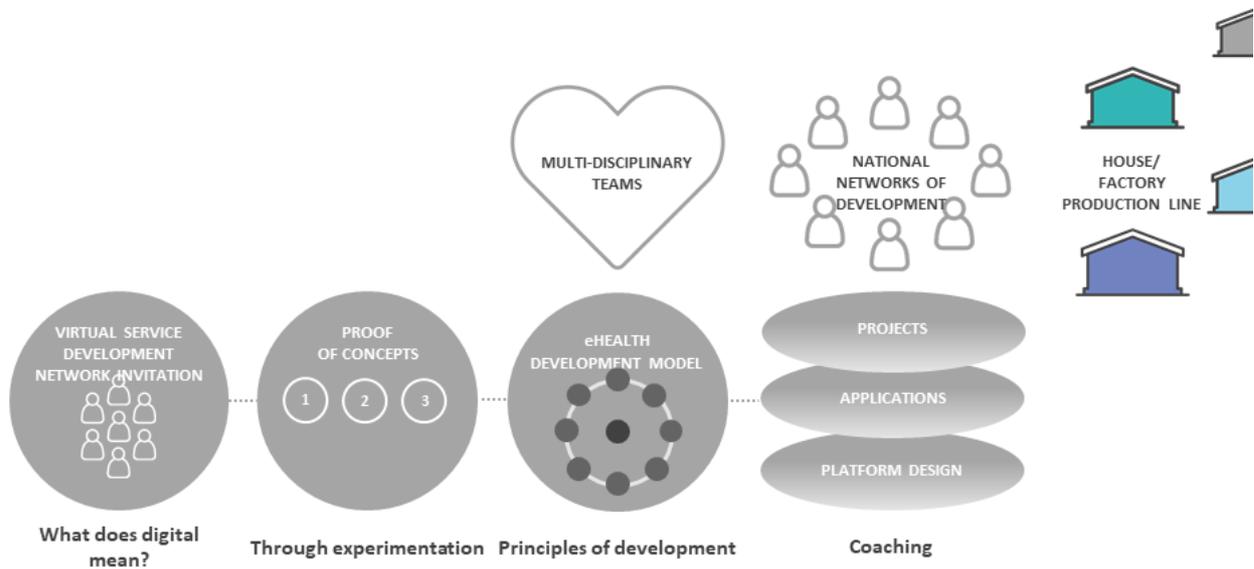
The network and the development model

Virtual Hospital 2.0 has mainly been a project about changes to operations and how we do things. The digital services supplement traditional care paths and processes, and they need to be seamlessly integrated into the existing service system. This will require new approaches to working practices, management, expertise and processes.

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 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.

In the healthcare providers' processes, lean must be made an integral part of the development of eHealth Services, because digital solutions cannot be produced on top of traditional processes. 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.

The Virtual Hospital project combined network and change management methods, lean methodology, service design and flexible development working methods, and inclusive work development methods that rely on facilitation. The project helped establish informal development forums, multi-professional teams, processes of innovation and experimentation, and realistic and practical training. The project's steering group, management team and working groups supervised and supported the development work.

Figure 3. Key arenas and methods in the progress of the Virtual Hospital 2.0 project.

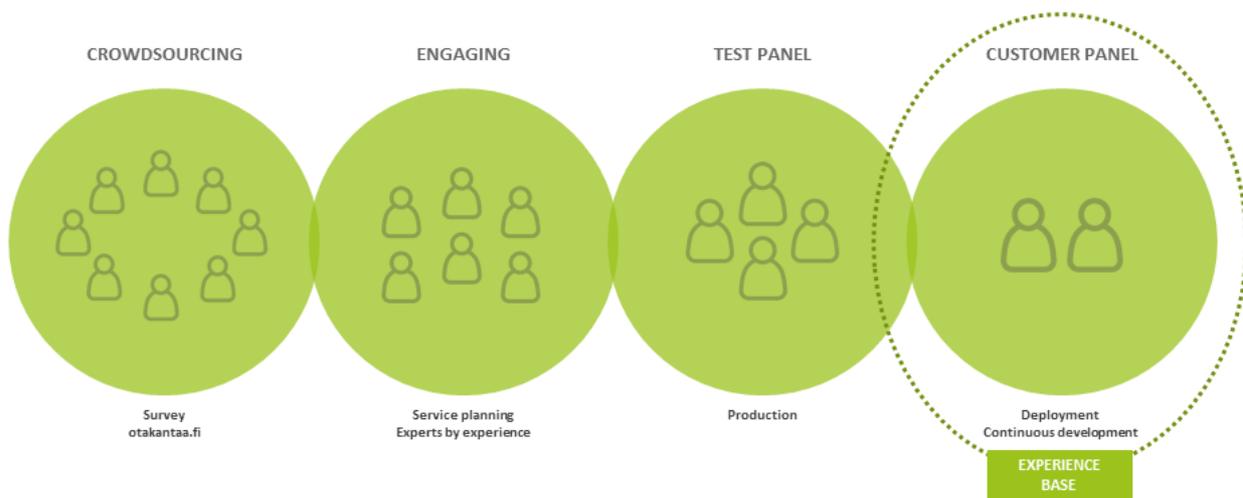The eHealth Services development model ensures that the development work and service design methods are standardised from the point of view of quality, risk management, engagement, customer focus, customer panels, communications and eExpertise development. The service development model also contains review points and criteria for putting the services into production.

Figure 4. The continuously developing eHealth Services cycle

The main principles underlying the methods and approaches employed in the development of the eHealth services were the involvement of the public, patients and professionals in the social welfare and healthcare sectors in the service development process, as well as the use of co-creation working methods in the formulation of ideas and the support for innovation processes.

Figure 5. The development of the services made use of crowdsourcing, engagement and a testing and customer panel.

| CROWDSOURCING | ENGAGING | TEST PANEL | CUSTOMER PANEL |
| Survey otakantaa.fi | Service planning Experts by experience | Production | Deployment Continuous development |

EXPERIENCE BASE

The aim of the university hospital district development network was to establish eExpertise centres around the university hospitals, so that the university hospital districts might help other hospitals to disseminate the digital expertise and services intended for the public that resulted from the Virtual Hospital 2.0 project.

The project helped produce an enthusiastic and motivated eHealth Services network of development expertise, in which customers, professionals, patient organisations and primary healthcare partners were invited to assist in the planning of services and a continuous programme of monitoring. It was important to include all the different professional bodies working in specialised medical care in the reform and renewal of the services. The ideas that emerged from working with patients and customer panels will be central to development work, but if innovations and service development are to be progressed, there needs to be multi-professional cooperation in teams consisting of doctors, nurses, therapists, social workers, behavioural specialists, researchers and scientists, information analysts, ICT experts and service design professionals.

Figure 6. The development of eHealth Services is dependent on multidisciplinary cooperation and a combination of different competencies.
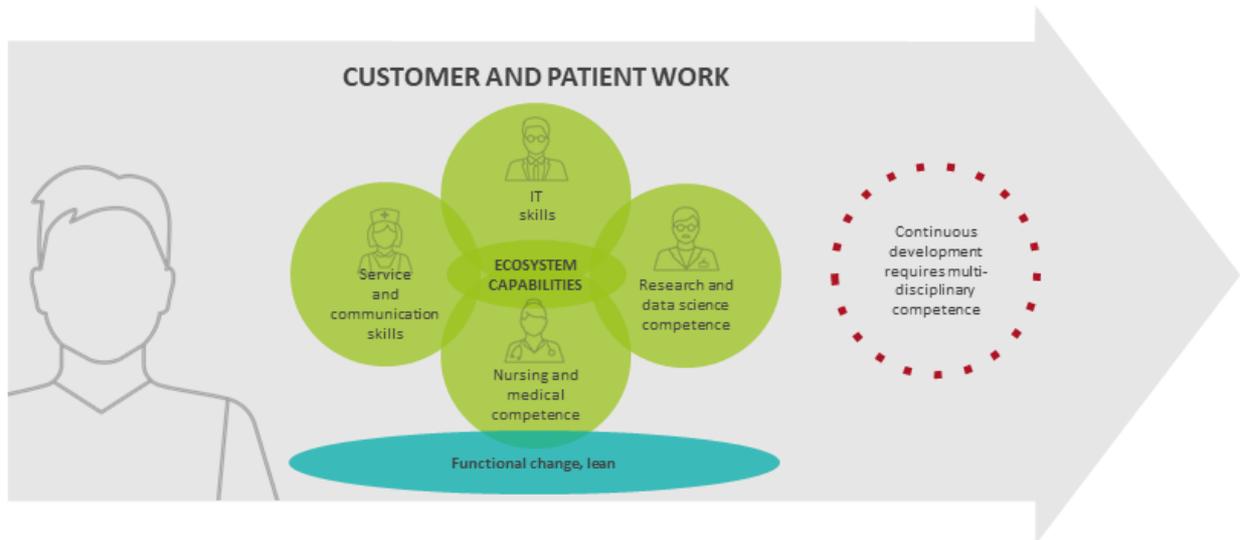
The cooperation and service network of experts from different fields exploited specialist skills and knowledge in the combined production of services and delivered safe, secure and reliable tools and related working methods. The development directors of the university hospital districts coordinated the cooperation within the network and the interaction in the various forums.

The Virtual Hospital 2.0 development network:

- Encouraged professionals to adopt a customer-oriented approach to development that relied on an appreciation of the customer experience.

- Promoted service innovation, introduced digital working methods and exploited new technology.

- Initiated cooperation at a national level on the innovation farm facility and to exploit jointly new approaches, new technology and data analytics.

- Provided companies, research partners and third sector partners with the Virtual Hospital network as a development environment for digital health solutions.

- Increased eExpertise among staff.

- Formed teams of experts in healthcare, health social work, research, data analytics, ICT and service management to create forums for multidisciplinary and cross-disciplinary research.

The Virtual Hospital 2.0 ICT environment and applications

The Virtual Hospital 2.0 ICT environment and the ICT services that have been scaled up nationally were put into production, even if there was an evident need for further development. The project was responsible for the construction of a system platform, eHealth Services applications and their modular components, continuous service processes and a standardised production method, all of which make it possible to plan and produce services for different patient groups in a safe and cost-effective way.

Central to the design of the ICT environment was the national social welfare and healthcare architecture and the HUSMAP® service architecture, which is scaled up robustly to the level of social services and healthcare. The ICT solutions were planned from the perspective of the service provider and the organiser, so that by using the Virtual Hospital 2.0 environment, its applications and their components, providers of social welfare and/or healthcare services could produce digital services in a way that is production-efficient for their own customers. User interfaces for content producers, professionals, researchers, customers and patients were designed for the Health Village applications produced for the Virtual Hospital environment. Standard interfaces for the Health Village services are to be published in the spring of 2019, when it will be possible to integrate the applications of different service providers with the Health Village more flexibly than before. The future development of the Health Village will move towards an ecosystem and a multi-provider environment.

Figure 7. The Virtual Hospital platform and the Health Village concept enable the planning, production and continuous development of digital services in healthcare using standardised product development and production processes.
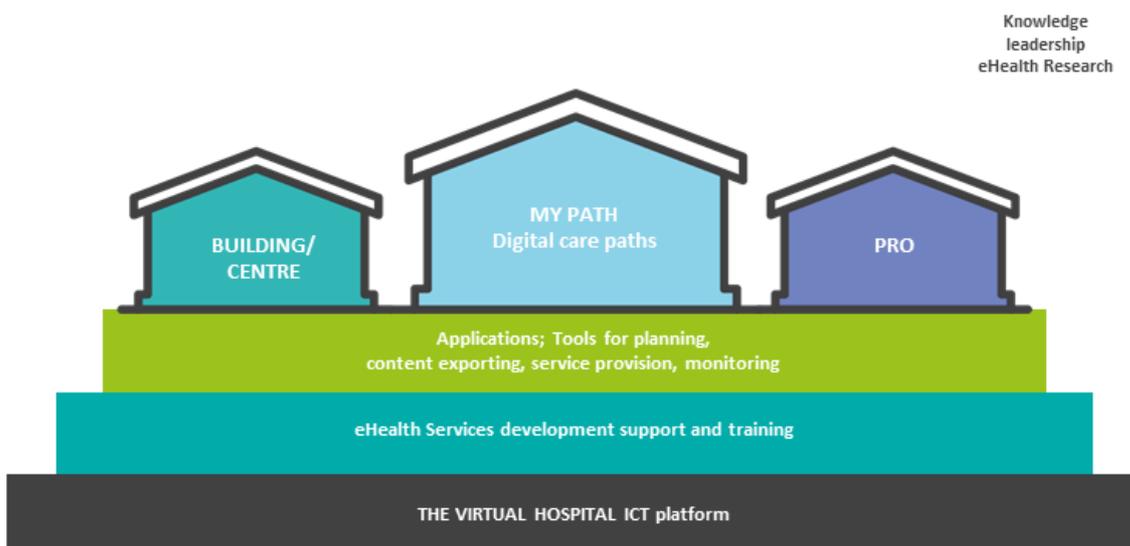
The Virtual Hospital 2.0 project was responsible for the planning, development and production of the Health Village concept, which consists of services for the public, patients using identifiers, professionals, content producers and researchers.

Figure 8. The Health Village service concept consists of services for all citizens, services for patients using identifiers who have been referred for specialist medical care, and support services related to digitalisation for healthcare professionals.
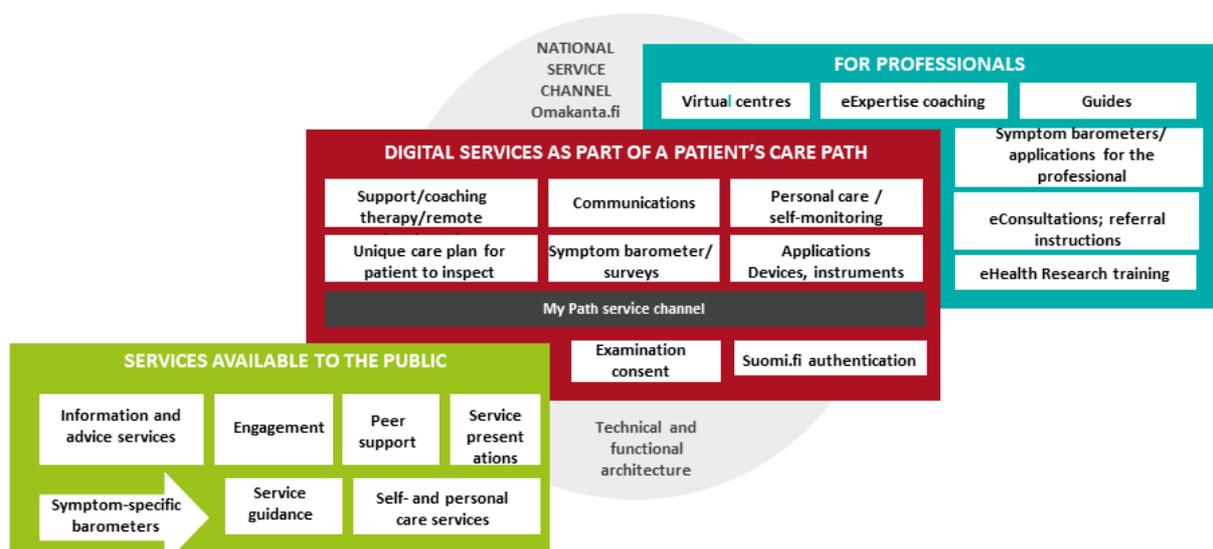
Health Village

The Health Village will make specialist healthcare services available to all Finns, regardless of their income and where they live, in a way that is clear and interesting. It can contribute towards equality between citizens and improve service accessibility.

Its services supplement and offer alternatives to traditional inpatient care. The content will also function as an excellent aid in patient guidance and motivating patients in the area of self-care. The components of the Health Village service guidance facility, such as the symptom navigators, chatbots and the different forms of remote service, will be developed further over the next two years.

The village consists of the Brain Hub, Allergy and Asthma Hub, Diabetes Hub, Organ Transplant Hub, Rare Diseases Hub, Dermatology Hub, Geriatric Hub, Infection Hub, Lung Hub, Pain Management Hub, Rehabilitation Hub, Children's Hub, Surgery Patient Hub, Medicine Hub, Mental Health Hub, Men's Hub, Kidney Hub, Women's Hub, Joint Hub, Young Persons' Hub, Healthy Weight Hub, Palliative Hub, Casualty Hub, Rheuma Hub, Eye Disease Hub, Heart Disease Hub, Cancer Hub, Examination Hub, Blood Vessel Hub, Peer Support Hub and Abdominal Hub. The Mental Hub opened in 2009 is also part of the Health Village.

The My Path and Digital Care Paths

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 digital care paths for specific patient groups and self-care programmes.

The digital care paths for patients require a doctor's referral or a specialist care relationship. Part of the self-care programme is open to all, while some is designed solely for patients receiving care.

The My Path and Digital Care Path application consists of:

- The generic Digital Care Paths' stalk.
- Generic, continuously developing elements (cf. Lego bricks).
- Standard interfaces for integrations.
- Coaching based on service design and lean methodology, to promote operational and functional change in the healthcare service provider's unit.
- Models and instructions for social welfare and healthcare actors to plan multi-channel digital services for specific customer groups, produce content and export it, conduct studies and examinations on the service path, and produce knowledge leadership reports.
- Patient, professional, content producer and researcher interfaces and knowledge leadership analytics tools.

The university hospital districts have used the application to produce 91 different Digital Care Paths or self-care programmes using identifiers, where patients can prepare themselves for procedures, recover afterwards, receive remote services on the chronic illness path, and receive the service entirely online with the aid of new therapy and training programmes.

Below are a few examples of planned services or those in use at the end of 2018.

Self-care programmes linked to the My Path	Quitting Smoking to Aid Good Care, Good Nutrition, No Smoking before an Operation, Do you Eat Properly?
HUS	adults: pregnancy, IVF, joint replacement surgery, mitral valve surgery, inguinal hernia repair, bariatric surgery, sleep apnoea, cervical surgery, chronic pain, insulin-deficient diabetes, chlamydia, rheumatoid arthritis, asthma, dialysis, diabetes during pregnancy, healthy slimming training, bowel incontinence, home haemodialysis, veins, living relative kidney donor, minor brain injury, chalazion. children: headache, epilepsy
KUS	adolescent psychiatry, diabetes during pregnancy, insulin-deficient diabetes, adult outpatient psychiatric care
OYS	insulin-deficient diabetes, coronary artery disease
TAYS	type 1 diabetes, IBD, home dialysis, brain injury, cerebrovascular disorder
TYKS	pacemaker, rheuma

The IVF (In Vitro Fertilization) Digital Care Path means that the customer and the clinic can save time, plus it allows better information flow.

Customers attending for in vitro fertilisation can, prior to their arrival at the surgery, familiarise themselves with the details of the treatment on the IVF Digital Care Path. In this way, when they arrive at the surgery the doctor can focus on the couple's personal details. Furthermore, a biologist imports information into the digital path, such as how the embryos have been fertilised. A nurse sends the patient details of appointments for the treatment and reminders electronically.

At HUS Helsinki University Hospital, the IVF path had been used by 700 customers (350 couples) by the end of 2018.

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, encourages them to see through to the end the operational changes associated with digital services, and prompts them to 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.

The eHealth Research network

As part of the project from 2016 to 2017, the HUS eHealth Research group promoted the use of electronic research consent and the establishment of the researcher's interface within the context of the Health Village services. It also encouraged the use of shared experiences of, and models for, the establishment of eResearch, and the updating of researcher skills and knowledge in the use of predictive analytics and the exploitation of the opportunities afforded by the data lake.

From the start of 2018, the Northern Ostrobothnia Hospital District was the agency that was mainly responsible for the coordination of the eHealth Research network. The aim of the network is to bring together researchers and developers in the fields of social welfare and healthcare to establish joint research plans and projects connected with the digitalisation of healthcare.

The use of the research data by the various working groups involved in the Virtual Hospital 2.0 project has been a natural contribution to evidence-based (research-based) work in connection with the delivery of the services. The developer groups responsible for planning, developing and producing eHealth Services in the project have consisted of specialists and researchers for each field or branch of science represented.

A provisional research plan and design has already been conceived for the service packages produced in the project and for use in their development stages. The production and introduction of applications and new service components have frequently been preceded by a pilot study, a period of research design, and an evaluation of results. The data based on the research findings can be used to evaluate the viability of a service, its impact and reliability, and the potential for using the service in a broader context.

The aim has been for the project to develop recommendations concerning the eligibility of different research methods in eHealth Services at different stages of their lifespan. The eHealth Research network will progress this task, and it will continue its programme of cooperation after the project ends.

Innovation network

An innovation network was developed as part of the project. University hospital staff suggested ideas and areas that needed improvement for which mobile solutions were desirable. More than 80 ideas were posted on the website, 60 of which related to mobile solutions. The ideas were also peer reviewed. You can view the ideas at ideatehdas.fi. The innovation network has decided to continue cooperation after the project ends.

EVALUATION

The benefits and impact that the Virtual Hospital 2.0 project aimed for have been monitored with the help of an evaluation matrix created by the project evaluation group, as well as various surveys. The evaluation matrix is used to assess financial viability, customer and health benefits, interoperability and feasibility at a national level from the perspective of the health services organiser and provider and the customer. The services produced within the context of the project were assessed separately for those that were open to the public, patients receiving specialist care and professionals. The financial and qualitative impact of the services produced are to be monitored continuously, mainly by means of evaluation and effectiveness studies conducted over the next three years.

Figure 9. Summary of the evaluation matrix for eHealth Services produced by the Virtual Hospital 2.0 evaluation group, with respect to services for patients using identifiers.

LEVELS	Economic viability	Customer benefit	Health benefit/ impact	Interoperability	Feasibility
National level	Production efficiency, financial impact	Customer experience	Clinical validation/study of each separate patient group	Personal Health Record integration, coupled with a citizen's health and well-being plan	Standards and interfaces in relation to the national service architecture
Organisation /organiser	Production efficiency	Seamless service guidance	Clinical validation/study of each separate patient group	Maturity level of information systems in relation to the national service architecture/regional IT solutions	Standardised and efficient eHealth Services development model. Resources for development.
		Seamless service chain for primary and specialist medical care. Meeting points.	Effect of digital services on re-admission	Seamless service chain for primary and specialist medical care. The data moves with the customer.	
Provider/ unit	Share of digital services in service production between different patient groups in relation to production efficiency.	Number of customers receiving traditional services in relation to number of digital services users	Monitoring of the effectiveness of remote services	Maturity level of information systems	Staff eExpertise (number of training sessions and participants)

Professional's use of time in relation to performance.	(take-up %/patient group), customer satisfaction			
Share of customer self-service	Waiting time – change in and customer experience of active waiting time with the digital service	Clinical validation/study of each separate patient group	Use of eHealth Services in patient guidance throughout the service chain	Staff time
Customer lead time/length of queues	Added value of service can be evaluated and monitored	Effect of digital services on re-admission		Safety and availability of services
New eHealth Services (number, LV)	eHealth services recommendation	Patient safety monitoring	Standardisation and modularity; harmonised data models	Standardisation and modularity
Standardised and efficient eHealth Services development model	Number of adverse events in relation to customers' health problems	Quality of life and functional capacity indicators; nursing quality indicators		
Customer/ user Savings made due to remote services (travel, time, loss of working hours)	Accessibility and availability audits	Effect of digital services on quality of life among long-term patients (15D)	Number of users of the My Path service channel	Customer skills and induction (induction model, training and instructions)
Monitoring of escort costs	Customer feedback and experience	Commitment to treatment; number of adverse events	Single sign-on	Accessibility and availability audits
Monitoring of interpreter costs	TAM (technology acceptance model) measurements and monitoring	Quality of life and functional capacity indicators; symptom assessments for each patient group	Amount of joint development with patient organisations, experts by experience and those offering peer support	

A working group led by Dr. Kaija Saranto, Professor in Health and Human Services Informatics at the Department of Health and Social Management at the University of Eastern Finland was selected to conduct a study. The study was based on a questionnaire and interview involving the project actors for the purposes of an external assessment of the Virtual Hospital 2.0 project.

The survey sought the views of the project workers involved in the Health Village development work on the impact of eservices on their own work (system functionality, quality of data, feasibility of the services). It was also designed to identify whether the participants intended to use eservices in the future (satisfaction). The respondents thought that the Health Village services would boost patient-centredness and provide them with greater opportunities to take more responsibility for their own well-being. They felt that the Health Village services were a good idea and thought that patients would benefit from the services. The quality of the service produced by the Health Village was judged to be good. At the time of the survey in August 2018, there were still some challenges associated with technical functionality, and not all university hospital districts had yet introduced services for patients using identifiers. Nor had integrations yet been implemented, for example, in the patient information systems.

Cooperation on the project was considered to have gone well between both the university hospitals and the specialists. However, the provision of information, the establishment of cooperation between primary healthcare and specialist healthcare providers as the Health Village services expanded, and a commitment to national practices were considered challenging.

Financial impact

The cost-benefit analysis of the Virtual Hospital 2.0 project plan suggested that the savings and other benefits the project brought would be worth up to at least € 40 million per year at a national level. According to the forecasting model for the financial impact of the Virtual Hospital services produced in autumn 2017, which was performed as part of the project's mid-term evaluation, the annual impact of improved production efficiency will rise to € 316 million a year.

Figure 10. Esior Oy. 2017. The forecast for freed-up capacity annually as a result of the services produced in the Virtual Hospital 2.0 project scaled up to national level.

Annual amount of freed-up capacity achieved by 2022: approximately €316 million at national level
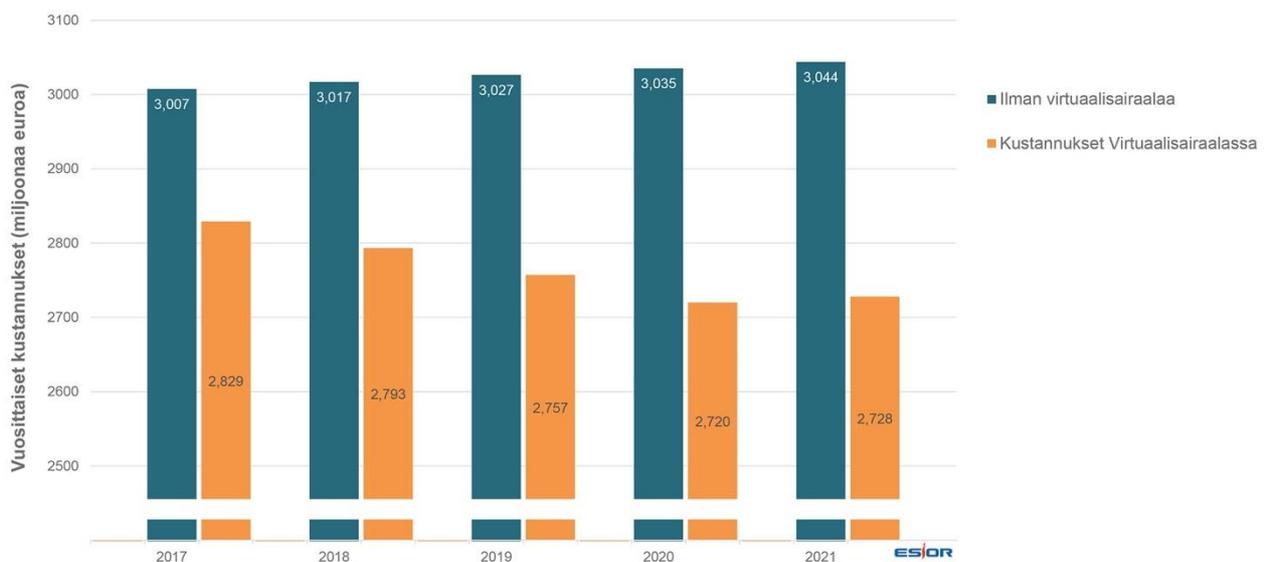
Financial impact at this stage is based on a forecasting model, which may be reviewed when the services are introduced and specified properly at the follow-up and evaluation stage on a two- to five-year cycle. A requirement for establishing the financial impact is how successful the reform and operational changes associated with health services are, and, for example, the step-by-step accomplishment of working methods and changes in work. The forecasting model made it possible to assess the potential overall financial benefit and to judge, for example, what sort of impact various factors, or drivers had. The role of drivers in health economics evaluations is major as regards both costs and health benefits. For example, letters and telephone calls have an unexpectedly major impact on the whole situation, even if some of the calls are not logged and it is difficult to estimate unit costs.

Cost-benefit analyses for each separate unit were an integral part of the development model used in the project. The digital services produced for patients are either care packages consisting of digital components or care programmes that are delivered entirely digitally. In order to monitor the financial impact of the new, multi-channel services, the services will have to be commercially exploited.

Figure 11. The view of the working group responsible for the commercialisation of the Virtual Hospital 2.0 project, regarding making digital services for specialised medical care part of traditional services and their commercialisation as new services.
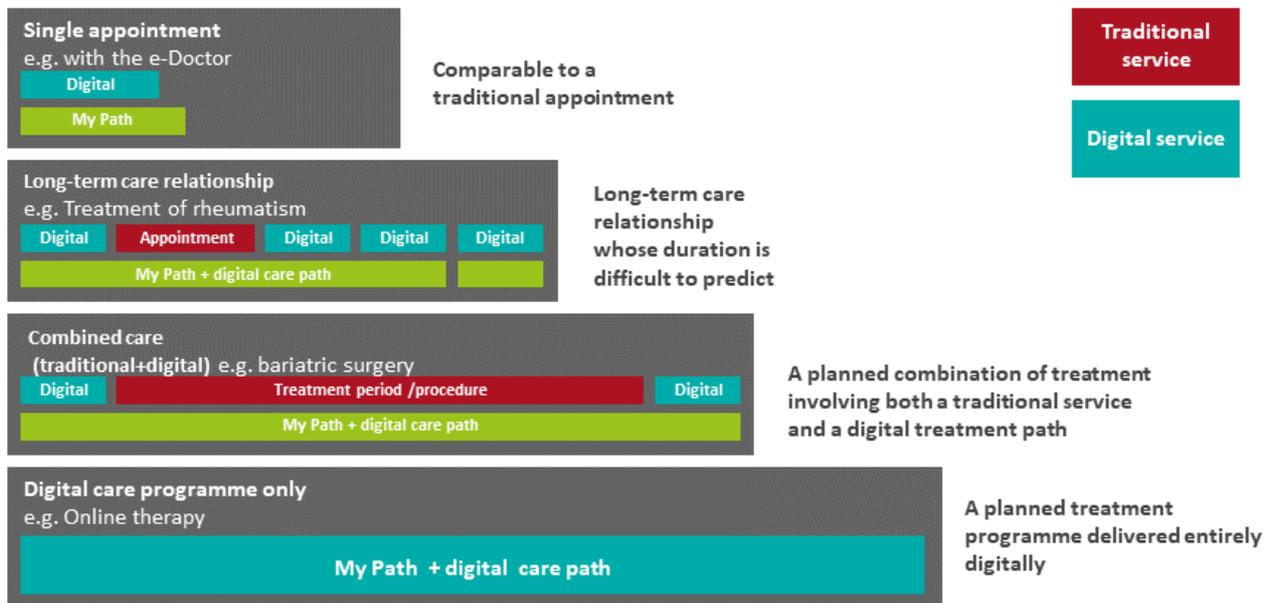
Qualitative impact

By means of the Virtual Hospital 2.0 evaluation matrix, the qualitative impact of the eHealth Services will be assessed from the perspective of benefit to the customer, impact on health, interoperability and feasibility. The customer benefit indicators are customer satisfaction, customer experience, recommendation levels and customer numbers. The impact assessment on health will be based on a scientific medical and nursing study using sector-related expertise. In assessing interoperability and feasibility, use may be made of the JulkiICT matrix indicators, mainly for technical feasibility and functionality. Central to them all are the single sign-on facility for national eservices, using integrations to allow for the movement of data, and availability/usability from the customer's perspective.

Support for a qualitative study in association with eHealth Research is highly relevant in order to obtain evidence of the impact of the eHealth Services and to develop the services further so that they are headed in the right direction in terms of quality.

The effects of the behaviour of the public and patients and of the general opinion of the eHealth Services also needs be monitored by means of a consumer survey. Consequently, the study and monitoring of impact will have to be on a five-year basis at least.

The following qualitative benefits were the aim of the Virtual Hospital 2.0 project.

Benefits to employees and organisations

- Knowledge leadership services based on continuous analysis will become increasingly cost-effective and customer-oriented.

- There will be less hierarchical management and decision-making when operators have the information they need to improve their work and the means to apply predictive modelling.

- The work will go more smoothly and staff motivation and well-being will increase as the service structures and operating models are rationalised.

- Queues and waiting times will shorten, resources will be allocated more effectively, and there will be less waste and failure demand.

Benefits to the customer and the patient

- Customers will be able to use the services in the best possible way in terms of their well-being.

- They will find information, advice, service guidance or self- or personal care services that suit their needs, life situation or health problem.

- Patients will be able to use self-care services regardless of time and place.

- Specialised medical care can be provided quickly and regardless of distance, and straight to the customer's home, if required.

- eHealth Services exploiting artificial intelligence and big data will learn to guide and advise patients and will benefit from continued improvement.

- Patients will find timely assistance faster and with fewer steps involved, and will be able to enter the 'service stream' in a way that best suits their own situation.

- Mobile apps will act as everyday tools to promote good health, remote care and its monitoring at a distance, and rehabilitation. Patients will have a digital communications channel to connect with the professionals who are treating them.

- There will be improvements in regional equality, availability of services and service accessibility.

Interoperability and feasibility

The university hospital districts have produced knowledge leadership, eResearch and quality development projects and data lake design and deployment as separate exercises. Integrations have been described for the Virtual Hospital 2.0 service architecture for each healthcare service provider's data lake and the national Personal Health Record. The first integration to export the well-being data of an individual to the Personal Health Record was accomplished in October 2018 in collaboration with Kela's personal health record staff.

Figure 12. The Health Village's My Path – the My Kanta integration as part of lifestyle guidance

The data produced by the Health Village services and patients themselves will transfer to each operator's data lake, where it will be used for research and knowledge leadership in accordance with the protocol specified for each organisation. These data lakes will also collect data from separate quality registers, customer feedback systems, patient record systems and, in the future, genome and biobank information. By combining the existing data, it will be possible to produce new data on the impact of the digital services. This will enable the collection and analysis of data on the impact of the eHealth Services from financial and qualitative viewpoints over a broader context in the next few years. Several studies, dissertations and other academic theses have been completed on the Health Village services and their impact.

Lessons and insight

The Virtual Hospital 2.0 project has invited the developers of new services and the providers of management- and organisation-level development, communications and training services to react to the demands of a new type of working environment and method. An attempt was made to take account of aspects of eExpertise, eManagement and eServices in a new way.

The project has prompted the entire university hospital district organisation and different professional groups to think about configuring eservices with current services, clarifying service processes, and the lean approach. It has been possible to respond to some of the challenges by means of the support models developed in the project and through training.

A persistent theme has been seeing through operational changes using a precise and gradual plan. Upon completion of the project, lessons learnt from the introduction and management of eservices will continue to be felt in specialist care units. It will take several years to change the service culture and ways of doing things. The project evaluation group discussed whether a project lasting just three years was too short a time to obtain data on impact or results. A monitoring and study stage lasting at least three years should be planned as soon as state funding is provided.

Systemic and network-managed methodologies succeeded in establishing various joint forums of learning and interaction, where professionals with different educational backgrounds were able to discuss and create a common text for development and change resulting from digitalisation. In the future, it is relevant to have resources for change management and for creating models to support of the overall change.

Experiences from the project will raise the following matters to be taken into account in future developments.

1. A digital leap by the social welfare and healthcare services will only succeed via a multidisciplinary development network. In addition to professionals at different levels in the social welfare and healthcare sector, the development projects will require the participation of customer representatives through the whole development cycle. There will also be a need for agile management in service design and on the part of ICT experts, researchers, and technology and data analytics specialists involved in the co-creation process.

2. Cost savings from the digitalisation of healthcare or improved production efficiency will not be achieved merely by developing ICT services. It will be essential to have the social welfare and healthcare service structures and chains delivered as a multi-channel facility. In addition, support will be required for a change to the processes as required by digitalisation in functions and operations in the healthcare sector and in the practical working methods of staff.

3. There will be a substantial need for eHealth Research into the impact of digital services, so that the new eHealth Services are based on evidence and to allow their introduction to spread. Resources will need to be allocated for the research, and the timescales must be noted. This will be essential in healthcare, so as to ensure the quality, reliability, safety, security, accessibility and usability of the services.

4. The full exploitation of new technology in healthcare is contingent on the ability to act as producer of medical software and devices (ISO13485), where it must be possible to be responsible for not just the product development process but the entire life cycle of the service in accordance with the relevant standard.
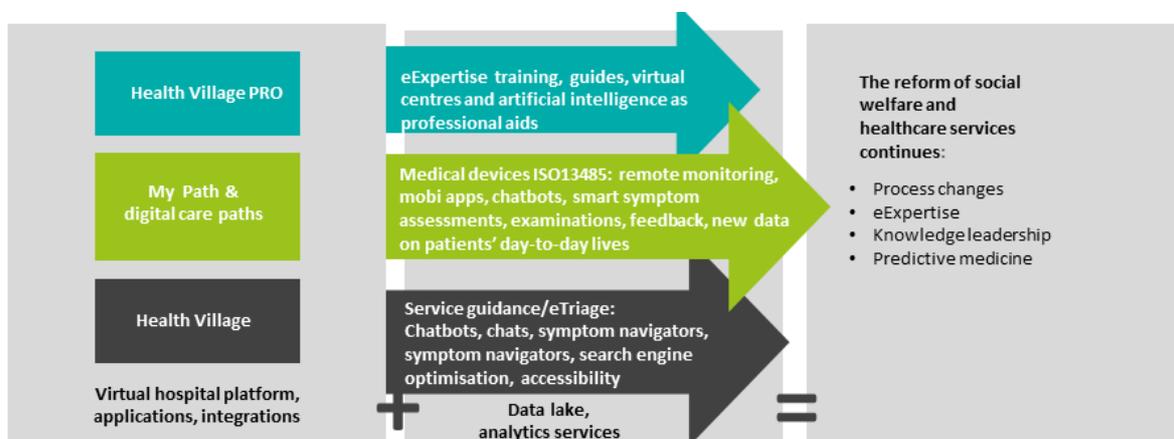
FURTHER DEVELOPMENT

There were discussions on the requirements of the further development of the Virtual Hospital 2.0 project and the potential for its expansion throughout the country with the Ministry of Finance and the Ministry of Social Affairs and Health, and subsequently with representatives of SoteDigi Oy in 2018. The public services provided by the Health Village and the Health Village PRO services are potential areas for further development nationally. They could be integrated through the promotion of the social welfare and healthcare reform, eHealth Services for residents in the regions and health advice provided via regional portals. It would be appropriate to include more primary healthcare experts, specialist social workers, patient organisations and other national actors in the further development process.

The Health Village services will be in production by the time the project ends. HUS IT Management, which produced the ICT services, has also produced support services and processes for the continuous delivery of Health Village services. The flexible development of services will continue, because the needs of patient groups and the feedback received from the public, patients and professionals will inform future developments.

The university hospital districts are committed to continuing the further development of the services that began in the context of the project and their spread throughout the country, if there is the national support needed for this. The various specialist units of the university hospital districts are committed to maintaining and updating the Health Village content and that of the Digital Care Paths for each patient group. The Health Village services are in use in patient guidance and advice services at specialist care units; that is, they represent some of the permanent activities of the university hospital districts.

In the period 2019–2020, the university hospital districts will endeavour to extend the Health Village services to the hospital districts in their Specific Catchment Area. This means that as many as 61% of the Finnish population could have access to the services produced in the project. Each university hospital district will be responsible for its own area. The first steps towards introducing the Health Village were taken in 2018 in HUS's Päijät-Häme Specific Catchment Area.

Figure 13. The foundations for the Health Village were established by the Virtual Hospital 2.0 project, and next it should be possible to start exploiting the potential of data lakes in order to develop services that use artificial intelligence and big data.

As part of the planning of the future development of the Health Village, HUS provided the resources for work on a Health Village brand strategy, visions and distinguishing features, and a service promise from the perspective of the patient, professional and healthcare service provider. Figure 14 is an illustration of this work from the patient's viewpoint. The vision of this promise is to provide a revolutionary care experience. In the middle of the triangle are the factors linked to the capabilities and strengths of the university hospital districts that make the service promise possible. The black bar at the bottom of the triangle describes the structures and factors that required for honouring the service promise.

According to the vision, the Health Village will revolutionise dealings between health professionals and patients, the patient's independent acquisition of data, remote care, and the support of peers patient's 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.

Figure 14. The Health Village vision for 2021 from the patient's perspective.
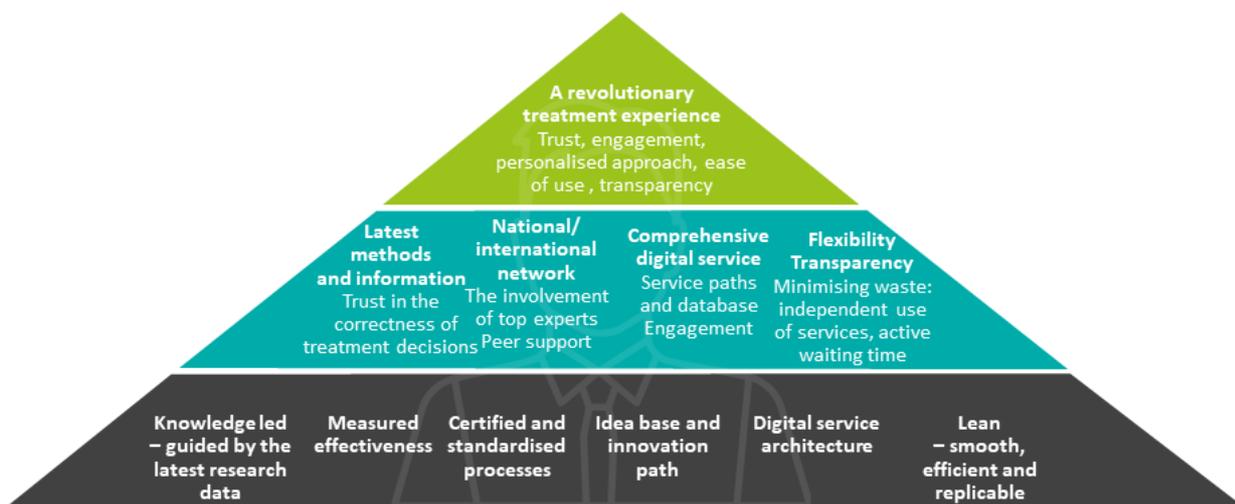
The Health Village potential

The Health Village, its development model and the 'production lines' are all opportunities for creating an international product for export. There is already plenty of interest. In order to exploit the export potential, discussions are to continue with Business Finland and corporate partners, and opportunities for applying for EU funding will be explored.

Further evaluation and impact assessment

The Virtual Hospital 2.0 project has established a network of experts who are well versed in eHealth Research. The network's objective is to produce research data on services to be developed for the Health Village and introduced there. Research data will be needed for the new digital solutions for healthcare services before they are expanded to cover the country safely. In accordance with a healthcare sector tradition, care practices and patient Care Paths must be based on adequate and compelling research evidence.

Linking research to the development of eservices will be of benefit at different levels, all the way from national healthcare planning to the end users. Future social welfare and healthcare organisations will be able to exploit the research data produced in the planning and deployment of new digital services and in the provision of the resources for them. Research enables knowledge leadership. Health sector organisations

and actors will take advantage of the research data to develop patient care and establish alternatives to conventional surgery procedures.

The cost-benefit analysis of the digital Care Paths to be introduced must be more closely associated with a scientific attitude, to obtain evidence of the impact of services. The Health Village digital Care Path app has a built-in facility for conducting impact and service studies. Studies can be shown to patients on the path, and they can be asked for their electronic consent to be included in a study. Withdrawal of consent is also possible. Researchers can be connected to the study path and can create a research design and surveys or indicators for integration with the path. They can also download and transfer data collected from the path to be worked on later in research programmes.

The eHealth Research network is to be extended over the next few years for use among behavioural, consumer and service science researchers familiar with customers' experience of the service. It is hoped this will help achieve broad competence in how to take customer experiences into account.

University hospitals as centres of eExpertise

The university hospital districts would like to be able to act as centres of eExpertise.

Their role in partnership with the universities is to:

- assess the quality and impact of the services and continuously monitor them

- continuously develop and examine evidence-based eHealth Services

- carry out eHealth Research and disseminate the findings among professionals in the social welfare and healthcare sector

- support the introduction of new practices and methods

- provide support services for professionals in the social welfare and healthcare sector

- develop digital channels for a new division of labour with primary health care, and social welfare and healthcare actors

- develop continuous innovation alone and with business.

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