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E-health and e-welfare of Finland

Check point 2015

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NATIONAL INSTITUTE
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Abstract

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The Finnish Ministry of social affairs and health commissioned this e-health and e-welfare report to monitor state of the art and trends in e-health and e-welfare in Finland. The report was produced by the Finnish National Institute for Health and Welfare (THL), FinnTelemedicum research unit at the University of Oulu, Aalto University and the Finnish Medical Association. Results are based on four national e-health and e-welfare surveys conducted in 2014 in Monitoring social and health care information systems and services – STePS-project (table 1).

At the time of conducting the surveys, the national e-archive ('Kanta') services as well as the first national e-services for citizens were being launched, and e-prescription services were in stabilization phase. The new Information Strategy for Social and Health Care 2020, published in the beginning of 2015, was under construction. The results of this report are targeted for e-health and e-welfare decision makers on local, regional, national and international level. They provide benchmarking data to support the implementation of the new e-health strategy as well as the social welfare and health care reform from the digitalisation perspective prior to the implementation of nationwide social welfare information system services. The indicators used for monitoring have been developed in collaboration with the Nordic countries and the OECD, and offer good basis also for international e-health benchmarking. The four surveys have been depicted in table 1.

Table 1 Surveys, their foci, informants and frequencies

Survey	Focus	Informants	Years
1) e-health	e-health implementation and use	Public primary and secondary and private health care provider organisations	2003, 2005, 2007, 2011, 2014
2) e-welfare	e-welfare implementation and use	Public and private social care organisations	(2001, 2010), 2014
3) Physician experiences	Usability, experienced benefits and challenges	Public and private physicians	2010, 2014
4) Citizen experiences	Use, experiences and needs of e-services	Representative sample of population	2014

The first survey (e-health) describes the implementation status and trends in health care information and communication technology (ICT) and e-health usage in Finland, comparing the 2014 results with earlier surveys. The e-health survey includes data from all the public hospital districts delivering secondary or tertiary care and 88% of the public healthcare centres delivering primary care (population coverage 95%). A sample of private sector service providers is also included. The second survey (e-welfare) was a national review of the electronic social services, implemented social welfare client information systems, and data management in different organisations operating in the field of social welfare in Finland in 2014. The survey has been conducted three times, and this report depicts results of the 2014 data collection. The respondents were 305 organisations providing 134 representatives of the public social welfare sector (municipalities, joint municipalities and other joint authorities) and a total of 171 commercial enterprises and NGO's providing social welfare services. The third survey (physician experiences) was addressed to all practicing physicians in Finland. It describes physician experiences on usability and utility of their health information systems. The survey was conducted for the first time in 2010 and repeated in 2014 in a situation, were public sector physicians could express first experiences of the usability and utility of the national e-prescription service. The fourth survey (citizen experiences) describes citizens' use, experiences and needs related to social and health care e-services. The survey was based on a representative sample of the population from the population register. It was conducted in 2014 for the first time. The timing coincided with citizens having experiences of the national patient portal with e-prescriptions as well as the national mental health portal.

According to the results of the first survey, availability of electronic patient data was saturated and the data were widely utilised at the regional level and increasingly on the national level. Electronic patient record (EPR) distribution covered 100% of both specialised care (hospital districts) and primary care (healthcare centres). EPRs were used as the only source of patient narratives in more than 90% of all the primary healthcare centres, and in most of the hospitals. Filmless picture archiving and communication systems (PACS) were in use in all 21 hospital districts and in 99% of the primary healthcare centres. Electronic information exchange between organisations had progressed rapidly, and the traditional regional data exchange systems had been supplemented by various new methods. Electronic referrals and electronic discharge letters and multilateral regional electronic patient data repositories were common. Fully interoperable patient data exchange was regionally in operational use in most of the health care institutions. There was also an increase in the regional health information exchange utilisation rate. The integration of the information systems had also become more advanced. All new core documentation was processed only electronically. All this development had been accompanied by the intake of structured core data, national classifications and coding systems. All hospital districts had started preparations for joining the national electronic patient

record archive ('Kanta' e-archive) and many had joined the service. All health care providers had joined the national e-prescription service. Compared to earlier surveys, more e-health services are now provided directly to the citizens. The median of ICT costs in hospital districts in 2014 was 2.7% of their total budget. In primary healthcare centres this figure was 2%. Private service providers spent 3% of their budget on ICT. Since the 2011 survey, the provision of direct e-health services for citizens had started to increase with the e-health infrastructure in place.

According to the second survey, an informative website is the most common online service offered by public and private organisations alike. The organisations offer the possibility to give feedback online. The availability of anonymous online counselling is limited. Less than half of the public organisations and an even smaller share of private organisations offer online services for specific target groups. Nearly all of the public authorities have a client information system, while private service providers make somewhat less use of client information systems. However, a client information system is not in use in all social services. Partial recording of data in electronic format is more common across all organisations than using electronic systems to record all client information. Not all social welfare employees in the public and private sectors have a personal workstation. Internet access, on the other hand, is very common in all organisations. Mobile client information system applications are less commonly used in private organisations, in particular. Public organisations typically employ information systems management personnel totalling three person-years, while in private organisations the total is one person-year. Less than half of the public organisations transfer data electronically from their own client information system to that of another organisation. One in three has granted read-only access to employees of other organisations. The need for the electronic exchange of information across different organisations is greater than the need to expand viewing rights. It is not common for employees of private organisations to have access to information contained in other organisations' systems. In social welfare organisations, preparations to implement the National Client Data Repository for Social Services and structured data recording are still under way. Compared to private organisations, municipal organisations are ahead in their preparations. Between 2011 and 2013, the total ICT costs have remained more or less stable in organisations providing social services. Respondents estimate that ICT expenditure will increase in the next few years.

According to the third survey, usability of e-health systems and services showed modest improvement in the 4-year period. The biggest positive change in public hospitals, primary care centres and public sector organisations was the increased availability and usability of key information contents, and the biggest negative change in decrease of usability of telelaboratory results. Overall utility trend was improving, but still very modest. Usability of nursing documentation had improved in the public sector, but reduced in the private sector. Almost half of public hospital physicians and 40% of public healthcare centre physicians regarded usability of the

national e-prescription system as one of the functionalities requiring the most urgent development. However, there were big vendor-specific differences. Implementation of new functionalities seemed thus to pose challenges for overall usability of the systems. Other improvements requested were the possibility to guide treatment processes with ICT.

According to the fourth survey, Finland is well on the way towards digitalisation of many of the health care services or functionalities most frequently used and needed electronically by citizens, namely prescriptions, laboratory test results and electronic booking of services. The proportion of respondents having used e-services for social and health care was still very modest (12%). The citizens estimated having saved on average 1,37 visits per year by using electronic services. Frequent service use, higher education, younger age, living area and use of occupational health services predicted frequent e-service use. Key obstacles for use were belief that e-services cannot replace face-to-face services, complicated terms of use and usability and accessibility for people with disabilities. The big challenge is thus to make the e-services more user-friendly and demonstrate their added value both to citizens and professionals for them to start the digitalised services. Safeguarding equal opportunities for promoting the health and wellbeing of people living in different regions, with different demographic profiles also remains a challenge. Achievement of the objectives set for patient portal services is conditional on the simultaneous renewal of service processes. Electronic services cannot fully replace face-to-face services in social and health care; they can complement the range of existing services.

According to the national e-health and e-welfare plans, nationwide online client services are to be promoted in both social welfare and health care: The new e-health and e-welfare strategy aims to support the renewal of the social welfare and health care sector and the active role of citizens in maintaining their own well-being by improving social and health care information management and increasing the provision of online services. The overall structural changes currently taking place in Finnish health and social care will also influence ICT construction.

Acknowledgements

Suomalaiselle lukijalle (For the Finnish reader)

Raportti kokoaa tulokset neljästä erillisselvityksestä, joiden tarkoituksena on ollut tuottaa tilannekuva- ja seurantatietoa valtakunnallisten tietojärjestelmäpalveluiden toteuttamisen tueksi sosiaali- ja terveydenhuollon organisaatioille sekä tukemaan tietojärjestelmäpalveluiden suunnittelua ja ohjausta. Erillisselvitykset toteutettiin osana Sosiaali- ja Terveydenhuollon tietojärjestelmäpalveluiden Seurantahanketta (STePS) yhteistyössä Sosiaali- ja terveysministeriön, THL:n, Oulun yliopiston, Aalto-yliopiston ja Suomen Lääkäriliiton kanssa.

Erillisselvitysten tiedonkeruut toteutettiin alkuvuodesta 2014 tilanteessa, jossa sähköinen resepti oli kattavasti käytössä julkisella sektorilla, ja sen leviäminen yksityissektorille oli alkanut. Kansallisen potilastietojen arkiston käyttöönotto julkisella sektorilla oli vasta alkanut. Yksi erillisselvityksistä (kansalaisten kokemukset) toteutettiin nyt ensimmäistä kertaa, lääkärien kokemukset oli aiemmin kartoitettu kertaalleen vuonna 2010, tieto- ja viestintäteknologian käyttö sosiaalihuollossa kaksi kertaa (vuonna 2003 ja 2010) ja terveydenhuollossa neljä kertaa (vuosina 2003, 2005, 2007 ja 2011).

Erillisselvityksistä kartoitus tieto- ja viestintäteknologian käytöstä terveydenhuollossa vuonna 2014 kuvaa tietojärjestelmäpalveluiden leviämisen tilannetta, käyttöastetta ja kehityksen suuntaa julkisessa perusterveydenhuollossa, erikoissairaanhoidossa ja yksityissektorilla. Vastaava sosiaalihuollon kartoitus kuvaa kuntien, kuntayhtymien, järjestöjen ja yksityissektorin tietojärjestelmäpalveluiden tilannetta. Lääkäreille suunnatun tietojärjestelmäkyselyn tulokset keskittyvät lääkäreiden kokemuksiin ja kokemusten muutokseen käyttämiensä tietojärjestelmien teknisestä toimivuudesta, helppokäyttöisyydestä, potilaiden hoidossa tarvittavien tietosisältöjen saatavuudesta, tietojärjestelmien tuesta organisaatioiden sisäiselle ja väliselle yhteistyölle sekä hyödyistä. Kansalaiselle suunnattu kysely kartoittaa terveydenhuollon palveluiden perinteistä ja sähköistä käyttöä, sähköisten palveluiden käyttökokemuksia, esteitä ja tarpeita.

Kartoitusten suunnittelun aikana OECD oli kehittämässä mallikyselyä tietojärjestelmäpalveluiden saatavuuden ja käyttöasteen seurantaan, jonka tarkoitus on ollut auttaa jäsenvaltioita kehittämään vertailukelpoisia kysymyksiä kansallisiin kartoituksiin. Suomalaiset osallistuivat OECD:n mallikyselyn kehittämiseen ja hakivat vastaavuuksia mallikyselyn ja kansallisten kyselyiden kysymysten välillä tietojen kansainvälisen vertailukelpoisuuden parantamiseksi. Lisäksi pohjoismainen e-health Research Network (NeRN) yhdenmukaisti Pohjoismaiden tiedonkeruita keskittyen tiedonvaihdon ja potilasportaalin toiminnallisuuksien saatavuutta, käyttöä, käytettävyyttä ja hyötyä mittaaviin kysymyksiin Pohjoismaiden ministerineuvoston tuella. Muuttujien yhdenmukaistaminen kansainvälisesti ja tiedonkeruu samanaikaisesti useista näkökulmista tarjosi paitsi aiempaa

kattavamman kuvan sähköisen terveydenhuollon ja sosiaalihuollon tilanteesta Suomessa vuonna 2014, myös paremmin vertailukelpoisia tietoja kansainvälisesti.

Kunkin tutkimuksen yksityiskohtaiset tulokset on raportoitu kansallisissa ja kansainvälisissä vertaisarvioiduissa julkaisuissa sekä kolmessa suomenkielisessä raportissa. Käsillä oleva koosteraportti on tarkoitettu erityisesti kansainväliselle lukijakunnalle. Tästä syystä raporttiin on kirjoitettu kooste sosiaali- ja terveydenhuollon palvelujärjestelmästä ja keskeisistä sosiaali- ja terveyspolitiikan kysymyksistä sekä tietoa sosiaali- ja terveydenhuollon tietohallintoon liittyvästä politiikka-tasoisesta strategisesta päätöksenteosta ja toimeenpanosta. Tämän jälkeen kuvataan omana lukunaan kunkin osakartoituksen tulokset. Raportti sisältää lisäksi kuvauksia eräistä muista sähköisen sosiaali- ja terveydenhuollon näkökulmista Suomessa ja Suomen suhteesta kansainväliseen kehitykseen. Lopuksi tuloksia tarkastellaan tuoreen SOTE tieto hyötykäyttöön 2020 strategian valossa.

Abbreviations and concepts

Abbreviations

BCP	*business continuity plan*
CDA	*clinical document architecture*
CEO	*chief executive officer*
CIO	*chief information officer*
CIS	*client information record in social care*
DICOM	*digital imaging and communication in medicine*
DRP	*disaster recovery plan*
eAMS	*Electronic archive management plan*
EBM	*evidence-based medicine*
EBMDeS	*evidence-based medicine decision support system*
EDI	*electronic data interchange*
EDIFACT	*EDI for administration, commerce and transport*
EPR	*electronic patient record*
EHR	*electronic health record*
EMR	*electronic medical record*
FinnTelemedicum	*Centre of Excellence for Telehealth at the University of Oulu*
GDP	*gross domestic product*
GPS	*global positioning system*
HILMO	*Care Registers for Social Welfare and Health Care*
HIS	*Health Information System*
HL7	*a set of standards*
ICT	*information and communication technology*
ISO	*International Organization for Standardization*
Kanta	*The short name of the Finnish National Health Information system*
KELA	*Social Insurance Institution of Finland*
NGO	*non-governmental organisation*
NHIS	*National health information system*
OID	*code object identifier code*
PACS	*picture archiving and communication systems*
RHIE	*Regional Health Information Exchange*
R&D	*research and development*
SADe programme	*The Finnish Government Programme for public e-services for citizens funded by the Ministry of Finance*
SFINX	*Swedish-Finnish-Interaction-X-referencing*
SITRA	*Finnish National Fund for Research and Development*
SMS	*short message service*
SOKY	*Query service of KELA's economic benefits*

SSL	*secure socket layer*
STAKES	*National Research and Development Centre for Welfare and Health*
TEKES	*National Technology Agency of Finland*
THL	*National Institute for Health and Welfare*
VPN	*virtual private network*
VRK	*Population Register Centre*
VTT	*Technical Research Centre of Finland*
XML	*extensible markup language*

Definitions

e-health	*use of information and communication technology locally and at distance in health care*
e-welfare	*use of information and communication technology as well as electronic information management in social care*
My Kanta pages	*give Finnish citizens access to their electronic prescriptions, medical records, consent management, living will, and organ donation testament. My Kanta pages are part of the Kanta services*
PHR	*Personal Health Record. A health record where health data and information related to the care of a patient is maintained by the patient. (Wikipedia)*
PKI	*public key infrastructure*
Patient portal	*healthcare-related online application that allows patients to interact and communicate with their healthcare providers [...]on the internet [...] at all hours of the day and night.* Currently the d*efinitions between an EPR, a PHR, and a patient portal are blurring (Wikipedia)*
Usability, user satisfaction, user experience.	
	the ability of the ICTs to have a positive impact on patient care by supporting physicians in achieving their goals with a pleasant user experience. In order to support physicians in their daily clinical work, ICTs need to be compatible with physicians' tasks: the systems should provide the physicians with key (context-matching) functionalities, be efficient (especially in terms of record-keeping and information retrieval), and have intuitive user interfaces. In addition, ICTs should support information exchange, communication and collaboration in clinical work and be interoperable and reliable. Since the clinical ICTs are used in numerous environments, they should also adjust to various user needs and organizational settings. (Viitanen, Hypponen et al. 2011)

For the reader

This report compiles the results of four separate studies, with the aim of producing information on the status and trends of social and health care information services that will support the implementation of the national social and health care information system services, and information system services planning and management in the social welfare and health care organizations. The separate studies were carried out as part of the social welfare and health care information system services Monitoring project (STePS) in collaboration with the Ministry of Social Affairs and Health, THL, the University of Oulu, Aalto University and the Finnish Medical Association.

The four dedicated data collections (surveys) were carried out in early 2014 in circumstances where electronic prescription was extensively used in the public sector, and its implementation to the private sector had begun. Implementation of a national patient data archive in the public sector had just begun. One of the surveys (citizens' experiences) was carried out for the first time. The experiences of physicians had previously been mapped once in 2010, while the use of ICT in social care had been mapped twice (in 2003 and 2010), and in health care four times (in 2003, 2005, 2007 and 2011).

At the time of designing the individual surveys, the OECD was developing a model survey to help member states develop comparable questions in their national surveys. The national survey representatives participated in the OECD model survey development and mapped the model survey questions against the questions of the national surveys with the aim of achieving OECD-level comparability of availability and usage rate measures. In addition, a Nordic e-health Research Network (NeRN) was in the process of harmonizing Nordic data collections (focusing on health information exchange and patient portal availability, usage, usability and benefit indicators) with support from the Nordic Council of Ministers.

As a result of harmonizing the variables and data collection simultaneously within the various indicator domains and also including the citizens' views, it has been possible to gain a more comprehensive overview of the e-health and e-welfare situation in Finland in 2014, as well as to generate comparable benchmarking data internationally.

The detailed results of each study have been reported in national and international peer-reviewed journals, as well as in three THL reports. The present synthesis report is intended especially for international audiences. For this reason, the report contains a description of the Finnish social and health care service system and the main social and health issues, as well as information on social and health information management related to policy-level strategic decision-making and implementation. The report also includes descriptions of a number of other e-health

and social care aspects and benchmarking of the Finnish situation with regards to international development.

There are compelling reasons for monitoring the progress and impacts of e-health. Aging populations, increased demands for service equity and patient expectations, advances in medicine, and low economic growth increase the pressure on health care systems across the world. Health care administrators and policy-makers face major decisions regarding the allocation of scarce health care resources while looking to select interventions that support the high performance of health systems and increase the quality and efficiency of care and services. (Ryan, Doty et al. 2014, Codagnone, C. & Lupiañez-Villanueva, F. 2014) Health policies and priorities differ across countries, but appropriate use of information and communication technologies (ICTs) are expected to improve care, to increase the level of engagement of patients in their own care worldwide, to offer quality health services, to support sustainable financing of health care systems, and to promote universal access (WHO 2013, Adler-Millstein et al. 2013, Scott et al 2008, OECD 2014).

Adoption of ICTs and building of Health Information Systems (HISs) has grown substantially worldwide (Ryan, Doty et al. 2014, Codagnone, C. & Lupiañez-Villanueva, F. 2014, Deidda, Lupiáñez-Villanueva et al. 2013). Rapid technological diffusion has increased the importance of commonly agreed reliable and valid indicators to monitor the adoption and impacts of HISs, to learn from past and current initiatives, and to provide decision-makers with evidence to make informed policy decisions. (Zelmer, et.al. 2016)

In Finland, an amendment of the law on the electronic processing of health care customer data in social and health care 1227/2010 stipulates that THL is responsible for planning, directing and monitoring the use and implementation of national information systems services in health and welfare. In order to understand the context of the results, Chapter 1 provides a description of the Finnish social and health care system, e-health and e-welfare policies and the circumstances of their implementation in 2014. In subsequent chapters, the key results of each of the four studies are presented. The report includes also descriptions of some other aspects of digitalisation of social and health care in Finland. In addition, some references to international e-health benchmarking are made. Finally, the Finnish results are viewed in the light of the new Information Strategy for Social and Health Care 2020.

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Contents

4 PHYSICIANS' USE AND USABILITY OF HEALTH INFORMATION SYSTEMS   98

1 Finnish social and health care system and ICT-policies

Päivi Hämäläinen, Jarmo Reponen

1.1 The Finnish Health and Social Care System

Finland is a sparsely populated country of 5.5 million inhabitants (Statistics Finland 2015a) who live in an area of 303 892 km^2 with an average population density of 18 persons/km^2 (Maanmittauslaitos 2015, Statistics Finland 2015). In the eastern and northern parts of the country the population density is especially low and distances are long. Finland is divided into 317 municipalities. More than half of the municipalities have less than 6000 inhabitants. (The Association of Finnish Local and Regional Authorities 2015) The large number of small municipalities with big responsibilities for providing services is a unique characteristic of the Finnish health and social service system.

The Legal and the economic basis

People living in Finland are covered by the Finnish universal public health and social care system. The constitution states that public authorities shall promote the health of the population and guarantee for everyone - as detailed by an Act of Parliament - adequate social, health and medical services (The Constitution of Finland 731/1999). Municipalities have by law the primary responsibility to organize social and health care services for their residents and they have strong decision-making power when organizing services. Legislation sets out the overall structure for the services provision, as functions of the municipalities, health care centres and hospital districts (Act on Health Care 1326/2010, Act on Primary Health Care 66/1972, Act on Specialised Medical Care 1062/1989). A portion of the publicly funded health and social care services are purchased from private providers. In addition the private health and social care providers have occupational health care and private citizens as their clients. Private health care services are partially reimbursed by the National Social Security Fund when the service is purchased by a private person or organisation. (Ministry of Social Affairs and Health 2015a, Teperi et al. 2009)

Health and social services are mainly funded by general tax revenues. The municipalities have a right to collect taxes. The State participates by paying a general, non-earmarked, subsidy to the municipalities. The subsidy payable to a particular municipality is mostly dependent on the age structure of its residents.

(Ministry of Social Affairs and Health 2015a). The overall funding of the Finnish public and private health and social care system has also other mixed features. (OECD 2012, Teperi et al. 2009) According to the European System of Integrated Social Protection Statistics (THL 2015a), the overall social protection expenditure in Finland amounted to EUR 63.2 billion in 2013. Social protection expenditure equalled 31.3% of GDP (gross domestic product) in 2013. The majority of the costs are due to cash benefits, which include items such as pensions, child benefits and social assistance, sickness, and also maternity, paternity or parental leave. One third of the overall social protection expenditure is accounted for by cash benefits and services for the elderly, and this proportion is rising rapidly. The population of Finland is aging and these demographic changes pose the greatest challenges to the sustainability of the Finnish social protection system.

According to the national accounts of health expenditure and financing, health expenditure in Finland amounted to EUR 18.5 billion in 2013. Finnish health expenditure as a proportion of GDP was 9.1% in 2013 (THL 2015b). In 2013, the cost of secondary and tertiary care accounted for 34% of the total costs and the trend is rising. Primary care represented 17.3% of the total costs, medication 13.0 %, dental health 5.8 %, the private health care sector 5.9%, institutional care of the elderly 3.9 %, and occupational health and student health together 4.7%, and additional groups accounted for other smaller costs. The public sector covered 75.6% of the total health care expenditure in 2013; 24.3% of this funding comes from the State, 37.7 % from the municipalities (local authorities) and 13.6% from the Social Insurance Institution of Finland. The main part of the remaining private funding (24.4% of the total costs) was direct out-of-pocket money paid from households (18.2%). Service charges and the cost of medicines are the main out-of-pocket burden for citizens, since they are not fully covered by reimbursement.

At the end of 2012, health and social services employed a total of 383 497 persons, of whom nearly three quarters (72%) worked in the public sector. Eighteen per cent worked in the private sector and 10 per cent in the third sector (THL 2015c). In this work force there are 20 000 working age physicians, resulting in 3.7 physicians/1000 inhabitants. (Finnish Medical Association 2015)

Primary healthcare and cure

Public primary health care services are either produced by the municipalities themselves, or provided in cooperation with other municipalities or purchased from private or public providers. The municipalities of Finland have alone or jointly formed 152 healthcare centres (Association of Finnish Local and Regional Authorities 2015) that organize primary health care. Healthcare centres are not necessarily single buildings or single locations. A healthcare centre can be defined as a functional unit or as an organisation that provides primary curative, preventive and public health care services to its population. The healthcare centre may also

acquire the services either from other healthcare centres or from the private sector. Vouchers can be used for some services. Some municipalities have contracted a company to organise all the services provided by the healthcare centre. (Teperi et al. 2009)

Healthcare centres offer a wide variety of services: outpatient medical care, inpatient care, preventive services, dental care, maternity care, child health care, school health care, family planning, care for the elderly, physiotherapy and occupational health care. Legislation states the responsibilities of healthcare centres, but does not define in great detail how the services should be provided. (Teperi et al. 2009) The number and type of personnel in each healthcare centre depends on the size of the population it serves and on local circumstances. The staff consists of general practitioners, sometimes medical specialists, nurses, public health nurses, midwives, social workers, dentists, physiotherapists, psychologists, administrative personnel and so on. The inpatient department of a healthcare centre works in much the same way as a hospital department. A typical healthcare centre has 30 to 60 beds. The number of inpatient departments within a healthcare centre varies – large centres have several and can be seen as local hospitals. The majority of patients in these departments are older people and the chronically ill. (Mikkola et al. 2015) However, in remote sparsely populated areas, healthcare centres provide rather comprehensive short-term curative inpatient services for the general population. Municipalities provide long-term care in wards at healthcare centres and non-medical long-term care in institutions for older people. The latter are considered part of social welfare services and are described below.

Alongside the municipal system there are *private and occupational health services.* Private health care in Finland mainly comprises general practice and specialised outpatient care, which are available mainly in the cities. Private physiotherapy and dental services are also common. Physicians can run a practice within a private company or as a stand-alone practice. The total number of yearly reimbursed private health care visits was 10 000 000, of which 3 000 000 were visits to a physician (Social Insurance Institution of Finland 2015). Two thirds of the physicians working in the private sector are specialists or general practitioners, whose full-time job is at a public hospital or at a healthcare centre. One third of the Finnish physicians work part- or full-time in the private sector. (Finnish Medical Association 2014) Patients do not need a referral to visit private specialists at private clinics. Physicians working at private clinics are allowed to send patients with a referral to either public or private hospitals. The Social Insurance Institution of Finland gives some reimbursement to patient for the costs of private care, but the coverage percent is declining (Act on Sickness Insurance 364/1963)

Occupational health care services are provided to the employee by the employer. Legislation (Occupational Health Care Act 1383/2001) enforces only preventive occupation health services, but about 90% of employers also provide at least some curative services that are mostly purchased from the private sector, where

occupational health accounts for about 15% of all physician visits. The Social Insurance Institution of Finland provides partial reimbursement for these visits. (Teperi et al. 2009) Almost 2 000 000 employees were covered by sickness care purchased by employers in 2014. (The Social Insurance Institution of Finland 2015) The State is also a health and social care provider. It provides health care services to the military, the prisoners and two state owned mental hospitals (THL 2015d).

Specialised secondary and tertiary care

In the public health care service system patients require a referral to see a specialist except in a case of emergency. Both public outpatient and inpatient secondary care are provided by hospital districts. Each municipality belongs to a particular hospital district that has a central hospital. Each municipality must be a member of a hospital district. Of the central hospitals, five are university hospitals, which also provide specialised tertiary levels of treatment. Each hospital district organises and provides specialised hospital care for the population in its area. Hospital districts can purchase services for their population from other hospital districts, the private sector or from abroad. Finland is currently divided into 20 hospital districts. In addition, the semi-autonomous province of Åland forms its own district (Ministry of Social Affairs and Health 2015a, Teperi et al. 2009).

A hospital district is an administrative entity. In different hospital districts the central hospital may operate in more than one location and it may be supported by regional hospitals as well. The overall number of specialised care hospitals is between 70 and 90 depending on the definitions used in counting. This includes the five university hospitals, 16 other central hospitals and over 40 smaller specialised hospitals. The range of specialised care varies according to the type of hospital. Hospital districts own most of the public hospitals. Some are owned by other municipal arrangements (one city etc.). The population of hospital districts varies between about 44,000 and 1,580,000 inhabitants (Association of Finnish Local and Regional Authorities 2015) with the exception of Åland with 29,000 inhabitants (Statistics Finland 2015a). By law, hospital districts also have some administrative responsibilities. The provision of ambulance services is a responsibility of the hospital districts. (Act on Health Care 1326/2010, Act on Specialised Medical Care 1062/1989)

There are some private hospitals in the country that mostly provide only beds reserved for short-stay surgery. These hospitals treat about 8 % of the total number of 640 000 patients treated on hospital wards within one year (THL 2015e). The conceptual boundary between public and private hospitals is becoming less clear, since in several cases municipalities have also established private hospitals that sell services to both public (i.e. the municipalities and the State) and private customers, while on the other hand, municipalities purchase public care from many private hospitals.

Social care

The law on social welfare stipulates the social services that municipalities must produce. (Social Welfare Act 710/1982, Child Welfare Act 417/2007, Family Carer Act 312/1992, Act on Supporting the Functional Capacity of the Older Population and on Social and Health Services for Older Persons 980/2012). Municipal social welfare work involves the prevention of social problems, maintaining social security, and supporting people's independent living. Municipalities arrange social services, provide social assistance, grant social loans, organise guidance and counselling on social welfare benefits and other forms of social security, and their use and take responsibility for the development of social conditions and solving problems. However, there are cases where services are arranged by federations of municipalities. Municipalities purchase several kinds of social services from private service providers and non-governmental organisations NGO: s.

Specific pieces of legislation cover different areas of social care. The social services arranged by municipalities include service such as (Ministry of Social Affairs and Health 2015a):
- *Social work:* Social welfare professionals provide guidance, counselling and investigation of social problems and other support measures for individuals, families and communities.
- *Emergency social services:* Handle acute problem situations, such as those involving domestic violence, child neglect or after-care following accidents or crimes.
- *Home services:* Home services provide assistance to older people, people with disabilities, in the event of illness and to families with children to help with coping with everyday life and, for example, in regard to hygiene.
- *Informal care support*: A relative may provide care at home for an older person, a person with a disability or a chronic illness and receive payment.
- *Housing services:* Support may be provided to enable older people or people with disabilities to live at home by arranging for necessary home renovation or service housing.
- *Institutional care:* Provides around-the-clock treatment in an institution for people who would not be able to manage at home using other services. This may comprise long-term, short-term or periodic care.
- *Family care:* This is provided to enable someone in need of assistance and support (such as a child or older person) to be cared for at home and in order to meet their individual needs.
- *Rehabilitation*: All social services involve a rehabilitative approach. Rehabilitative working activities are arranged under municipal social welfare. If a client requires rehabilitation that social services cannot arrange, it is sought elsewhere.

- *Child and family services*: Municipalities arrange child day care, child protection, foster care guidance, child and family advice, family conciliation, paternity checks as well as support to related services, plus conciliation related to child custody and access rights.
- *Services for older people*: Social services required by older people include support for home services and for informal care, and institutional care.
- *Disability services.* People with disabilities mainly use general social services and only when these prove inadequate would they then require special services, such as home services for the home, assistive devices, transport and interpretation.
- *Substance abuse intervention and services*: Preventive work on substance abuse is promoted by spreading awareness on substance free lifestyles. Services dealing with substance abuse provide support, help, treatment and rehabilitation for substance abusers and their family and friends.

One third of social services is provided *by private social care providers or NGOs* (Statistics of Finland 2015c). The majority of services produced by the private providers are financed by the public sector. Finland has over 3000 private social care providers (THL 2011). The most common private social service is assisted-living accommodation for older people followed by home services for older and disabled people. Foster care under child welfare arrangements and institutional childcare are also common private services. At least some private social services are operating in about 87% of the municipalities. (THL 2011)

The State also provides some social care services. At the moment these include special foster care. Mother-and-child homes and shelters will be included in the services organized by the state in 2016. The Institution responsible for organizing these services is the National Institute for Health and Welfare (THL).

Governance and Authorities in Social and Health Care

Prime Minister Juha Sipilä's cabinet began its period in office in May 2015. The programme of the cabinet includes structural reforms, including the reform of health and social care. Digitalisation is also on the agenda. In health and social care the empowerment of citizens is to be promoted. (Finnish Government 2015) The Ministry of Social Affairs and Health is in charge of the planning, steering and implementation of social and health policy and its goal is to ensure that everyone has an equal opportunity to lead a healthy and socially secure life. The Ministry's mission is to promote a healthy, disability-free life, a healthy working and living environment and gender equality, as well as to secure sufficient social and health care services and a decent income at different stages of life. (Ministry of Social Affairs and Health 2015a)

The social and health policy strategy entitled Socially Sustainable Finland 2020 was published in January 2011 (Ministry of Social Affairs and Health 2011). It outlines three strategic choices: The first is a strong foundation for welfare. This includes health and welfare in all policies, longer working careers through wellbeing at work, balancing the various areas of life and sustainable social security financing. The second strategic choice is access to welfare for all. This includes reducing differentials in welfare and health, customer-oriented services, new service structures and operating practices, and a strong sense of social inclusion. The third strategic choice is a healthy and safe living environment, which includes strengthening of viability of the environment and ensuring that society can continue to function under exceptional circumstances. The goals of the strategy can only be achieved through cross-sectoral collaboration. Open preparations and active interaction lay the foundations for a well-functioning cooperation.

The administrative branch of the Ministry of Social Affairs and Health (Ministry of Social Affairs and Health 2015a) includes several independent institutions and agencies that implement the Ministry's objectives in society and participate in Government Programme projects. Some of the independent institutions and agencies produce research data for parliamentary bill drafting and as a basis for social and health policies and decision-making. Some of the government agencies act as licencing and supervisory authorities. In addition, two councillors work in connection with the ministry and there are several advisory committees and boards within its administrative branch. The Ministry coordinates activities in the administrative branch through a management group comprised of the top management of the ministry, agencies and institutions. The ministry signs a four-year performance agreement with several of the agencies and institutions.

There are six *Regional State Administrative Agencies* in Finland; they manage among other responsibilities the health and social care duties of the former State Provincial Offices. The duties of *the Finnish Medicines Agency (Fimea)* include pharmaceutical licensing and monitoring duties, research and development (R&D) and producing and distributing pharmaceutical information to improve pharmaceutical services and the effectiveness of pharmacotherapy. *The National Supervisory Authority for Welfare and Health (Valvira)* is the permit and supervisory authority in the social welfare and health care sector. Valvira guides and monitors the activities of social welfare and health care professionals and NGOs and deals with complaints within the sector in accordance with the division of duties with the Regional State Administrative Agencies. The duties of Valvira further include monitoring that health care equipment and devices comply with requirements as well as promoting their safe use.

The National Institute for Health and Welfare (THL) is an R&D institution whose purpose is to promote the wellbeing and health of the population, to prevent diseases and social problems and to develop social welfare and health care services. The Institute serves decision-makers in central and local government, actors in the

sector, NGOs, the research community and ordinary citizens. It is the official compiler of statistics in its sector and manages the collection and leveraging of the data within its domain. The Institute executes its remit through research, monitoring and evaluation, development, expert opinions, official duties and international cooperation. *The Finnish Institute of Occupational Health* is a multidisciplinary research and expert organisation that promotes occupational health and safety and the wellbeing of employees. (Ministry of Social Affairs and Health 2015a)

The *Social Insurance Institution of Finland (Kela)* is also an important organisation for the health and social care sector. Kela provides basic social security for all persons resident in Finland throughout the different stages of their lives. Kela operates under the supervision of Parliament. The legal status, responsibilities and administrative structure of Kela are defined in the Act on the Social Insurance Institution.

The challenges of the Finnish health and social care system and the ongoing health and social care system reform

Demographic change and globalisation of the economy are changing the operational environment of social protection, while at the same time challenging established practices. Finland's population is aging faster than that of many other countries. Demographic and regional diversification is increasing and the municipal and service structure is in a state of transition since the current structure cannot bear the challenges of the ongoing demographic changes, with urbanisation and an aging population leaving local authorities outside the major cities without working-age taxpayers. Moreover, population mobility, types of working life and forms of interaction between people are changing. Developments in information and communication technology and other technologies challenge the ways in which different functions operate. (Ministry of Social Affairs and Health 2011, OECD 2012)

A health and social care system reform has been on the agenda of several appointed governments. Prime minster Sipilä´s government has a plan to put the new health and social care system into operation by 2019. One of the main targets of the ongoing health care system reform is to reorganise service providers in to larger units such as health and social care provider regions. The aim is a full horizontal and vertical integration of health and social care and the primary and secondary levels of services. (Finnish Government 2015)

1.2 Finnish e-health and e-welfare policies and deployment

The Finnish e-health and e-welfare strategy

The first Finnish national strategy for applying information technology to health care and social welfare was introduced in 1995 by the Ministry of Social Affairs and Health, following the initiation of an information technology development programme during Prime Minister Lipponen's first term in office in 1995 (Finnish Government 1995, Ministry of Social Affairs and Health 1995). The strategy was built around the principle of citizen-centred and seamless service structures. One of the main targets of the strategy was the horizontal integration of services (social, primary and secondary care). Citizens and patients were envisioned as informed and participative actors in the healthcare delivery process. The strategy was updated in 1998, placing specific emphasis on the following targets: adoption of digital patient and client records at all levels of care, combined with nationwide interoperability between distributed legacy systems, and supported by a high level of security and privacy protection (Ministry of Social Affairs and Health 1998). During the past 20 years many plans and efforts have been made to align political visions closer to everyday routine health and social care performance. During this roadmap of implementation, the architecture of the solutions has become clearer and is underpinned by legislation on health care information infrastructures.

The main points of the original strategic visions from 1996 are still up to date, but the information society readiness and technological possibilities to reach the full benefits of e-health and e-welfare solutions has increased. Finland is undergoing a process of health and social care system reform. E-health and e-welfare were identified as an important tool in modernising the system. Thus, the Ministry of Social Affairs and Health upgraded the Finnish national e-health and e-welfare strategy. A wide range of stakeholder groups participated in a process that was finalised by the end on 2014 and 'Information to support well-being and service renewal, e-health and e-social Strategy 2020' (Ministry of Social Affairs and Health 2015b) was published in January 2015. The strategic objectives by 2020 of the six themes of the strategy are described below and a visual summary of the strategy is also given below (Figure 1).

1. <u>Citizens as service users – doing it yourself</u>: Citizens use online services and produce data for their own use and for that of the professionals; reliable information on well-being and services supporting its utilisation are available; and information on the quality and availability of services is available in all parts of Finland.
2. <u>Professionals – smart systems for capable users</u>: Professionals in social welfare and health care have access to information systems that support

their work and its operating processes; electronic applications are in use by professionals.

3. <u>Service system –effective utilisation of limited resources:</u> Client and patient information is accessible to professionals and clients irrespective of changes in organization structures, services and information systems, information management solutions increase the effectiveness and impact of the service system, and the availability and accessibility of the services is improved through electronic solutions.

4. <u>Refinement of information and knowledge management – knowledge-based management:</u> Data sets support the management of service production and decision-making in society in real time and data sets support research, innovation and industrial and commercial activities.

5. <u>Steering and co-operation in information management – from soloists to harmony:</u> The structures for steering and cooperation in the area of information management are clear and support the social welfare and health care service reform

6. <u>Infostructure – ensuring a solid foundation:</u> Interoperable and modular architecture, information security i.e. accessibility, integrity and protection of data, ensuring sufficient data connections and cooperation in development and procurement.

VISUAL SUMMARY

Opportunities

Service innovation
Holistic health and well-being
Prevention
Personalisation and
segmentation of services
Genetics
Big data
Open data
Cross-sectoral cooperation
Evidence on effectiveness

Enablers

Steering and legislation
Comprehensive planning
Open interfaces and standards
Mobile technology
Service-oriented architecture
Cloud services
Ecosystems for development
Security and data protection

Focus on people
Inclusion,
individualised
services and well-being

Smart tools for professionals
Usability, summaries, decision
support and process
management

Adaptable
processes,
support for
high-quality
work and
services

Technology
that supports
personal well-
being and
the system of
services

Refinement of
information,
knowledge-
based
progress and
management

Quality and availability of services, new operating models,
competence, steering and cooperation

Data repositories: national social and health
information, personal health records, high-quality data

Reliable and scalable information infrastructure
for service production and development

Figure 1 Visual summary of the Finnish e-health and e-social Strategy 2020 (Ministry of Social Affairs and Health 2015b).

Digitalisation is one of the themes of Prime Minister Sipilä´s government that came in to office in 2015 after the launch of the e-health and e-welfare strategy. Promoting the implementation of the strategy is well included in the government´s programme (Finnish Government 2015).

The implementations of the first e-health and e-welfare strategy

The first health care project implementing the strategy, with a focus on seamless services, was called 'Makropilotti' (from 1998 to 2001) in the hospital district of Satakunta. In 2001 three new regions were also allowed to start pilot projects. Eighteen regional projects began in 2004. (Ohtonen 2002, Hämäläinen et al. 2005)

'Seamless' was understood to mean a smooth care process when two or more responsible organisations are involved in the care process. Privacy protection regulations, such as the Personal Data Act (523/1999) set conditions on the exchange of information (i.e. patient data) between different register controllers. Running the pilot projects was possible only with the support of a special legislation. The legislation on Experiments with Seamless Service Chains in Social Welfare and Health Care Services was adopted in 2000 (Act 811/2000, Finnish Government 2003). The main focus of the legislation was to build regional information service systems and adapters between existing legacy systems.

Finland carried out the first national e-prescribing pilot programme during 2002-2006. This pilot was stopped because the first system was not technically ready for implementation; however, all the experiences were evaluated and reported on (Hyppönen et al. 2006) and have been exploited in the development of the permanent e-prescribing system.

The interoperability of electronic health records was promoted by a Decision-in-Principle by the Council of State on securing the future of health care. It was issued on 11 April 2002. The document states that 'nationwide electronic patient records (EPR) will be introduced by the end of 2007' (Finnish Government 2002). The National Health Project Programme was launched and an electronic patient record project was included in the programme. The Ministry of Social Affairs and Health formed a working group that produced specifications for the national electronic patient records and their implementation strategy. The working group received funding during 2003-2007 to develop the National EPR (Ministry of Social Affairs and Health 2003 and 2004). The working group also defined the architecture and the common technical structure that should be utilised in every EPR system in all organisations. This included, in addition to the core data, other codes delivered by a code server containing standards for semantic interoperability. The usage of open standards for interoperability, such as XML-based HL7 CDA R2 standards, was also suggested. The work also included national guidelines for the safeguarding of data (informed consent, secure archiving, e-signatures, identification of patients and professionals, documents and organisations with an ISO/OID standard and usage of PKI architecture).

Funding was also given for the implementation of the programme at the regional level from 2004 – 2007. Several regional projects were launched in the hospital districts and municipalities. Many of the projects developed regional e-health information systems, but different architectural solutions were chosen. No solution for the exchange of data between the regions was developed. (Nykänen et al. 2006, Nykänen et al 2008)

The legislative basis for the national infrastructure of e-health and e-welfare

Prime Minister Vanhanen's government, in office from 2007 – 2011 (Finnish Government 2007), supported the previous work on e-health. During his term of office, permanent legislation was laid down to regulate the use of electronic social and healthcare client and patient information. The new legislation came into effect in July 2007 (Act 159/2007). The legislation on handling electronic patient information covers centralised archive services for health care, encryption and certification services, and patients' access to data. The creation of a common national archiving system was at that time expected to promote patient and client care, confidentiality and higher efficiency in healthcare services. The law made it mandatory for all public health care providers to integrate their operations with the electronic archiving system. Private health care units that did not use paper-based archives were similarly obligated. (Ministry of Social Affairs and Health 2006, Reponen et al. 2009) Legislation on the use of electronic prescriptions also came into effect in 2007 (Act 61/2007). The legislation made it mandatory to join the national e-prescription system for all others except solo-practice physicians, who were obliged to do so later.

The Act on electronic social and healthcare client and patient information (Act 159/2007) and the Act on the electronic prescriptions (Act 61/2007) have been subject to many changes during their implementation phase. The changes have been due to both; corrections due to difficulties in the implementation of the original phrasings of the legislation and due to the addition of new services in to the infrastructure. The main new services added are the Patient Summary service and the web based portal that gives direct access to the central services. The latter enables access to services for small services providers and private solo practitioners. Examples of other changes include giving the right for parents to access data on their children. (Act 250/2014, Act 254/2015) A new major service was included in to this legislation in 2015, the 'Kansa-service', which is an extension of the data repository to also include client documents from social services. Currently, an extension to include a personal health record for each citizen is under discussion.

The current Finnish ICT infrastructure for social and health care

The Finnish ICT infrastructure for health and social care is based on legislation from 2007 and all its amendments (Act 159/2007). It includes a national digital repository for patient documents and a national e-prescription database. They are both hosted by the Social Insurance Institution (Kela). The same PKI system is used for both services. It includes strong authentication and a smart ID card for professionals as well as an e-signature. The architecture integrates national services with the different local electronic patient record systems. (Reponen et al. 2009) My Kanta pages for the citizens give access to one's own information in both repositories. Patients can

also access log data on the usage of their data and manage their consents in the My Kanta pages.

Other elements of the infrastructure are the National Code Server and the National Pharmaceutical Database. The main functional responsibility areas have been shared between national actors. Kela is responsible for the technical infrastructure of the e-archive and the national e-prescription database. Kela is also responsible for the National Medication database. Cards for identification of professionals are provided by the Population Register Centre (VRK) supported by information provided by Valvira. Nationally standardised codes and classifications are managed by THL and delivered via the National Code Server. (Reponen et al. 2009, Winblad et al. 2010) The Finnish national e-health and e-welfare infrastructure is shown in Figure 2. More information on the governance of this system is given later in this chapter.
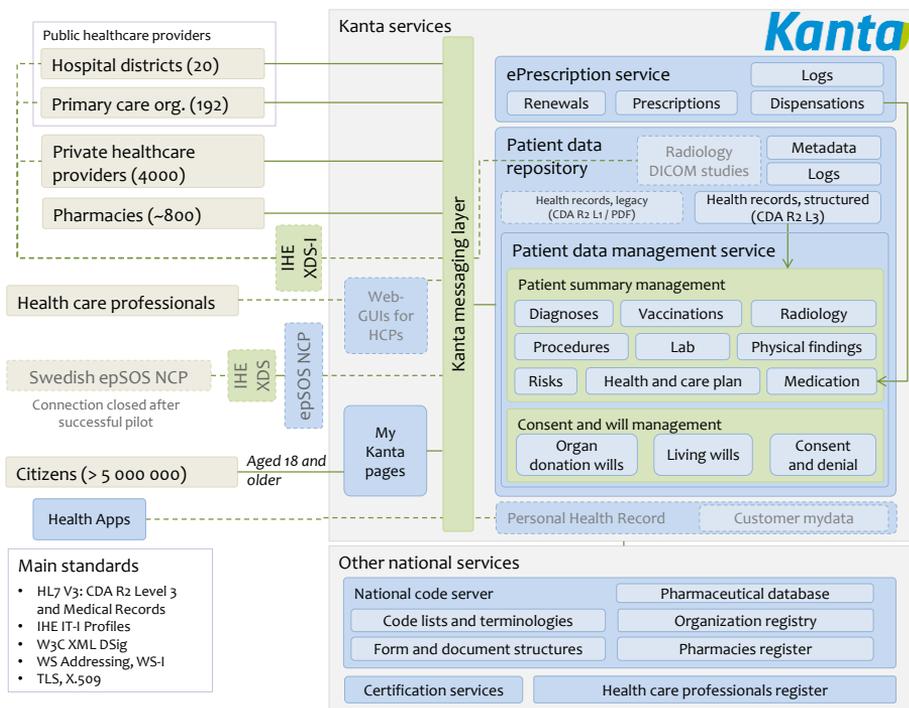
Figure 2 Scheme of the most important elements of the national e-prescription and e-archiving system (Hyppönen K 2012).

The structured electronic health records

The need for structured data instead of prevailing plain narrative text in the patient records was already identified in the Finnish e-health strategy documents in 1998. The electronic patient records project of the National Health Project Programme

2002 – 2007 worked on the common content and structure of the EPRs. The project for the common structures of the EPR was funded by the Ministry, and led by the Association of Local and Regional Authorities. The first 'core data' were defined in cooperation with different interest groups (professionals, administration, software enterprises). They were publicly available to be commented on via the Internet and were later finalised and first published in 2004 and updated in 2009 (Häyrinen et al. 2004, Hartikainen et al 2009). The National Health Project organised a cluster project and a subproject for the implementation of structured core data for EPRs (Nykänen et al. 2006). The Finnish HL7 Association was also active in defining the EPR structures.

The National Code Server was built in 2003-2004. It has been providing the main codes since 2004[1]. In 2007, by law, the task of maintaining the technical code server application was given to the National Social Insurance Institution (Kela) and the task of providing code services (codes and classifications and other contents of the code server) was given to STAKES (1 January 2009, the National Institute for Health and Welfare, THL). The electronic patient records that will be archived in the national electronic patient record archive and the patient summary have to use standardised data structures that are available via the National Code Server. THL is by law the authority responsible for the codes and information structures published in the National Code Server (Act 159/2007, Ministerial Act 298/2009). In 2012 the Ministry of Social Affairs and Health stated, in a new piece of legislation, more precise regulations on which structures have to be used in a standardised form by a certain time (Ministerial Act 11.4. 2012/165). The first core data set including the diagnosis, surgical procedures and laboratory results was adopted into use in 2014 and there is an implementation roadmap for more structures in the coming years. In October 2015, the Ministry of Social Affairs and Health gave out more regulations on the use of standardised structures. The new regulations strengthen the standardisation with a new list of regulated data sets. (Ministerial Act 13.10. 2015/1257)

In addition to the regulated codes, a large list of other codes has been given out from the code server for both regular use and piloting purposes. One important area of this work is structured nursing data. The target of the National Nursing Documentation project has been to create nationally unified and standardised nursing data documentation for the management of the nursing process and for the integration of nursing documentation into the multi-professional patient record. A national working group has worked on a plan to implement the structures nationally (Nykänen and Junttila ed. 2012) However, these structures will mainly not be a regulated part of the national EPR structures before 2020 (Ministerial Act 13.10. 2015/1257).

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[1] www.thl.fi/koodistopalvelu

THL plays a strong role as an authority giving binding orders on the structures of national electronic patient records and national coding systems; no such authority has existed before 2011 in Finland. The attitude of hospital districts and healthcare centres towards this role was elicited in the national e-health benchmarking survey of 2011. At that time the attitude towards this role was found to be positive. (Hämäläinen et al. 2013) The most important stakeholders are the users of the e-health and e-welfare solutions in the hospital districts and the healthcare centres. In 2011 they were asked for the first time in the e-health benchmarking survey (Winbland et al. 2012) how their experts had participated in defining the structures of the national electronic patient records. The response options were 1) participation in expert groups, 2) participation in expert work in virtual group work, 3) participation in workshops, 4) participation by replying to communications and 5) contacting authorities. The same questions were used in the national e-health benchmarking survey of 2014 (see Chapter 2 for methodology). The results and trends are shown in Figure 3. Specialised care experts from hospital districts are the most active participants. However, their activity level has somewhat declined. Private sector experts seem to have most difficulties in finding time for the work in national networks. However, the activeness of the primary care sector and the private sector is increasing for some forms of activities.
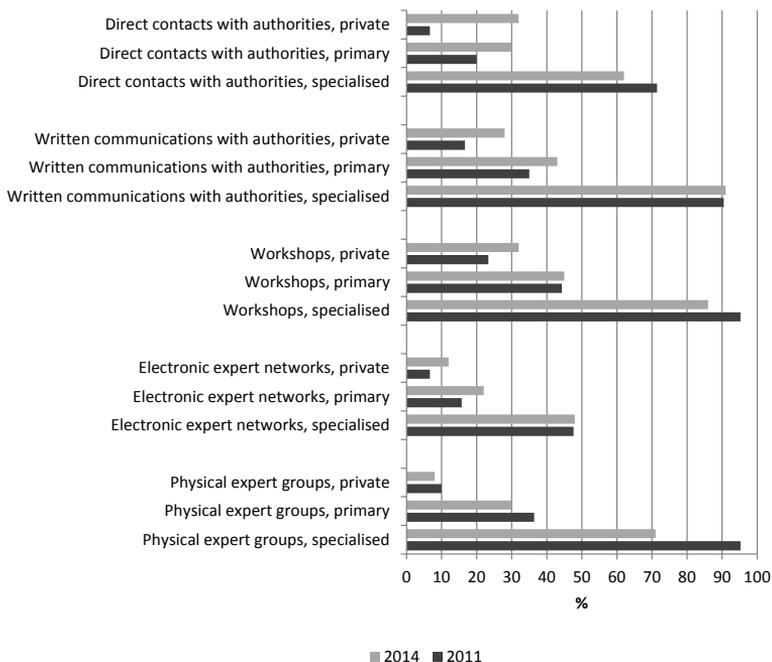
Figure 3 Hospital districts, healthcare centres and private care providers that participated in defining national information structures in 2011 and 2014 (%).

ICT for social services

An e-welfare programme was launched in 2003 as part of the national information society programme (Finnish Government 2003) in order to develop ICT for social services (Sahala 2005). A National Project of ICT in Social Services (named Tikesos) was started in 2005 and ended in 2011. Tikesos was implemented by the Finnish Association of Municipalities, THL, the East Finland Social and Welfare Centre of Expertise and the University of Eastern Finland. The aim of the national development project was to promote the utilisation and interoperability of ICT in social services.

The needs for information in social care production were collected and analysed. The general work flows and the processes of the different social services were modelled with Business Process Modelling Notation (BPMN). Finally a data model and technical specifications were built based on standards like XHTML and RDF/a as well as UN/CEFACT CCTS. The coherent data model for social care consists of core components, specifications of client records and a concept model. Thus the conceptual bases for interoperability were created. All the results and methods of the Tikesos project were published (THL 2015f). Since 2012 the national development of ICT in social welfare has been organised by THL in the Unit for the Operational Management of Health and Welfare Information (OPER). The work has been based on the conceptual foundation that was created in the Tikesos-project. Some sets of defined code structures are available from the National Code Server.

The first legislation on social welfare client documentation on the local and regional level came into effect in 2015 (Act 254/2015). A national social welfare client information repository and other national e-welfare ICT services are under preparation. The first legislative reforms enabling the implementation of such systems were passed in 2015 (Act 255/2015) and more legislation is planned to be offered for Parliament's approval in 2016. The first social service client documents would be archived in the national data repository in 2018. The social services clients would get access to their documents in 2020. The very first documents would not be structured. The level of structured elements would increase gradually. The current situation of the digitalisation of social service client documentation is presented in Chapter 3of this book.

E-prescribing

Most physicians have EPR applications and prescriptions that are produced electronically within the electronic patient record system. The e-prescriptions are sent from the physician's surgery to the national e-prescription repository. All the pharmacies are connected to the repository and are able to access the prescription for purposes of dispensing. The national e-prescription database is hosted by Kela. Finnish e-prescribing is fully integrated with the different EPRs and the centralised

Drug Database; this ensures that the system contains continuously updated knowledge about all drugs prescribed to patients, using highly secured networks (Reponen et al. 2008). The architecture of the system can be seen in Figure 2.

The public health care sector joined the e-prescription service between the years 2011 and 2014. By the end of 2014 all the pharmacies and public service providers with the exception of Åland Islands had joined the service. A big proportion of the private sector providers have also joined, and the e-prescription system is almost fully implemented. By 2017 it will be the only and obligatory way to prescribe and dispense. The web portal for the small organisations and solo-practitioners has to be in operation before that time. During the third quarter of 2015 over 4 million e-prescriptions were dispensed monthly in the pharmacies. Some 95 % of all prescriptions from the public sector are e-prescriptions. Over 3.6 million different persons have received one or more e-prescriptions. (Jormanainen 2015)

Sharing patient documentation in the Kanta services

Joining the national digital repository for electronic patient documents, Kanta services, (Figure 2) is mandatory for all public health care providers. The types of documents to be archived are stated in a ministerial Act; see the topic 'structured EPRs' earlier in this chapter. The private service providers using electronic documentation (Act 159/2007) also have to join the Kanta services. The national architecture consists of local EPRs using common data structures and technical standards, the national repository in which all EPRs and patient summaries are made available online following patients' consent. Data between the central organisations and health care providers are transferred over the Internet via a VPN/SSL-secured connection.

The first public health care providers joined the Kanta national electronic patient record repository in 2013. A total of 97 % (n= 171) of all public health care providers had joined the Kanta e-archiving services by October 2015. By that time 236 683 676 documents had been archived in the Kanta repository. The documents contain information of care of 4.5 million different patients. The first private services providers are expected to join by the end of 2015. (Jormanainen 2015)

Citizen centeredness and electronic services to citizens

The very first Finnish national strategy for applying information technology to health care and welfare was already built around the principle of citizen-centred and seamless service structures. During the first 10 years of strategy implementation, the idea on focus survived, but in practice was not much implemented. (Hämäläinen and Hyppönen 2006) However, some local projects were launched, for example the self-care project in the city of Oulu among others (Winblad and Reponen 2008, Hyppönen et al. 2010). The first national e- health service to citizens is 'My Kanta'

pages in the national Kanta services, which includes giving access to one's own EPR-data, prescriptions-data, log information and consent management. My Kanta pages have been accessible to all citizens in the areas that have joined the Kanta services since 2010. First it contained only data on prescriptions, but today patient documents are also available. A total of 250 000 persons had used their My Kanta pages and it had been accessed 500 000 times by the end of September 2015 (Jormanainen 2015). The first citizen experiences on My Kanta services are described in chapter 5 of this report.

The Cabinet Committee on Economic Policy adopted the government communication dated 3th June 2009 on accelerating the development of the information society. On the basis of this communication the Ministry of Finance established the eServices and Democracy Acceleration Programme (SADe programme) for the term 2009 – 2014 (an extension up to December 2015 was given). The aim of the programme has been to ensure that all key public services will be available through multiple channels, can be easily found, and will support the life situations of citizens or enterprises. The programme has included common public infrastructure projects and sector-specific projects in different administrative areas. Regarding the social and health care sector, national-level e-services for citizens were included in the programme. (Ministry of Finance 2015)

Social and health care sector services entail the generic health and welfare information for citizens including self-health checks and risk tests, a national service provider database with comparisons, and feedback services. In addition national information requirements for interoperability in e-booking, safe e-messaging services and spontaneous feedback were included. The 'self-service' web portal[2] was opened in May 2015. The service had been used by 50 000 visitors by October 2015. The risk tests have been in daily use. The national service provider database with data for comparisons between providers has been open in pilot mode, but remains under development. For example, it is planned to publish the results from three patient satisfaction surveys through the service. It is possible for the service providers to update the basic information on their services directly in to the portal. Information requirements for interoperability in e-booking, safe e-messaging services and spontaneous feedback have been adopted by some local and regional projects. (THL 2015g, THL 2015h, Lindqvist 2015)

The current governance structure of the national e-health and e-welfare infrastructure

At the strategic level, steering of the national e-health and e-welfare infrastructure falls under the responsibility of the Ministry of Social Affairs and Health. The Ministry is supported by the Advisory Board for Electronic Information

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[2] www.Omahoitopolut.fi

Management in Social and Health Care. Operational steering and co-ordination is the responsibility of the National Institute for Health and Welfare (THL) since 2011. The task of THL includes planning, guidance, steering and follow-up of the development of the Finnish e-health system. For this work THL founded a specific unit, the Unit for the Operational Management of Health and Welfare Information (OPER) in 2011. (Hyppönen et al. 2011)

There are many important stakeholders in the development of the national e-health and e-welfare infrastructure. The Association of Regional and Local Governments have an important role in supporting the implementation of the national health and social care information systems. The association has launched forums to support the development of e-health and e-welfare at the local and regional level and is maintaining an ongoing innovative discussion on practical questions between care organisers, providers and the State authorities.

The Ministry of Finance also has a role in the governance of health and social care ICT. The Act on Information Management Governance in Public Administration (634/2011) came into force on 9th June 2011. It is an enterprise architecture approach that enforces and promotes interoperability, standards, descriptions and definitions and the utilisation of common data. The aim of the legislation is to reinforce interoperability of products that are used in public health care (and other public services as well).

Finland and international e-health developments

Finland is an active member of the e-health Network under the directive for cross boarder services. The country has participated and participates in several European e-health projects. In the epSOS project Finland piloted, together with Sweden, the cross border e-presciption (eP). Currently Finland is participating in projects that are working on the development and implementation of the assets created during the epSOS project (Expand, JAeseHN). The discussions are ongoing on the possible participation in a Connecting Europe Facility (CEF) call for a proposal to build a persisting European e-health infrastructure for cross-border care.

Finland participates also in the OECD's work on e-health benchmarking and information infrastructure guidance. Together with other Nordic countries Finland is active in the ministerial working group on e- health under the Nordic Council of Ministers. A Nordic research group is working on Nordic e-health indicators under the umbrella of the Nordic Council. More on this collaboration can be found in chapter 7 of this book.

Activities supporting the implementation of e-health and e-welfare by research and educational institutes and professional organisations

Funding for research and development in health informatics originates primarily from the public sector. Much of the development is funded by the municipalities and private service providers themselves. External funding is provided nationally by the Ministry of Social Affairs and Health, The Ministry of Finance, the Academy of Finland (a science academy), the Finnish National Fund for Research and Development (SITRA) and the semi-public sector (such as the National Technology Agency – TEKES). Resources are also provided by European Union projects or structural funds (Hyppönen et al. 2011). The allocated funds are primarily targeted at pilot projects, innovation and the promotion of e-health applications, as well as at the further standardisation of existing tools.

Research on various aspects of medical imaging and bio-signal processing and analysis is performed at the Aalto University in Helsinki, at Tampere University of Technology, the University of Oulu and the University of Eastern Finland. In addition, a health informatics laboratory operates as part of the VTT Technical Research Centre of Finland (VTT). Considerable research work at international level is undertaken in the fields of bioinformatics and genomics. However, a direct connection of this work to health informatics research has not been established. THL is a research organisation of the Finnish State. It undertakes and co-ordinates research work in the area of e-health and e-welfare with a focus on the impacts of the implementation of legislation and national policies.

Research groups in several Finnish universities cover e-Health and e-Welfare issues. The University of Eastern Finland has an active Healthcare Information Systems Research and Development Unit (HIS R&D). Its activities focus on areas such as electronic health records, personal health information management, enterprise architectures and enterprise modelling, health IT standards, health informatics capacity development, medication management and large-scale public sector ICT initiatives. (University of Eastern Finland 2015a) The University of Eastern Finland also has a Social and health information technology research unit (SHIFTEC). The unit's research primarily addresses the definition of the contents and structures of electronic patient files, evaluation and introduction of information systems, modelling of informatics in the health care sector, information security issues and studies addressing the skills of information system users. (University of Eastern Finland 2015b)

FinnTelemedicum at the University of Oulu is a research and development group for medical ICT applications belonging to the Research Unit of Medical Imaging, Physics and Technology, MIPT (University of Oulu 2015a). Its main focus areas are the development and assessment of new telehealthcare models as well as the evaluation of e-Health applications and health information systems. Its applied research focuses on the clinical and usability aspects of the examined systems.

The University of Tampere has a biomedical technology unit, BioMediTec, a cross-scientific research and educational unit operating at the intersection of biomedicine and technology, which is collaborating with the Tampere University of Technology (University of Tampere 2015a). In addition, the Unit of Information Sciences (SIS) has a research group focusing on Medical Informatics research (University of Tampere 2015b). Operating under the University of Tampere is a research institution called the Tampere Research Centre for Information and Media (TRIM), which has also researched social informatics (University of Tampere 2015c).

The Turku University Unit of Information Systems Sciences has focus on the assessment and evaluation of health information systems, with a specific focus on business processes, revenue models and cost-benefit assessment (University of Turku 2015).

Aalto University, Department of Computer Science and Engineering, also applies research in the field of usability of healthcare IT systems, as well as in user-centred healthcare service design (Kaipio 2011).

Training in health informatics is currently not available as a standalone line of study, except at the University of Eastern Finland, which has offered since 2000 a Master's degree programme in Health and Social Care Information Management. The curricula of undergraduate studies in medicine do not currently include health informatics training, but the need is recognized and universities are preparing changes in their teaching programmes. Until now, the emphasis has been on training healthcare practitioners to acquire the necessary IT skills for their daily tasks. It was the first master's degree programme in the world to be certified by the International Medical Informatics Association. (University of Eastern Finland 2015c)

For detailed studies of practical implementation of e-health and telemedicine, the University in Oulu organises a web-course in a specific virtual learning environment on the theme of 'Basics in e-health'. This course is also provided in English (University of Oulu 2015b).

At the University of Lapland, the Faculty of Social Sciences has organised a Master's degree programme in e-competence in Social Work (SIMO III) (University of Lapland 2015), which combines the disciplines of social work and applied information technology. The aim of the programme is to understand and develop different ways of performing social work, and to utilise IT in social work practice. Students of the programme obtain dual competence: both in social work and in how to use applied IT in social work.

There are two main professional organisations active in the field of health informatics in Finland. The Finnish Society for Telemedicine and e-health (FSTeH) [3] is a national member of the International Society for Telemedicine and e-health (ISfTeH) and the Nordic Telemedicine Association. The Finnish Social and

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[3] http://www.telemedicine.fi/en

Healthcare Informatics Association (FinnSHIA) [4] is a national member society of the International Medical Informatics Association (IMIA) and the European Federation for Medical Informatics (EFMI). Those Finnish associations publish together the Finnish Journal of e-health and e-welfare[5]. The Association of Finnish Local and Regional Authorities [6] also have an active role in networking between Finnish health and social care providers around e-health and e-welfare questions. For more than two decades, all these three associations have organised annual national conferences and special topic sessions in the field of health and social care informatics. These conferences are an important source of continuous education to the personnel in the health and social care sector.

Finnish Medical Association has since 2013 established a special competence for healthcare information technology for Finnish physicians (Reponen et al. 2013). It is a special competence that a medical specialist can achieve on top of his medical specialisation. It brings a competence in, for example, supervising health ICT architecture design from a user perspective, participating in e-health development, or establishing new telemedical services.

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Ministerial Act 298/2009. Act on patient record documentation. Ministry of Social Affairs and Health (Sosiaali- ja terveysministeriö) [in Finnish]. Asetus potilasasiakirjojen laatimisesta sekä niiden ja muun hoitoon liittyvän materiaalin säilyttämisestä
Ministerial Act 11.4. 2012/165. Ministerial Act, Ministry of Social Affairs and Health, on timing of the implementation of the eArchive. Sosiaali- ja terveysministeriön asetus terveydenhuollon valtakunnallisista tietojärjestelmäpalveluista
Ministerial Act 13.10. 2015/1257. Ministerial Act, Ministry of Social Affairs and Health, on timing of the implementation of the eArchive. Sosiaali- ja terveysministeriön asetus terveydenhuollon valtakunnallisista tietojärjestelmäpalveluista

2 Availability and Use of e-health in Finland

Jarmo Reponen, Maarit Kangas, Päivi Hämäläinen, Niina Keränen

The Ministry of Social Affairs and Health in Finland has regularly instructed and followed the implementation of ICT and e-health development in health care. This work has resulted in a series of surveys. A comprehensive survey on the implementation and use of e-health was conducted for the first time in 2003 – 2004 (Kiviaho et al. 2004a, 2004b) and showed the situation prevailing right before the onset of the National Project for Securing the Future of Health Care. That survey was followed by a second survey in 2005 that showed the situation halfway through the National project (Winblad et al. 2006), a third survey in 2007 (Winblad et al. 2008) at the end of the National project, and a fourth survey in 2011 (Winblad et al. 2012) describing the situation at the launching stage of the national health information exchange (HIE) services 'Kanta'[7], which covered electronic prescription, the Patient Data Repository (electronic patient records archive), and My Kanta pages for citizens. The current survey in 2014 (Reponen et al. 2015) is a continuation of the four previous surveys, and was conducted at the time point when e-prescription services had been nationally adopted in public health care and first institutions had started to use the Patient Data Repository.

The methodology involved in the surveys comprised a web-based questionnaire. Questions have been kept as comparable as possible to the questions of the previous surveys, but due to the fast development of ICT in health care, and in order to achieve compatibility with the new indicators based on the OECD (OECD 2013) and the Nordic e-health Research Network (NeRN) (Hyppönen et al. 2013a, 2013b, 2015) indicator development, some modifications were made to the current 2014 survey.

2.1 The 2014 survey structure and comparison to earlier surveys in 2003 – 2011

The survey was conducted as described in the reports of previous national e-health surveys of Finland (Hämäläinen et al. 2009, 2013). A structured web-based questionnaire was distributed by e-mail to all public health service provider organizations, which are municipal healthcare centres for primary health care and hospital districts for specialised secondary health care, and to a sample of private

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[7] http://www.kanta.fi/en/

health care provider organizations. Hospital districts described particularly the situation of their central hospitals. As mentioned in the Section 1.1, the public sector provides about 75% of the health services in Finland.

The questionnaire (English translation in electronic format in http://urn.fi/URN:ISBN:978-952-302-563-9) comprised the following: the identification of the responding organisation and the respondent; questions about the adoptation of electronic patient records systems; systems or applications to transfer/exchange patient information between organisations during care processes and the standards in use for the migration of patient information; methods of authentication, identification, and informed consent of patients; the age of the application, the use of different e-education systems for staff education; the types of human and material resources needed; systems supporting quality control and service delivery; and the adoption of different e-services for patients.

In addition to availability, the intensity of use of the main systems was also inquired about. The intensity revealed the amount (%) of an action or function that was carried out by electronic means. For example, if a service provider used an electronic patient record (EPR) for the documentation of patient data in half of the cases and a paper-based record for the rest, the intensity of use of the EPR was 50%. The questions for hospitals, healthcare centres and private health care providers differed to some extent, depending on the nature of the services they provided.

The questionnaire was sent in March 2014 to all public service providers, including 21 hospital districts and 153 healthcare centres. It was targeted to IT leaders (CIOs) in hospitals and municipalities, parallel to medical directors and chief physicians. The questionnaire was also emailed to a sample of 46 private health care service providers offering medical care. It was targeted to their chief executive officer (CEOs) or medical directors. The contact information for private sector organizations was obtained from a list of 30 of the biggest (by the sales volumes) private health care providers and supplemented with those units that had taken part in the survey in 2011. All organisations were asked to give their answers based on the situation on 31st of January 2014. Reminders by email and telephone were sent to those organisations that had not returned the questionnaire by the first deadline.

The results in this section are mainly presented as a percentage of organisations having the functionality of interest (availability) and as the organisation's estimate of the intensity of use of those functionalities. For hospital districts, the total number of organisations (Ntot) is the number of hospital districts, that is 21. For healthcare centres the total number of organisations (Ntot) is the number of organisations that had answered the questions related to functionality. The results for the private sector organisations are presented as the number of organisations having the functionality out of Ntot, which was 25. A full report in Finnish with a detailed description of the method and all the findings of the survey was published in July 2015 in Finnish (Reponen et al. 2015). Data for the years from 2005 – 2011 are based on previous

reports (Kiviaho et al. 2004a, Kiviaho et al. 2004b, Winblad et al. 2006, Winblad et al. 2008, Winblad et al. 2012; Reponen et al. 2015) if not otherwise stated.

Coverage

Responses to the questionnaire in public health care were obtained from all 21 (100%) hospital districts (Åland included) and from 135 (88%) healthcare centres. The latter figure covers 95% of the Finnish population at primary health care level, and includes primary health care organisations from each of the hospital districts. The response rate is comparable with the previous survey from 2011 (Winblad et al. 2012). The data obtained from public health care organisations can be considered as representative and exceptionally comprehensive, which makes comparison with the previous reports feasible.

Results were obtained from 25 private service providers giving a coverage of 45%. The sample of private service providers is a heterogeneous group including enterprises of various sizes, from conglomerates with hospitals and operative services to small part-time general practices. That is why the results concerning private providers can only be regarded as indicative. However, the results are moderately comparable with earlier results, since 58% of those organizations which responded in 2011 responded also in 2014.

2.2 Electronic patient records in Finland

2.2.1 The Development of the structured EPR

In the 1980s the Association of Local and Regional Authorities designed a set of paper-based health records that became widely used for primary care and specialised care. The municipalities have strong decision-making power in arranging services, including the utilisation of information and communication technology (ICT). When health care providers started adopting the EPR in the 1990s this resulted in different EPR designs in many organisations. The lack of common health record structures made it difficult to exchange EPR information between health care providers.

The need for structured data instead of prevailing plain narrative text in the records was already identified in the Finnish e-health strategy documents in 1998. In 2002 the Finnish government stated in its decision on electronic patient records that 'Nationwide electronic patient records will be introduced by the end of 2007' (Finnish Government 2002). The working group on the EPR strategy (Ministry of Social Affairs and Health 2003, 2004) defined the common semantic and technical structure that should be utilised in every EPR system in all organisations. This included core data and other codes delivered by a code server containing standards for semantic interoperability. The usage of open standards for interoperability, such as XML-based HL7 CDA R2 standards, was also suggested. The strategy also

included national guidelines for the safeguarding of data (informed consent, secure archiving, e-signature, identification of patients and professionals, documents and organisations with an ISO/OID standard and usage of PKI architecture).

The code server was built in 2003 – 2004 and has been providing the main codes since 2004[8]. In 2007, by law, the task of maintaining the technical code server application was given to the National Social Insurance Institution (Kela) and the task of providing code services (codes and classifications and other contents of the code server) was given to STAKES (as of 1 January 2009, the National Institute for Health and Welfare, THL). A large list of other codes has been given out from the code server for both use and piloting purposes. The most often used codes are discussed in detail in Chapter 2.2.3.

The project for the common structures of the EPR began in 2003. It was funded by the Ministry, and led by the Association of Local and Regional Authorities. The first 'core data' were defined in cooperation with different interest groups (professionals, administration, software enterprises). They were publicly available to be commented on via the Internet and were later finalised and first published in 2004 and updated in 2009 (Häyrinen et al. 2004, Hartikainen et al. 2009). Both the legislation and the implementation of the data structure into the existing EPR systems have since been developed further. First, the National Health Project organised a cluster project and a subproject for the implementation of structured core data for EPRs (Nykänen et al. 2006). The Finnish HL7 Association was also active in defining EPR structures. The electronic patient records that will be archived in the national electronic patient record archive and the patient summary have to use standardised data structures. The standardisation work started in 2003 and is still ongoing, but changes to the legislation in 2011 gave THL authoritative power to implement the structures. In 2012, the Ministry of Social Affairs and Health stated, in a new piece of legislation, more precise regulations on which structures have to be used in a standardised form by a certain time. The first core data set including the diagnosis, surgical procedures and laboratory results was adopted in 2014 and there is an implementation roadmap for coming years.

The work on structured electronic patient records has included work on nursing data. The target of the National Nursing Documentation project is to create nationally unified and standardised nursing data documentation for the management of the nursing process and for the integration of nursing documentation into the multi-professional patient record. A national working group has worked on a plan to implement the structures nationally (Nykänen and Junttila 2012) However, these structures will not be a regulated part of the national EPR structures until a few years after 2016 (Ministerial Act 11.4. 2012/165).

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[8] www.thl.fi/koodistopalvelu

2.2.2 The availability and use of electronic patient records

Today, the documentation of patient data in the Finnish health care system is carried out by electronic means. The transition from paper-based to electronic records took place in the late 1990s in healthcare centres and after the year 2000 in hospitals. In 2014 the median of life of the EPR system in healthcare centres was 15 years, which also suggests that the EPR was in use before the turn of the millennium in more than half of the healthcare centres. The progression towards saturation point in the implementation of the EPR can be assessed based on data from repeated surveys since 1999 (Hartikainen et al. 1999, 2002, Kiviaho et al. 2004b, Winblad et al. 2006, Hämäläinen et al. 2007, Winblad et al. 2008, Hämäläinen et al. 2009, Winblad et al. 2012, Reponen et al. 2015). Presently paper-based records serve mainly as an archive of historical data.

In *public specialised healthcare hospitals,* the EPR for narrative texts and additional information has been in use in all of the 21 hospital districts and the availability has thus been 100% already since 2007. The progress since the mid-2000s has been very fast.

In *public primary healthcare centres* the availability of the EPR has already been over 90% since 2003 and the saturation point for EPR implementation with 100% availability was finally reached in 2010.

Among *private health care service providers*, all survey respondents in our samples have reported the EPR availability since 2005 suggesting that the deployment of the EPR has reached saturation point in private health care as well. However, the sample material of these studies does not offer precise information on the smallest offices.

The EPR infrastructure is not uniform but the number of EPR trade names has decreased over the course of time. As of 2014 there were five different EPR trade names in public secondary care and six different trade names in public primary care covering core EPR functionalities. In our sample of private care providers, six different EPR trade names were in use.

As the saturation point for EPR availability was reached in all health care levels, new indicators were required. The *intensity of use* is an indicator that describes the amount of information that is actually utilised only in electronic form. Furthermore, because the stage of development varies between specialised medical care sectors, an additional parameter gives us information on the situation in four main medical responsibility areas in hospitals (conservative care, operative care, psychiatric care and emergency care).

In 2014 the intensity of use in *hospital districts* was over 90% in the responsibility areas of conservative, operative and psychiatric care in 95% of the hospital districts, and in the area of emergency care in 86% of the hospital districts (Figure 1). Compared to earlier studies, further progress in already high numbers has been made. There are now only a few areas where the intensity of use for electronic

data is less than 50%. Interestingly enough, emergency care seems to use slightly less electronic-only information than other areas.
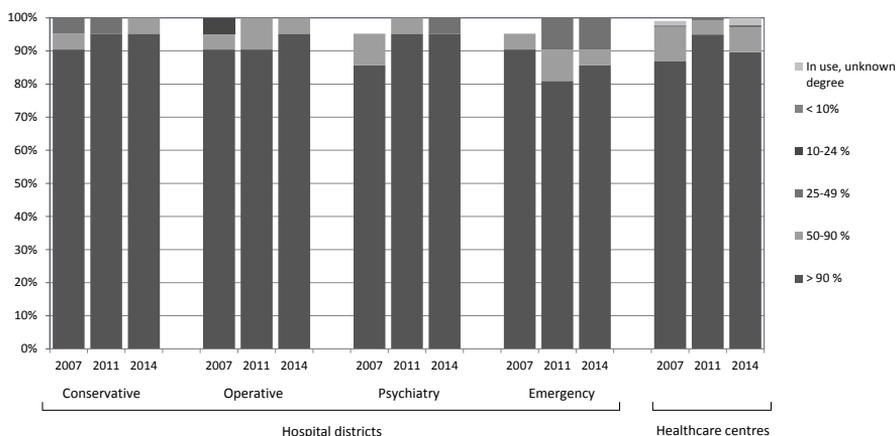
Figure 1 Distribution of public healthcare providers according to the intensity of EPR usage. Hospital districts are shown separately for the responsibility areas of operative, conservative, psychiatric and emergency care.

Due to the long history of electronic records and the uniform nature of primary health care information systems, the intensity of use for electronic-only data was high, which means that 92% of the responding healthcare centres reported that over 90% of patient data in their medical records was only processed electronically (Figure 1). This intensity of use was already at the same high level in the earlier 2005, 2007 and 2011surveys.

In the present survey sample of *private service providers*, 84% reported that the intensity of use for EPR data was over 90%. There has been progress compared to 2011 when 77% of respondent reported a similarly high level of EPR usage.

2.2.3 The usage of structured data-elements in EPRs and other patient information systems

The National Code Service maintains and distributes national code sets, classifications, terms and other datasets used in EPRs and social care client information systems. The National Code Server stores all the common (i.e. official) versions of different core data elements. Electronic patient record products acquire the codes for their own use from the server. Access to the codes is free of charge.

The five most common health care classifications used in EPRs and acquired from the code server are presented in Figures 2 and 3. The use of the major nomenclatures has remained high. Coded data required for joining the national

Kanta services (for example ICPC-2 and Type of risk data codes) have rapidly increased the intensity of use. The most common codes, like ICD-10, the nomenclature for radiological procedures, and the nomenclature for laboratory examinations are used in some form in all health care units, but they are not always or knowingly obtained directly from the code server.
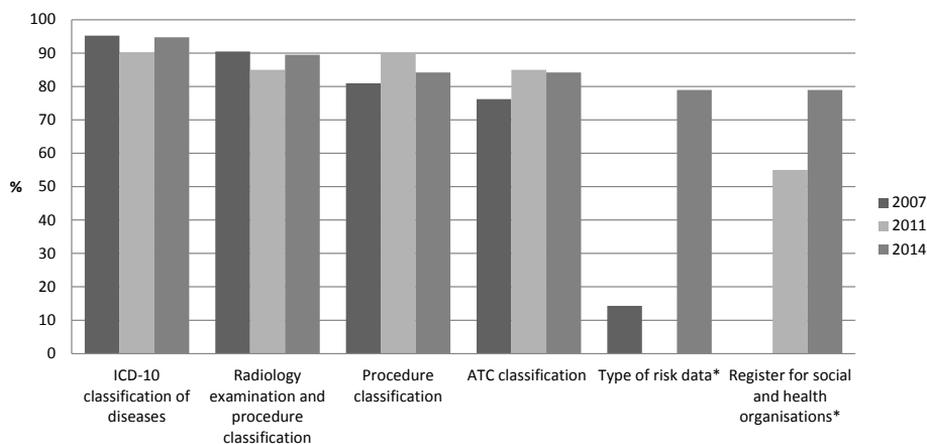
Figure 2 Codes and classifications most commonly used in Finnish public hospital districts. *Type of risk data and organization registry were not asked in 2011 and 2007, respectively.
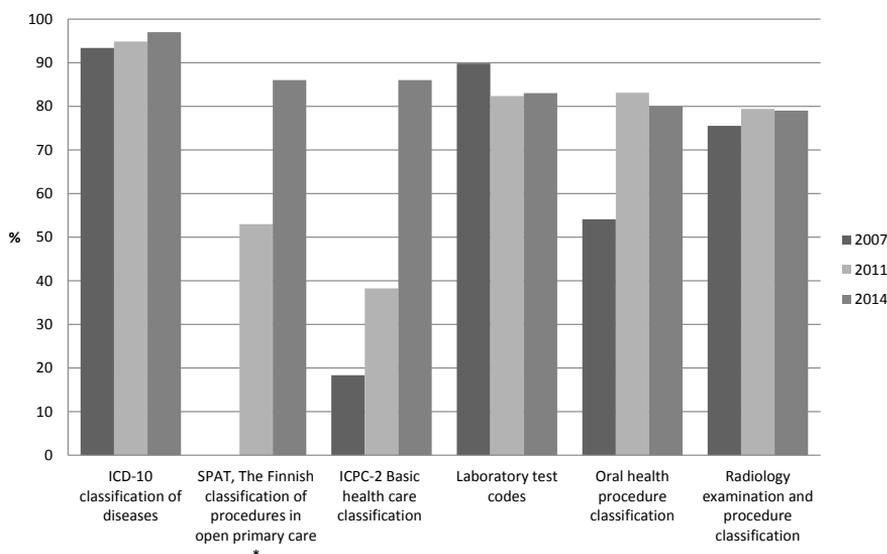
Figure 3 Codes and classifications most commonly used in Finnish public primary healthcare centres. *SPAT classification was not asked in 2007, and is estimated by the number of AvoHilmo users in 2011.

In 2014, 95% of the hospital districts and 93% of the healthcare centres reported that they used electronic nursing documentation. Of the responders, documentation was structured in 85% of hospital districts (76% in 2011) and 90% of healthcare centres (56 % in 2011). Thus there has been a modest increase in structured nursing documentation, especially in primary healthcare, since 2011.

2.3 Intra-organisational auxiliaries of EPR

2.3.1 Wireless usage and speech recognition

The auxiliaries of the EPR refer to the various systems and functions that support data and information management by health care professionals. *The wireless use of the EPR* refers to the mobile documenting and browsing of patient information, which make work in wards and emergency/casualty units smoother and more effective. All hospital districts had wireless access to the EPR within the institutions already in 2011, and in 2014 a total of 81% of the hospital districts had extended wireless EPR access outside of the hospital environment e.g. for doctors on call (33% in 2011). Simultaneously, 90% of the hospital districts provided wireless access to medical imaging outside the hospital (67% in 2011). In 84% of healthcare centres, bed wards had wireless access to the EPR in 2014, which is in the same level as in 2011. In 43% of these healthcare centres (31% in 2011), wireless EPR usage was available also for doctors on call, and in 9% of the units medical images were also available. In our sample of private service providers, five out of 24 respondents had wireless use of the EPR within the institution and four outside the institution. Altogether, wireless usage of the EPR has increased considerably compared to the situation three years earlier.

   Mobile terminal devices are one of the enablers for increasing wireless EPR usage. In 2014, 57% of the hospital districts were providing a tablet computer to their physicians and 24% of the districts used them for EPR access. In healthcare centres, 18% were providing a tablet computer for physicians but only in two cases was EPR access possible. Among our sample of private service providers, a tablet computer was available in 5 organisations and two of them mentioned EPR access. The median value of doctors having a smartphone provided by either the hospital district, or healthcare centre or private healthcare provider was 28%, 10% and 5% of the total amount of its doctors, respectively. Remote access to the EPR via a smartphone was not possible in public health care, but one private provider reported such a capability.

   A speech recognition system for digitally dictated doctor's notes produces written documents almost instantly and enables the health care professional to immediately check whether the document is correct. The main benefit is the faster delivery of the test results or doctor's notes to other members of the care team. The use of speech recognition had become more widespread even though the speed of progress has

been slow. Such systems were in use in 52% of the hospital districts and in 10% of the healthcare centres while three years earlier the figures were 42% and 9%, respectively. In our sample of private service providers (N=23), six of them reported a speech recognition system while the figure was two in 2011. The most often reported speciality using speech recognition in all sectors was radiology

2.3.2 Picture archiving and communication systems

Picture Archiving and Communication Systems (PACS) started to develop in Finland after the implementation of the DICOM (Digital Imaging and Communication in Medicine) standard in 1995, and the first filmless hospitals emerged around the year 2000 (Reponen 2004).

The adoption of PACS and teleradiology in everyday practice is high in Finland. Adoption started gradually as early as 18 years ago, while the availability of PACS in Finnish *public hospital districts* has been 100% already since year 2007. Moreover, since 2007, all hospital districts have been reporting the highest intensity of use category in the surveys with over 90% usage of digital medical images alone. None of the hospital districts reported any film imaging in the present 2014 survey. This comprehensive adoption of PACS by the hospital districts forms a solid basis for regional and later for national archiving of medical images. The PACS archive life is 10 years or more in 76% of the hospital districts, so digital comparison images are in most patient cases readily available. There are currently seven different trade names in the Finnish hospital PACS market.

According to the responses PACS was in use in 99% of the 132 *public primary care healthcare centres* that answered the question (Figure 4). The saturation point of PACS availability has been clearly reached, as only one healthcare centre reported that they did not have PACS, while in 2011 there were seven such cases. Most of the healthcare centres, 92%, utilised a common regional PACS with the hospital district and 8% had their own PACS. This increase in the availability of a regional PACS is remarkable compared to 2011 when it was reported by 76% of healthcare centres. The intensity of PACS use has also increased, 91% of the healthcare centres that responded reported over 90% usage rate, compared to 77% in 2011. Conventional film was still used in 16% of the healthcare centres that responded, mostly for dental x-rays except in one case where ordinary x-rays were also made. Four different trade names were reported as vendors for those PACS that were owned by the healthcare centres themselves.

In the sample of *private service providers*, 19 of the 22 providers that answered this question had PACS in use. In 2010, the figure was 16 out of 30, and in 2007 nine out of 28, so one could estimate that the use of PACS has increased also in the private sector. In the present survey, over 90% intensity of use for PACS was reported by 13 out of the 22 private service providers. There were seven different PACS vendors mentioned in the private sector.

The growth rate of PACS usage in Finland has followed the general adoption of the electronic patient record systems (EPR). This is only to be expected, since the full utilisation of PACS requires the distribution of images to end users. This was not possible before the installation of EPR systems, at which time wards were equipped with sufficient computer terminals. The tight integration of images with narrative texts in the EPR – and not only with RIS (radiological information systems) – has been one of the key aims of the development. In most cases, images are very successfully embedded into the EPR interface.

2.3.3 Radiology and laboratory information systems

A *radiology information system (RIS)* is a software entity for controlling the functions of radiological units. A RIS includes referral letters and appointment orders; it manages patient visits, transfers workflows and patient data sent to the radiological equipment, keeps a record of stored examinations and files radiologists' reports; it also manages the data for the statistical reports of the radiological unit. The complexity of various RIS solutions varies, as does their integration into the EPR.

A RIS was in use in all of the 21 *hospital districts* for all their radiological examinations. This 100% availability was already reached in the 2007 survey and the intensity of use was also in the highest over 90% category, because RIS was used practically in all examinations. Most of the hospital districts have already acquired a second-generation RIS in order to achieve seamless integration with EPR and regional services. There are five major RIS vendors in the Finnish specialised care market.

Among *healthcare centres* 90% of those that answered the question reported that they had a RIS in use, while the figure was 56% in 2011 (Figure 4). The utilisation of a RIS has thus increased steadily in primary care. Further analyses showed that most of the healthcare centres now used the RIS of their hospital districts. This situation has changed from the previous survey in 2011, when healthcare centres still had a RIS of their own. This enhances the fact that medical imaging in Finland is now a regional service.

In *private health care*, 40% of the respondents reported they had a RIS system in use and its reported usage has increased since 2011. In practice, all the private users of PACS (87% of the sample) most probably used RIS functionalities embedded in their systems, since it is a prerequisite for electronic archiving.
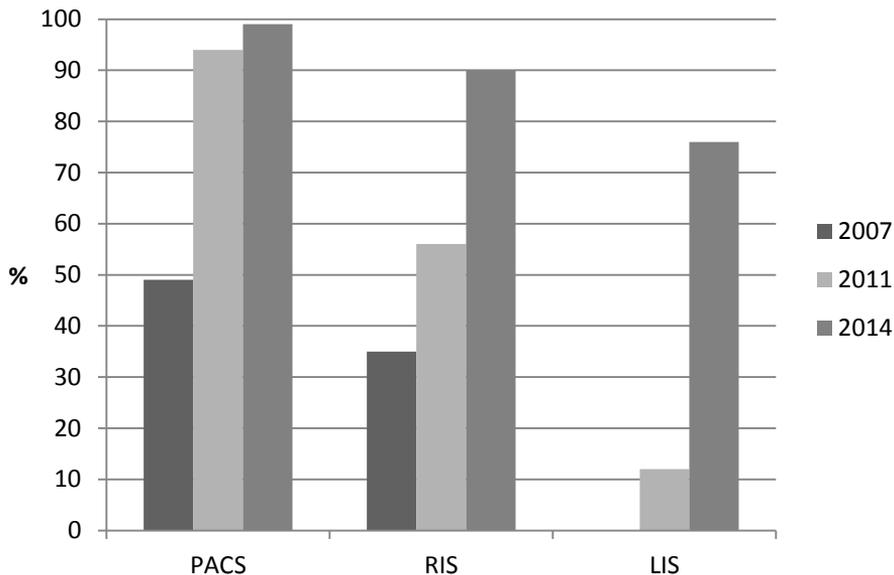
Figure 4 Availability of PACS, RIS and LIS in Finnish public primary healthcare centres.

A *laboratory information system (LIS)* is a software entity controlling the process of ordering laboratory tests electronically, identifying patients and controlling the equipment as well as sending the test results electronically back to the ordering physicians. The systems also give guidance for the use of the tests and statistical information about the test usage and performance of the laboratories. Today, it is essential to link the systems seamlessly with the EPR and present the results also through remote databases.

All of the 21 *hospital districts* (100%) used a LIS, which was already the case in 2007. There is currently a transition towards regional laboratory service providers that cater more than just one hospital district. There were four different trade names for a LIS in the hospital sector.

In *primary care healthcare centres*, 76% announced that they had a LIS in use, while the figure was 12% in 2011 (Figure 4). A LIS was provided by the hospital district in 69% of cases, by the regional laboratory service provider in 22% of cases and owned by the healthcare centres themselves in 9% of cases. In the *private sector*, a LIS was reported by 10 service providers out of the 21 that responded.

2.3.4 Digital ECG

Digital electrocardiogram (ECG) is the most important biosignal data used in everyday medical practice. It is essential in local patient care on wards and in outpatient clinics and emergency rooms, and it carriers important patient information when patients are transferred between institutions. For cardiac

emergencies, an ECG is necessary in order to initiate immediate treatment in ambulatory situations. Until recently, the lack of an agreement on a common standard has slowed down the implementation of digital ECG. If the ECG signal is not in digital format, it cannot be shown within the EPR, stored for later comparison or transmitted to another institution electronically. However, in 2014 86% of the hospitals districts, 80% of the healthcare centres and 39% of our sample of private providers had digital ECG in use. There has been a considerable increase in these figures since 2011. There is still a variation in the standards used, with the DICOM standard or a manufacturers own standard being used most often in hospital districts, while manufacturers own standard was most popular in healthcare centres, and a PDF format being most popular in our sample of private service providers. The difficulty of transferring ECG data from ambulances to hospitals has been discussed in a previous paper (Winblad et al. 2007); in the latest 2014 survey 71% of the hospital districts and 28% of the healthcare centres used electronic transmission between ambulances and health care units. Our survey did not show, how the standards used in this transmission compared with the standards used for ECG within institutions. All in all, there are still shortcomings in interoperability between institutions, as seen in Table 1:

Table 1 Availability of digital ECG and its data formats in hospital districts, healthcare centres and the private sector in 2011 and 2014

| | | Digital ECG in use (%) | % of users use this standard | | |
			DICOM	Another or manufacturer's standard	PDF format
Hospital districts	2014	86	50	50	22
	2011	57	25	67	17
Healthcare centres	2014	80	38	45	10
	2011	69	24	61	14
Private providers	2014*	39	20	20	60
	2011**	19	25	25	50
ECG standard only named by *10;** 8 organizations					

2.4 Exchange of electronic patient information between organisations

When technical possibilities first emerged in the late 1990s, two different lines of development started to emerge in the exchange of electronic patient information between organisations. Once technology enabled bilateral and regional networking, the organisations and regions started to define common structures for e-documents so as to enable exchange (teleradiology, e-referral letter, e-discharge letter, e-laboratory results) at the local level. When the construction of information networks

became technically viable, a government-supported project called 'Makropilotti' established ways of reading the EPRs kept by another organisation with the patient's consent (Ohtonen 2002).

The exchange of electronic patient information between providers of health services necessitates the use of networks with high data security, which can be actualised through different kinds of intranet solutions or secure internet connections. This inter-organisational data exchange is common in Finland thanks to the fact that digital data repositories in individual health care institutions are in active clinical use, and protected data connections enable the communication of electronic patient information.

Some terms need to be defined before discussing the many different and yet at the same time partially overlapping forms of data exchange. Firstly, point-to-point services like *electronic referrals* are basically sent to another institution in order to transfer the responsibility for patient care. *Electronic discharge letters* are then returned to the sending institution once the patient's treatment is completed. Instead of a referral, an institution may send an *electronic consultation letter*, if neither responsibility for the patient nor the actual patient is transferred, but professional advice for treatment is sought or professional opinions are given. There are special cases like *teleradiology* that can be used not only for consultation but also for information distribution; the same applies also to *telelaboratory services.*

The second main type of services, *regional patient data repositories* or *regional health information exchanges (RHIE)* can serve many purposes: they can provide a source of reference information for past treatment, a basis for current patient data distribution in a geographically distributed health care environment, as well as a data repository for consultation services and workload distribution. In many cases, RHIEs contain more than just one type of data. They can include e.g. narrative EPR texts, patient summaries, imaging and laboratory data. They can also provide citizens with a common access point to their health care data. In normal medical practice, all the various forms of data distribution described above complement each other.

The principal difference between messaging services (referrals) and health information exchange is that the former is mainly used for a specific purpose with a defined information package while the latter can be used on an ad hoc basis but has no connection to a specific patient case and requires more user interaction when selecting the appropriate data.

For collaboration between primary and specialised health care, the most important messages in use today are still referral letters, consultation letters, and feedback or discharge letters. In addition to a narrative text, the letters can include the results of laboratory tests and radiological examinations. When primary care and secondary care are within the same administrative organization or when they use a common information storage infrastructure as enabled by the 2011 law (Health Care Act 1326/2010), the traditional concept of referrals can be seen to be changing, as

discussed in the results of this chapter. The Finnish national health information services (Kanta services), which will modify the health information exchange even more in the future, are discussed in other chapters.

2.4.1 E-referral and e-discharge letters

The e-referral letter is a course of action by which the referring physician, usually a general practitioner, drafts a message with the intention of transferring a patient and the responsibility for care to a hospital. The role of hospitals in this kind of collaboration with healthcare centres is to receive referral letters, to provide a letter showing the treatment and to give feedback in a discharge letter.

This e-referral service was in 2014 *available* in 86% of the 21 *hospital districts*, while in 2011 the number was 95%, in 2007 90%, in 2005 76% and in 2003 only 48%. Those hospital districts that are no longer receiving e-referrals have developed alternative forms of collaboration through a common EPR for primary and secondary care.

A total of 91% of *healthcare centres* were able to send electronic referral letters to specialised health care in 2014. The figure has been at the same high level since 2011, although reflecting a slight drop in absolute numbers due to alternative means of information exchange, as is the case with hospital districts (Figure 5).

Only one *private service provider* received electronic referrals both from public primary and secondary care. Additionally, two private service providers received referrals from public primary care and two from public secondary care. In 2011, no private service provider had this type of electronic connection with public health care. Seven private service providers sent electronic referrals to other private care providers and eight sent them to public secondary care (hospital districts). This electronic messaging between private and public care had increased since previous surveys.
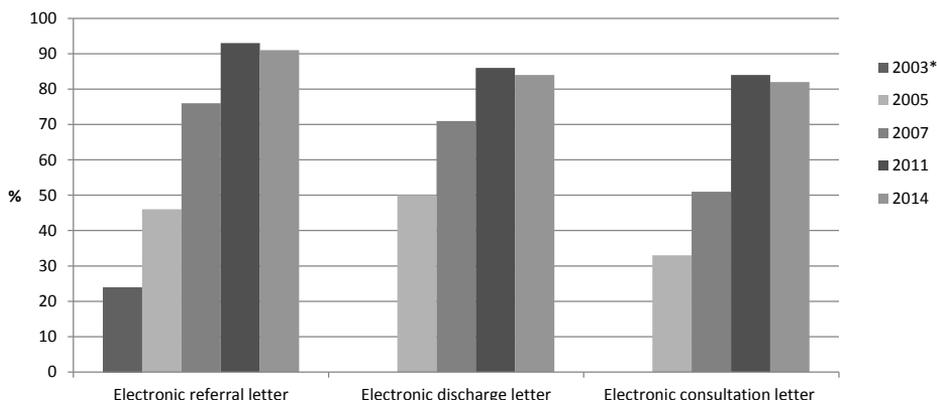
Figure 5 The distribution (%) of healthcare centres using electronic referral letters, electronic discharge letters and electronic consultation letter in 2003, 2005, 2007, 2011 and 2014. (*The proposition of electronic referral letter usage in 2003 is derived from all healthcare centres participating in that survey.)

The *intensity of use* of the electronic referral service in hospital districts has remained at a high level since 2011 (Figure 6). In 2014, as many as 76% of the hospital districts informed that the intensity of use for electronic referral and discharge letters had exceeded 90%. The intensity of use was somewhat lower in psychiatry than in other (somatic) specialities.
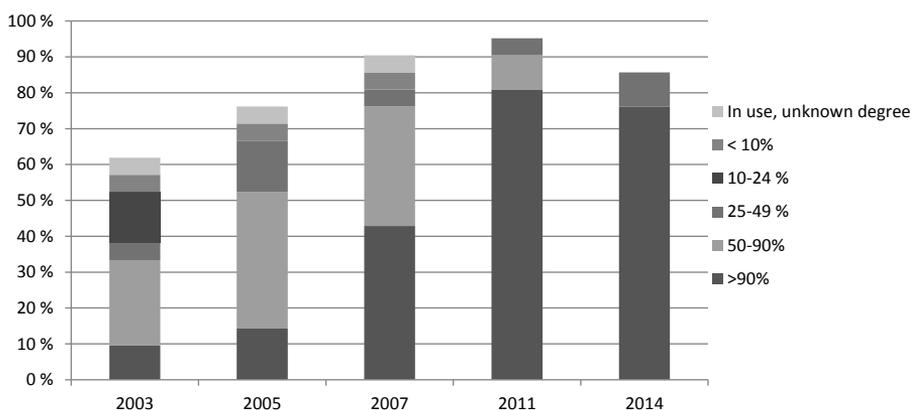
Figure 6 The intensity of use of electronic referral letters and discharge letters in the hospital districts in 2003 – 2014, somatic specialties.

The intensity of use of the electronic referral service in the public healthcare centres parallels the high figures of the hospital districts. More than 70% of the healthcare

centres reported that their intensity of use exceeds 90%. These figures have remained at the same level since 2011. (Figure 7)
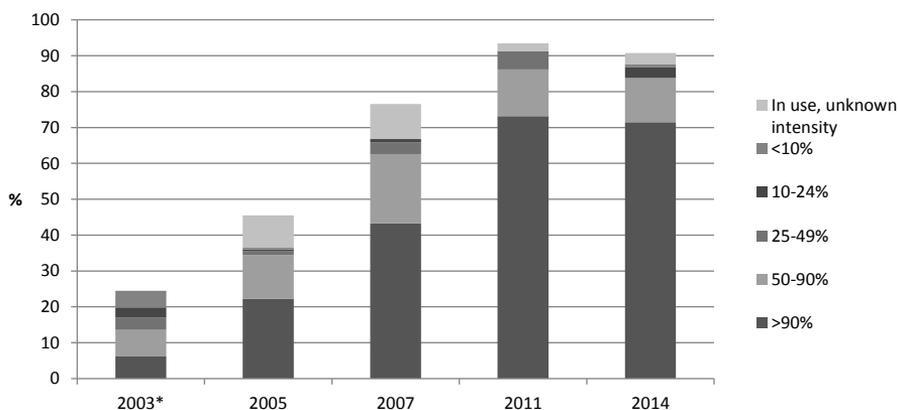
Figure 7 The intensity of use of electronic referral letters in public primary healthcare centres in 2003-2014.

After a patient's visit to an outpatient department or bed ward, the hospital mails a *discharge letter* or a feedback letter to primary care, that is to the healthcare centre concerned. A total of 86% of the *hospital districts* sent electronic discharge letters (90% in 2011) and 84% of the *healthcare centre*s (85% in 2011) were capable of receiving them. The minor decrease in availability might reflect the fact that some regions have adopted a common EPR since the previous surveys and a separate discharge letter is now not considered necessary. The intensity of use for discharge letters was at the same level as in 2011, in 48% of the hospital districts it was over 90% and in 29% of the hospital districts it was still between 50% and 90%.

Four of the 25 *private health care service providers* in our sample both sent and received electronic discharge letters from another healthcare organisation, while one additional provider had only a sending capability and another only a receiving capability. The private sector were engaged in these activities more than in 2011.

Treatment and care in a hospital bed ward can continue in the bed ward of a healthcare centre. In these kinds of cases a *document of nursing* is attached to the discharge letter. This nursing information was sent electronically by 38% of the hospital districts to primary care, with this availability remaining at the same level as found in the previous survey.

2.4.2 Electronic and remote consultations

The *consultation letter* is a mode of action by which a physician, e.g. a general practitioner, drafts a letter with the intention of obtaining a specialist's advice or opinion concerning the treatment and care of a patient. The responsibility for care is not transferred to the consultant. The consultation letter is a more developed way of

collaboration between primary and specialised care than conventional referral. This is because it better exploits the functionalities of electronic information exchange, such as flexible negotiations, between the physicians before decisions are made.

Electronic consultations in somatic care (excludes psychiatry) were offered by 86% of the *hospital districts* and the service had become more widespread since the previous surveys (67% in 2011, 52% in 2007 and 38% in 2005). This mode of action was used by 82% of the 130 *healthcare centres* that answered this question. It has not changed remarkably from previous survey in 2011 (91% of the 129 that answered then), with most of the progress already taking place by that time. (in 2007 electronic consultation letters were used by 55% of the 199 healthcare centres and in 2005 by 34% of the 179 healthcare centres that responded to this question). Also the intensity of use among the users has remained in the previous high level. Most of the progress was seen between the 2007 and 2011 surveys (Figure 8). Five private service providers in our sample of 25 informed that they are able to receive electronic consultations from public primary healthcare.
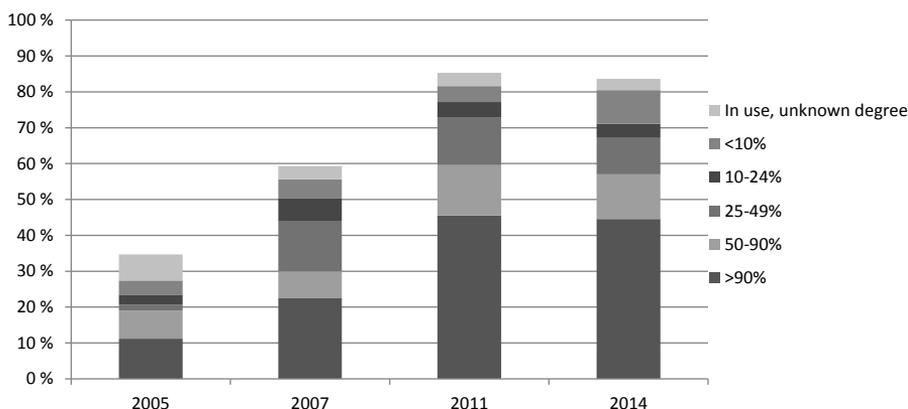
Figure 8 The intensity of use of electronic consultation letters in public primary healthcare centres in 2005-2014.

Consultations via videoconferencing between healthcare centres and hospitals are held according to the following procedure: At the healthcare centre, the patient, the general practitioner and the nurse attend the video session. In the hospital a specialist accompanied by a nurse gives the consultation. The percentage of hospital districts using videoconferencing was 67%, while the figure was 52% in 2011, 67% in 2007 and 48% in 2005. In general, availability seems to have increased rather slowly, although all those using video had done consultations within the three months (61%) prior to the survey date. A total of 35% of healthcare centres used video consultations and this availability figure has increased from previous surveys (19% in 2011, 17% in 2007 and 12% in 2005). 62% of the respondents had used videoconferencing during the last three months before the survey date. Most often

the video consultations were used in the psychiatric speciality, but it was also used in child psychiatry, dermatology, surgery, internal medicine, diabetic care, geriatrics, paediatrics, otorhinolaryngology, oncology and neurology. Similarly, during the period of the present survey three of 25 *private healthcare service providers* mentioned teleconsultation services via videoconferencing, which remains at the same low level as in 2011.

Electronic referral letters, consultation letters and teleconferencing are means of transferring patient-identifiable data. In addition, a primary care physician can consult a specialist *by e-mail about a patient's case without identification.* This function was used in 2014 by only 5% of the *hospital districts* while the figure was 14% in 2011 and 38% in 2007. This decrease in the use of unidentified data was probably due to greater efficiency when using electronic consultation letters with a patient ID or other means of consultation directly through the EPR systems. Additionally, 8% of *healthcare centres* were users of this type of unidentified consultations, the amount being the same as in previous studies. Among the 25 *private service providers*, three used consultations without patient identification, which also remains at the level as in 2011.

2.4.3 Regional data exchange systems

Many healthcare organisations and institutions make use of regional patient data repositories or a specific RHIE for exchanging patient data. This on-demand type of data retrieval has become possible because of high-speed public communications networks and secure communication channels like virtual private networks (VPN). A typical usage scenario is when previous patient information or test results are needed in an outpatient consultation or when long term conditions are treated by a virtual team of several care providers.

According to this year 2014 survey, 90% of the 21 *hospital districts* have a specific regional patient data repository in clinical use, which is close to the figures in two previous studies (86% in 2011 and 81% in 2007). The main development took place after 2005, when the figure was only 42%.

A very important step forward since the last survey in 2011 has been a law (Health Care Act 1326/2010) that allows public health care to build common patient registries for specialised care (hospital districts) and primary care (healthcare centres) in each of the regions. The patient is informed about their existence, but the personnel involved in patient care can use them, if a need arises. Since a specific consent from an informed patient is no longer needed for every single case of information retrieval in patient care, the usefulness of regional patient data repositories has increased.

There is no single technical solution for accessing these regional data repositories, though the on-demand viewing had been arranged in different manners and three main categories could be identified in hospital districts:

1) The *master patient index model* was in use in 10% of the hospital districts. Each has a centralised reference database of available selected information archived by customer organisations. Authorised users can then use these references as a link to the original data and have access to those selections in the customer organisations. The content of the original selected data include e.g. core narrative texts, digital x-rays and laboratory data. Depending on the data type, it can be viewed with user software or specific viewers

2) The *web distribution model* was used in 14% of the hospital districts. Authorised users can have full access to a web-based electronic record of patient data when situated in a secondary care unit. That includes all texts, radiological results and laboratory data that a patient has authorised for the treating physician to see. As this data is distributed online, no special viewer (except for radiological images) is needed, only a secure browser connection.

3) *Regional sharing of integrated electronic patient data* was utilised in 67% of the hospital districts as their principal regional data repository. In this most popular model, the physician has direct access to the EPR data kept by another institution in the region (virtual common database) or stored in a real common database. That includes all the texts, images and laboratory data. In this model both the viewer and the provider use the same proprietary EPR software.

Interestingly, 10% of the hospital districts mentioned that they additionally used another regional data repository in their area, meaning that the users had to select between two systems depending on the data source needed. This diversity was reflected in the answers of the healthcare centres, respectively. Depending on their EPR brand, they could have been connected to a different primary care repository. Then they could use another RHIE with the hospital district.

Finally, even those 10% of hospital districts that did not have a formal regional data repository had nevertheless developed alternative means of distributing imaging and laboratory data and 5% an alternative way to exchange core text data with the healthcare centres in the region.

When it comes to the content, regional patient data repositories or RHIE can exchange many different types of patient data, from images to bio signals, but their primary function has been the exchange of narrative texts. According to this survey, the regional exchange of narrative texts, including delivery, receiving and remote reading, was being set up through their RHIE in 86% of the hospital districts, that of laboratory results in 81%, that of radiological images in 48% and imaging statements (reports) in 86%. The figures for 2011 were 86%, 86%, 71% and 86%, respectively. Especially for laboratory services and medical images alternative solutions have emerged as will be discussed later.

In summary, if one counts up all the different means of distributing patient information on-demand regionally (RHIE, separate imaging and laboratory databases, other means of delivery), 95% of the hospital districts are capable of distributing text data while 100% of the hospital districts are capable of distributing

imaging data (both images and reports). This high level of regional health information exchange services was achieved by the time of the last survey in 2011 and has even improved for text exchange. The development between the years 2003 – 2014 is shown in Figure 9.
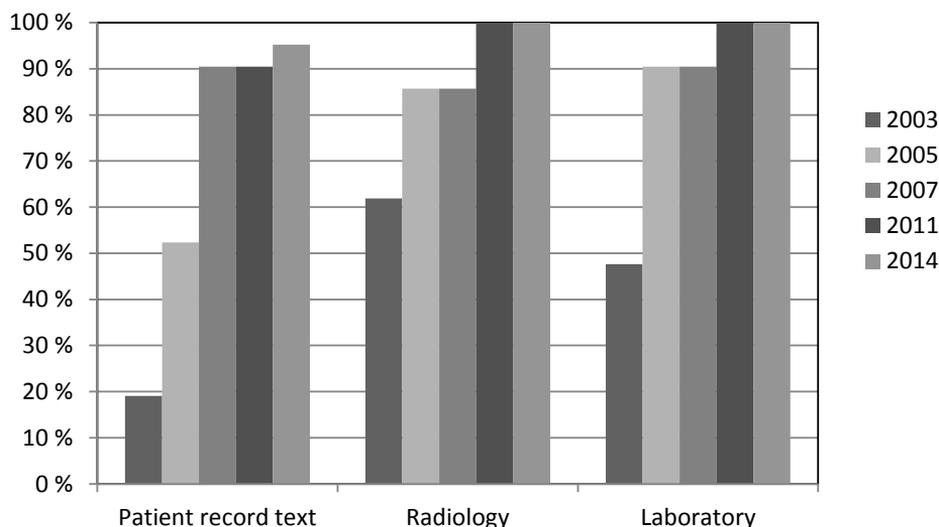
Figure 9 Regional electronic exchange of patient information in hospital districts with all means in 2003-2014.

A new implementation of RHIE is a data repository that caters for the special responsibility area of each of the five university hospitals in Finland. Each of these large area repositories caters for services for many individual hospital districts in that area: 29% of the hospital districts have joined this type of geographically larger repository for their laboratory services, 10% of the hospital districts for their imaging services and 5% for the exchange of digital ECG. Even more have plans to join one in the near future (33% for text data, 52% for imaging data and 29% for laboratory data). For imaging and laboratory services, those entities will not be mere repositories, but also service providers.

In *public primary care*, a total of 80% of healthcare centres were connected to some formal RHIE. Similar with the hospital districts, some healthcare centres were connected to more than one regional data system (13% of respondents). If all the means of communicating data are considered, exchange of patient record text is used by 78%, radiological images by 84% and laboratory results by 88% of the healthcare centres. Those figures had increased steadily from previous studies, as seen in Figure 10. Finally, if all the different subareas of patient data distribution are considered, every healthcare centre is using at least one regional patient data exchange component.
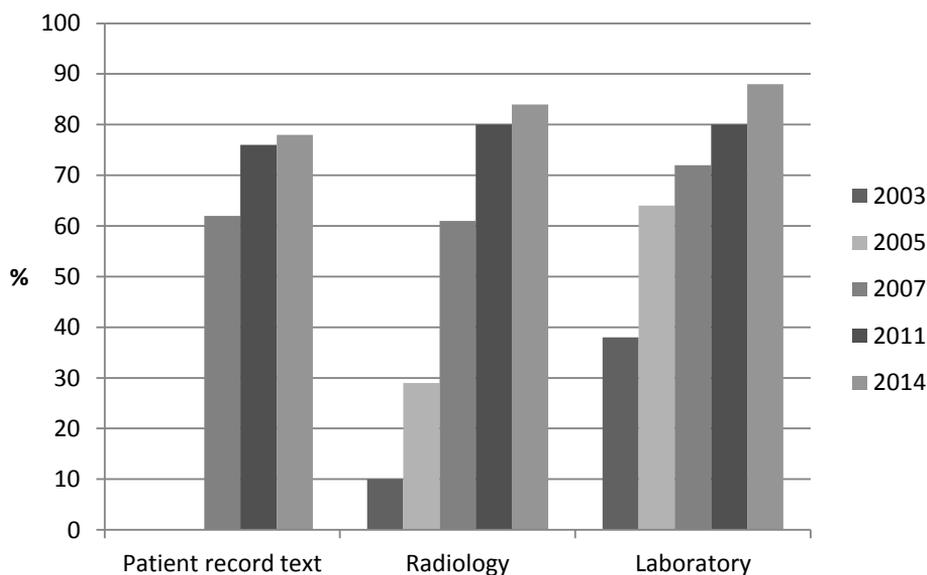
Figure 10 Regional electronic exchange of patient information in public primary healthcare centres by all means in 2003-2014.

Among *private service providers*, in our sample of 25 respondents, exchange of EPR text was used by 2, laboratory results by 3, medical images by 6 and imaging reports by 3 respondents. One private service provider was connected to the public RHIE in its area and could make use of EPR text, medical images and imaging reports.

In practice, regional on-demand information retrieval has grown to become an important tool for medical professionals as messaging services between primary and secondary care were previously. As a new trend after the previous survey, a common medical record for public primary and secondary care seems to fulfil many of the tasks that were previously solved with a messaging system or with a health information exchange.

2.4.4 Teleradiology and image distribution through a regional archive

Teleradiology was one of the first applications of telemedicine in Finland. The first experiments took place as early as 1969 (Reponen and Niinimäki 2006) and real implementation started at the beginning of the 1990s. In 1994, all five university hospitals had teleradiology services (Reponen 1996). Regular service started in the sparsely populated northern areas using dedicated connections, but has since then spread all around the country (Reponen 2010).

Teleradiology includes by definition either radiological teleconsultation or even clinical teleconsultation based on teleradiological transmission of images. In Finnish public health care, most primary healthcare centres have x-ray imaging capabilities. As it is today, all but one healthcare centre also create and store their images

digitally and have thus either a PACS or a connection to a regional PACS. Many of the imaging studies in the healthcare centres are primarily interpreted by the general practitioner, and a consultation is requested if needed. However, within Finnish public health care, dedicated teleradiology links are in most cases no longer needed, thanks to regional PACS implementations. Moreover the borderline between teletransmission and image distribution through a regional archive is gradually vanishing in the case of certain services. If a healthcare centre needs the images made in the hospital for comparison purposes, those can be transmitted (teletransmission) or viewed on-demand from the regional archive (if one exists). The same applies to connections between smaller hospitals and consultation hospitals. In our surveys, we have investigated all the methods used for image transfer. With the current infrastructure, teleradiology is a matter of service agreements between the partners.

In our series of surveys, 100% of the *hospital districts* provided teleradiology services within their responsibility areas in 2014, the situation having been the same since 2011. These figures were 81% in 2007, 76% in 2005 and 19% in 2003. For *healthcare centres*, we can assume that the figures correspond with the possibility of radiological image transmission within public health care, if a specific respond to the teleradiology service usage question was not received. Thus the estimated figures were 84% for 2014, 76% for 2011, 61% for 2007, 29% for 2005 and 19% for 2003. The results show that teleradiology is an established service in Finnish public health care and that healthcare centres are catching up in utilising the service provided by the hospital districts. At the same time, digitalisation of medical imaging and a standardised PACS architecture make it possible to outsource the image interpretation and consultations. Our survey did not reveal how many service contracts nowadays exist between public healthcare units and *private service providers*.

2.4.5 Information exchange with social care from a healthcare perspective

Close collaboration between health care and social care is becoming more and more important. This is especially beneficial when arranging services for children, elderly citizens and people with chronic conditions, for instance. In Finland an increasing amount of information within social care is available electronically.

In 10% of the *hospital districts* (19% in 2011) it was possible to access patient information that existed in a social care organisation with the permission of the patient, while 29% (38% in 2011) allowed social care organisations to have access to health care information in hospital districts. There is a slight decline in the figures, but this might be partially due to misunderstanding of the contents of exchange by the respondents in the previous survey.

At the *healthcare centre* level, 29% (20% in 2011) had access to read social care information with the permission of the patient and 44% (31% in 2011) allowed social care organisations to have access to the health care information of the patient. This is a clear increase compared to earlier results.

2.5 Data safeguarding

The strategy of the working group *Steering the Implementation of Electronic Patient Record Systems* included national guidelines for the safeguarding of data (informed consent, secure archiving, e-signature, identification of patients, documents, professionals and organizations by ISO/OID-standard, and PKI architecture) (Ministry of Social Affairs and Health 2004). The main ideas of the working group were included in the legislation on the e-archive (Act 159/2007) and the e-prescription system (Act 61/2007). This legislation was updated in 2010 with a more precise implementation timetable. Also in 2010 a new law was passed (Act 1326/2010) that describes public health care units within one health region as a single registration authority and enables the use of the opt-out principle for patient consent.

2.5.1 Systems supporting data security

Moving over to electronic documentation, archiving and transferring of data has meant that data security has become even more important. Legislation on data security in health care concerns different dimensions. The data security policy of an organization should include the aims and responsibilities for data security. The proportions of health service providers with a documented data security policy, data security plan and a designated person in charge are shown in Table 2. Compared to the 2011 survey, the availability of those components has increased, the biggest progress being on the availability of data security policy and a plan at the healthcare centre level.

Table 2 Proportions of health service providers with documented data security policy, data security plan, and a nominated person in charge

	Data security		
Provider	**Policy**	**Plan**	**Person in charge**
Hospital districts (%)	95	76	95
Healthcare centres* (%)	89	87	98
Private providers (n)	21/25	21/25	22/25

*(n=130)

At the *hospital district* level, a new set of questions were added compared to previous surveys. Following this addition, we found that 71% of organisations had a Business Continuity Plan (BCP) and 81% a Disaster Recovery Plan (DRP). About 33% of organizations had had to follow some recovery plan actions, mainly because of power failure or network problems. Typically the permissible down time for the EPR system was specified as between 0.004-0.5% of usage time, while in 2013 the actualized time was 0-2%.

2.5.2 Management of informed consent

New legislation on patient consent came in to effect in 2011 and will be fully implemented into the new national e-archiving system. The management of patient consent was transformed from 'opt in' to 'opt out'-scheme in the new system. However, already prior to this reform, electronic consent management had become more common in healthcare organisations (Hämäläinen et al. 2009).

Since 2011, in public healthcare, service providers within one hospital district area can jointly build a common patient data registry. All the personnel that are involved in patient care within that same regional public organisation, i.e. either in primary care or secondary care can utilise patient data provided the patient is informed. The patient has also a possibility to withhold his/her consent. The private sector or other hospital districts are considered different organisations and in this instance patient consent is needed to access patient records. A completely electronic system using the electronic signature of the patient was not in use any regions in Finland.

The national Kanta services now include a component that enables the patient to give his/her consent to those different organisations and service providers that participate in treatment. This centralised management will make consent management easier than it is currently for those public and private organisations that are connected to Kanta services.

Table 3 outlines the currently used ways of managing the informed consent of a patient within the regional data systems by electronic and/or by paper means. The surveys included an open question on the matter which was used to categorize the management into three aspects: 1) traditional method of consent on paper; 2) paper information is transferred to an electronic system; and 3) consent entered straight in the electronic system. Although not all institutions answered this question, it gives an estimate of the various methods currently used. When compared to the 2011 results, the trend in 2014 was towards electronic means of managing informed consent. The situation is in transition, while the national Kanta services are being adopted and implemented. Also, informed consent is still needed, if (older) information is exchanged between regions or if information is exchanged between public and private care, since not all smaller private sector providers are connected to Kanta services.

Table 3 Managing a patient's informed consent by electronic and/or paper means in the hospital districts, healthcare centres and private service providers

	Paper	Paper transferred to electronic	Only electronic
Hospital districts (%)	14	14	57
Healthcare centres % (Ntot=93)	8	15	77
Private service providers (n)(Ntot=25)	2	2	14

2.5.3 Electronic identification of healthcare professionals

In public healthcare the saturation point of all institutions using strong identification with smart cards for healthcare professionals was achieved in 2013, following the implementation of the national e-prescription component in the Kanta services. In addition to a smart card, other professional electronic signatures (such as a commercial password method with a password list) were used in 14% of hospital districts and 5% of healthcare centres. Among private service providers, 16 out of 25 used professional smart cards for identification.

2.5.4 Electronic identification of patients

Health care organisations provide some services requiring identification of patients. This survey makes no distinction between identification of physically present persons and users of remote services.

Among *hospital districts* identification of patients was based on a national smart card in 29%, a commercial password method with a password list in 62%, user name and password in 24%, and mobile identification in 19% of organisations. Among *healthcare centres* a national smart card, a commercial password method with a password, user name and password, and mobile identification were used in 32%, 31%, 11% and 14% of the organisations, respectively. Among *private service providers*, national smart card was used in 8, a commercial password method with a password list in 3, a user name and password in 4, and a mobile identification in 2 of the organisations.

When compared to 2011 in public health care, the availability of a commercial password method with a password list had increased and mobile identification has emerged as a new method. An electronic signature for patients was available only in one primary care organisation.

2.6 Standards for data exchange between organisations

Finnish registries use international classification systems such as ICD-10 and ICPC-2. The EPR Minimum Data Set will also be coded on the basis of these classification systems. In terms of communication and security, Finland has chosen to adopt

international standards, such as Health Level 7 (HL7) and Digital Imaging and Communications in Medicine (DICOM), and the ISO 17799 standard for Information Security Management (based on the BS7799).

HL7 standards will serve as the base communication standard and the use of extensible markup language (XML) as a basis for the transfer of patient information between health care organisations. Clinical Document Architecture (CDA) is a XML-based clinical document architecture for the exchange of various types of documents. The DICOM standard enables users to retrieve images from digital imaging devices.

The older Electronic Data Interchange (EDI) standard was still in use in 38% of the hospital districts, which is at the same level as in two previous surveys (Table 4). In healthcare centres the use of the EDI standard has remained at a rather low level of 17% availability. Release 1 of the CDA was being used in 67% of hospital districts and in 49% of the healthcare centres, the proportions declining from previous surveys. The use of release 2 of the CDA had increased, being in use in 52% of hospital districts, and in 42% of healthcare centres.

A total of 81% of hospital districts and 62% of the healthcare centres announced that they used XML messaging, both percentages increasing from previous surveys. The DICOM standard was in use in 100% of hospital districts and in 61% of healthcare centres based on their own announcements. In practice the figure is close to 100% also in healthcare centres, since 99% of them use DICOM based PACS. A more comprehensive comparison during the years 2005 – 2014 for public healthcare can be seen in Table 4.

In the sample of 25 private service providers, 13 respondents announced that they were using at least one of the standards mentioned. The most often named was DICOM (n=6), followed by HL7 CDA R1 (n=4), and EDI (n=3) and XML messages (n=2), There has been a slight increase in the named standards compared to 2011.

In Finland, all those organisations that produce electronic patient record data and thus are connected to the national Kanta services are given their own object identifier (OID) codes. The updated situation of OID code usage is available from the official health care organisation database maintained by THL[9], and is no more asked about in surveys. At the time of the 2011 report, 99% of hospital districts (all except Åland) and 100 healthcare centres were listed as having OID codes. Now that all the public health care units in continental Finland have been connected to the Kanta services as of October 2015, along with the major private service providers, a saturation point is gradually being achieved.

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[9]http://www.thl.fi/fi_FI/web/fi/tutkimus/palvelut/koodistopalvelu/koodistot/organisaatio

Table 4 The most often used standards for data exchange between organisations in public health care in 2005-2014 as a proposition of healthcare units

		%				
		OVT/EDI	HL7 CDA-R1	HL7 CDA-R2	XML-message	DICOM
Hospital districts	2014	38	67	52	81	100
	2011	30	70	40	70	90
	2007	21	79	26	84	90
	2005	67	72	22	67	94
Healthcare centres	2014	17	49	42	62	61
	2011	12	57	35	58	45
	2007	15	60	16	60	41
	2005	39	61	14	46	33

2.7 Information exchange between health care organisations and patients

The results of the 2014 survey are described below. First an overview of services provided through organisational web-sites is given and then some of the most common services are discussed in detail.

2.7.1 Availability of information

All organizations in all three responder groups (hospital districts, healthcare centres, private service providers) managed their own *websites*. A summary of the general content of the services available in these web pages can be seen in Figure 11.
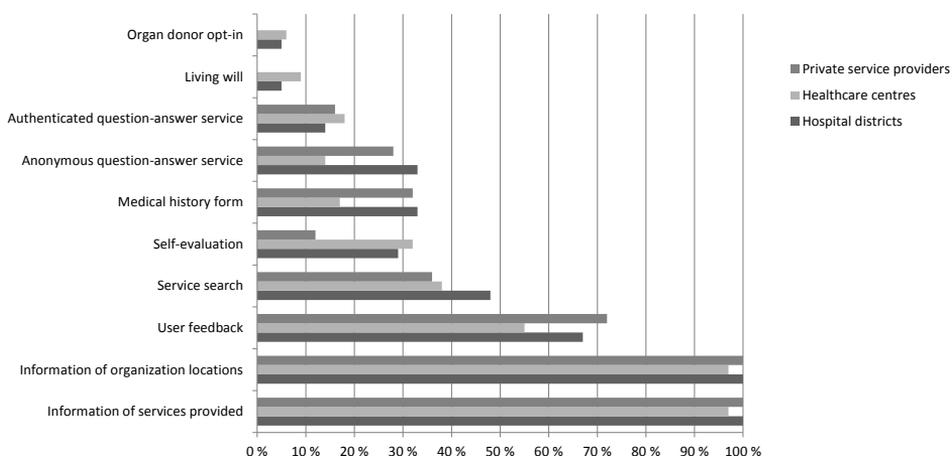
Figure 11 Services offered from an organization's web pages.

Information on services and locations was available on nearly all websites. The prevalence of online feedback, self-evaluation and online medical history/background form services has increased, whereas the availability of making a living will or organ donor registration has largely remained the same. The other functionalities accessed through the webpages or otherwise are discussed below.

2.7.2 Electronic appointment booking services

Online appointment booking means that a patient can reserve an appointment with a physician over the Internet. These services could potentially significantly save health care staff's time (Vähäkuopus et al. 2006) and increase service flexibility for customers. In the context of making an appointment in Finland, primary health care physicians have the role of gatekeepers to specialised health care. For this reason, primary health care and specialised health care differ when dealing with appointments.

In 2014, direct online appointment booking through webpages was in use in 81% of *hospital districts* and 49% of *healthcare centres* in Finland. The most common use is for laboratory appointments, but also imaging services, maternity- and child health clinics, and oral health are typical users. Use of the service has increased rapidly (figures 12 and 13). In our sample of 25 *private service providers* direct online appointment booking through webpages was available for 18 respondents.
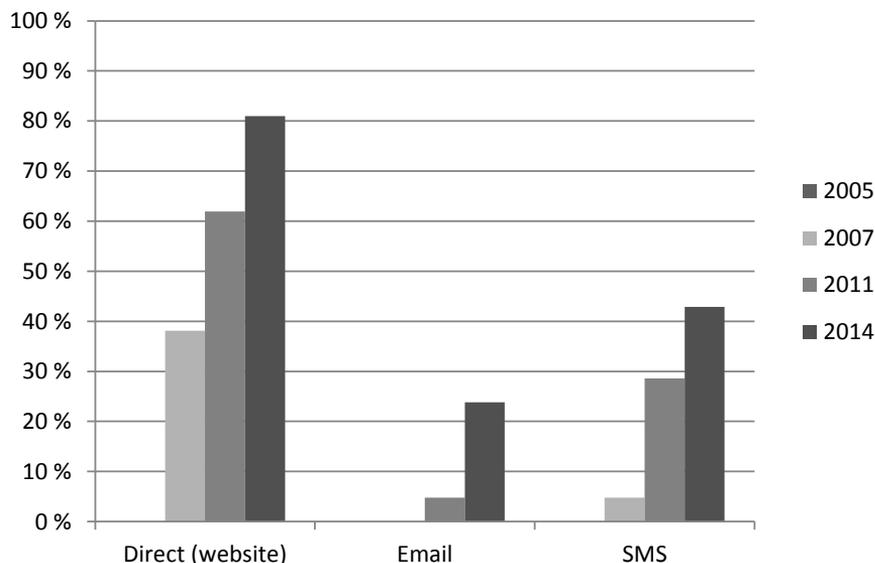
Figure 12 Electronic appointment booking services in hospital districts in 2005-2014. None of the hospital districts had these services in 2005 even though the question was also included that year.
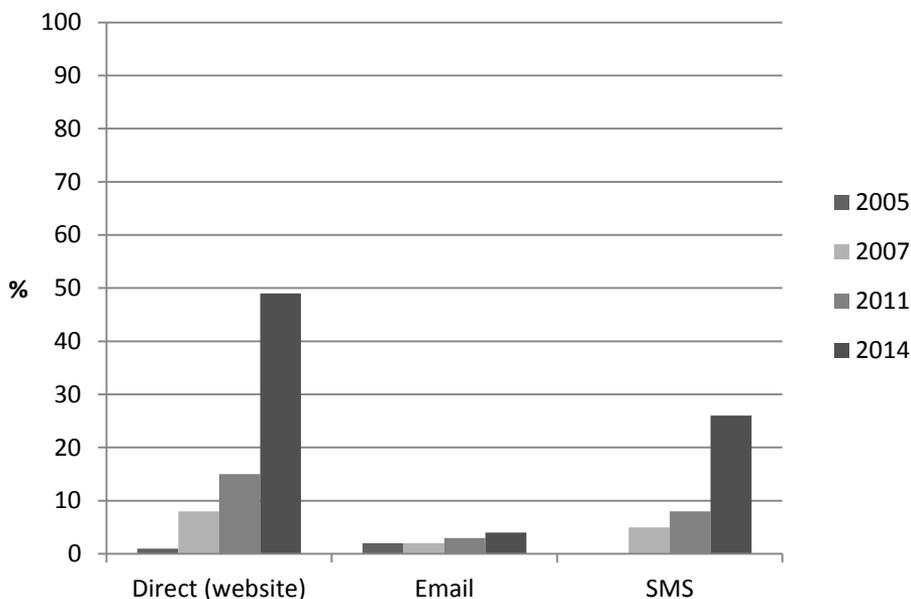
Figure 13 Electronic appointment booking services in healthcare centres in 2005-2014.

Availability of SMS or email appointments has also increased in *hospital districts* and *healthcare centres* (figures 12 and 13). Many responders clarified that email booking is available 'on request', or that the SMS service is an automated confirmation service. In our sample of 25 *private service providers*, SMS appointment making or confirmation was available in 7 organisations and changes to the appointment could be made in 12 organisations. E-mail could be used in 8 private organisations.

2.7.3 Direct communication between patients and professionals

Question–answer services and contact methods

A web-based anonymous question–answer service was being used in 33% of hospital districts, in 15% of the healthcare centres, and 7/25 of private providers. A telephone-based anonymous question-answer service was used in 29% of hospital districts, in 44% of the healthcare centres, and 30% of private providers. *A web-based question–answer service with patient authentication* was available in 14% of the hospital districts, while 19% of healthcare centres and 4/25 of private service providers offered this service. *Telephone-based health, illness and service consultation with patient identification* was still more commonly in use; in 52% of

hospital districts, 88% of healthcare centres, and 15/25% of private service providers. All in all, web-based services have increased slightly, and the focus of phone services has shifted from anonymous to authenticated services since 2011.

Information exchange between professionals and patients has increased and changed its type, from the continuously declining use of basic email to increasing availability of more secure channels. Ordinary email was used only in 5% of hospital districts (14% in 2011) and 5% of primary care centres and 7/25 private providers; encrypted email in 29% (none in 2011) of hospital districts, 13 % of healthcare centres and 6/25 private providers. SMS communication was available in 24% of hospital districts, 23% of healthcare centres and 4/25 private providers. The history of the availability of these forms of communication in primary health care is shown in Figure 14.
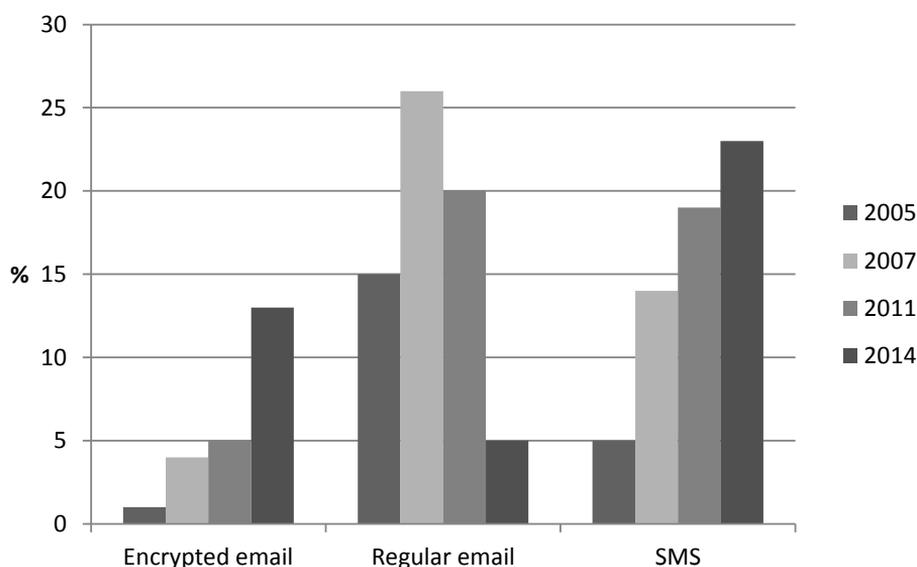
Figure 14 Electronic messaging between health professionals and patients in healthcare centres in 2005–2014.

Access to personal health information

In addition to the national service My Kanta pages which allows citizens to view their own summary of the EPR and e-prescription information, organizations can also provide their own services for citizens to view or add information in systems related to health care records. The ability to view EPR text or related information such as medications, laboratory results, and diagnoses, has increased since 2011, but is still rather rare (Table 5). An electronic request to renew and view e-prescription

was available in three hospital districts, 19% of primary healthcare centres, and one private provider.

Table 5 Citizen access to their own EPR information in health care organizations in 2014, divided by information type

	Medications	Laboratory results	Diagnoses	EPR text
Hospital districts (%)	24	19	10	5
Primary healthcare centres (%)	20	15	5	5
Private providers (n) (NTot=25)	5	4	3	1

Personal health records

The prevalence and interest in personal health records (PHR), that archive patient-produced data, has also increased since 2011 (Table 6), and citizens are increasingly able to send measurements and test form information to professionals. Citizen initiated recording of measurements was now available in 19% of the hospital districts, 14% of primary care centres, and 2/25 private providers; citizen initiated recording of text information was available in 29% of hospital districts, 14% of primary care centres, and 4/25 private providers. Additional functions of personal health records, such as communication, were not assessed as part of the PHR system.

Table 6 Availability of personal health records in 2014 in hospital districts, healthcare centres, and in private service provider

		% (number of organisations)		
		In planning	In testing	In use
Hospital districts	2014	43 (9)	10 (2)	5 (1)
	2011	33 (7)	5 (1)	0 (0)
Primary healthcare centres	2014	27 (35)	3 (4)	7 (9)
	2011	16 (22)	2 (3)	1 (2)
Private	2014	20 (4)	0 (0)	10 (2)
	2011	14 (4)	4 (1)	0 (0)

2.8 Human and material resources

2.8.1 Professional Education and Training

Televideo-conferencing for the education of personnel was maintained by 95% of hospital districts, around 53% of healthcare centres, and by only one private service provider. The utilisation of the functionality has increased compared to 2011. The availability of web-based training for personnel has increased since 2011, and it was available in 100% of central hospitals, in 92% of healthcare centres, and in 13/25 private service providers. Education was mainly regarding privacy and data security, patient security, procedures, and radiation safety.

2.8.2 Computer skills of health care personnel

Based on the earlier study (Hämäläinen et al. 2009) the percentage of organisations where all personnel who documented or read patient information had computers was already 90% both for secondary and primary care in 2007. In a similar manner, in about 83% of the hospital districts and healthcare centres all the personnel involved in providing or reading patient information had access to the Internet. Given such high saturation, these questions were no longer included in the surveys in 2011 or 2014.

The ICT skills of the personnel were measured by asking the percentage of personnel documenting and reading patient information who had basic computer skills. Based on this survey in 2014, this percentage was high in health care organisations. In over 70% of the hospital districts and healthcare centres at least 90% of the personnel documenting and reading patient information had basic computer skills. The trend has been moving towards the 100% saturation point of computer skilled personnel (Figures 15 and 16). However, the results from 2014 show signs of a decline in the total, especially in primary care. This might reflect actual decreased ICT skills among personnel or differences in evaluation criteria. Compared to earlier surveys, digital systems are now more comprehensive and patient information management requires skills to operate local, regional and even national IT systems. This means that a more profound understanding of ICT tools is needed. Among private health care providers, a majority (19/25) of the personnel had ICT skills and in the rest at least 70% of the personnel.
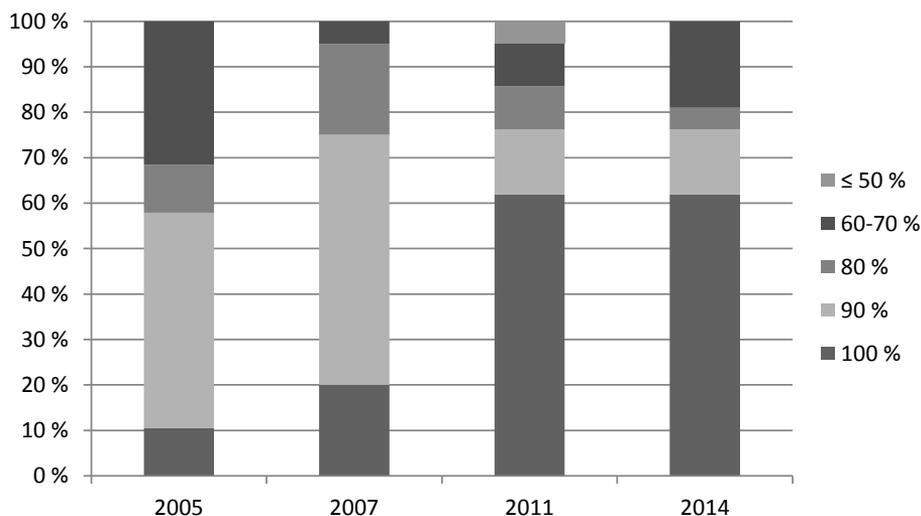
Figure 15 Distribution (%) of hospital districts based on the proportion (%) of personnel with computer skills documenting and reading patient information. Scale modified from 10% interval menu (10-100%).
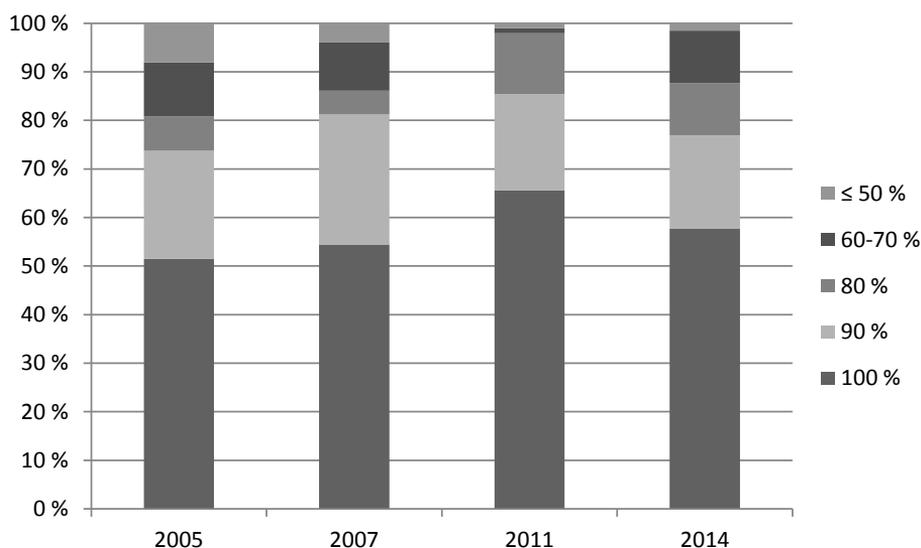
Figure 16 Distribution (%) of healthcare centres based on the proportion (%) of the personnel with computer skills documenting and reading patient information. Scale modified from 10% interval menu (10-100%).

Privacy training was received comprehensively by the personnel in 76% and to some extent in 19% of hospital districts. In healthcare centres 100% of personnel had

received at least some privacy training, 76% of which was comprehensive training, with the latter being and increasing trend. Among private sector samples, 17/25 organisations had provided comprehensive, 7/25 some privacy training, and one no training. There were no changes compared to 2011.

2.8.3 Technical support availability for users of the patient record system

The survey from 2014 looked at how comprehensively organisations had made technical support available for users of the EPR system. Around 76% of the *hospital districts* provided technical support during all the operating hours of the organisation and 24% during normal office hours (Figure 17). Among *healthcare centres*, most (76%) of the organisations provided support during normal office hours, 19% at all times during operating hours, and 5% daily, but less than during office hours. Among pr*ivate service providers*, the service was most often provided during all operating hours (16/25) or during office hours (6/25), the rest providing support daily, but less than during office hours.
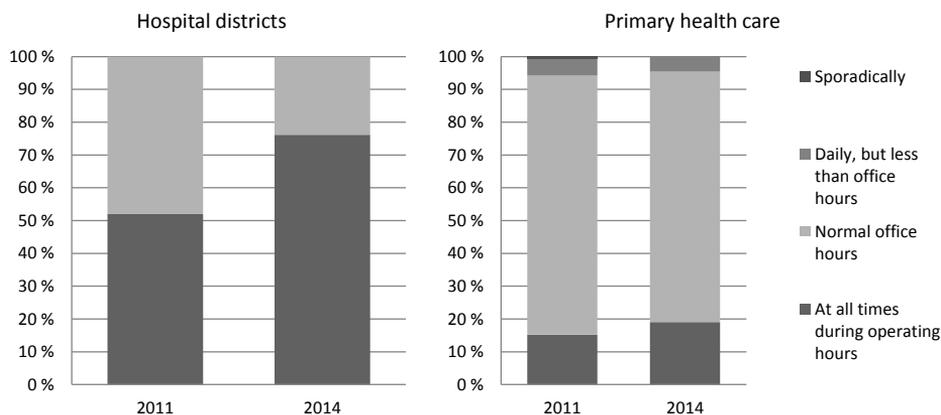
Figure 17 Technical support availability (as a percentage of answered organization) for the EPR in specialised and primary health care.

2.8.4 Costs for systems of information and communication technology in e-health

In the section on the implementation and usage of ICT, a question requested an estimation of annual costs (in EUR or as a percentage of total budget) in 2013 (the previous year to the survey in order to reflect completed budgetary reporting) for purchasing, maintaining and developing information and communication technology and for training. In the hospital districts the proportion of the budget varied from 1% to 5%, with the top values of around 10% that were present in previous years being

missing (Figure 18). From 2005 to 2010 the median value of ICT costs has varied from 2% to 3%, now being 2.7%. The majority of health districts estimated that the percentage of their budget used for ICT systems in 2013 had gone up (67%) compared to 2012.
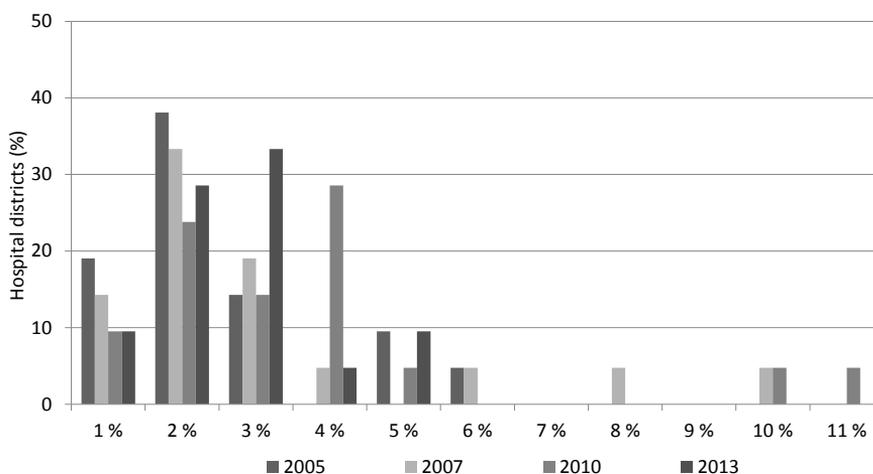
Figure 18 Distribution of hospital districts (%) based on their estimations of the proportion (%) of ICT-related costs in the annual budgets in 2005, 2007, 2010 and 2013.

In the healthcare centres the ICT-related annual costs had a median value of 1.8% in 2013 which is about the same level as in 2010 (2%). However, as in the case of hospital districts, 75% of the organisations estimated that the percentage of their budget used for ICT systems in 2013 had gone up compared to 2012. The situation is much the same with private service providers, which reported a rise in the ICT budget percentage and median value of an estimated 3% in 2013 instead of 2.7% in 2010. The ICT costs as a percentage of the budget remains at the same level as in other Nordic counties (Jerlvall and Pehrsson 2014)

Hospital districts' ICT-related costs in 2007, 2010, and 2013 are presented as EUR per capita in Figure 19. Per capita costs can be used, since in Finland everybody belongs to the population of a healthcare centre that in turn belong to a hospital district according to their residence. The median of annual costs per capita in hospital districts has increased, since the median was EUR 14.7 in 2003 (range from EUR 9 to EUR 24), EUR 19.6 in 2005 (from EUR 10 to EUR 35), EUR 23.7 in 2007 (from EUR 11 to EUR 38) (Hämäläinen et al. 2009), EUR 23.6 in 2010 (from EUR 11 to EUR 75) (Hämäläinen et al. 2013), and EUR 39 per capita in 2013 (from EUR 7 to EUR 214).
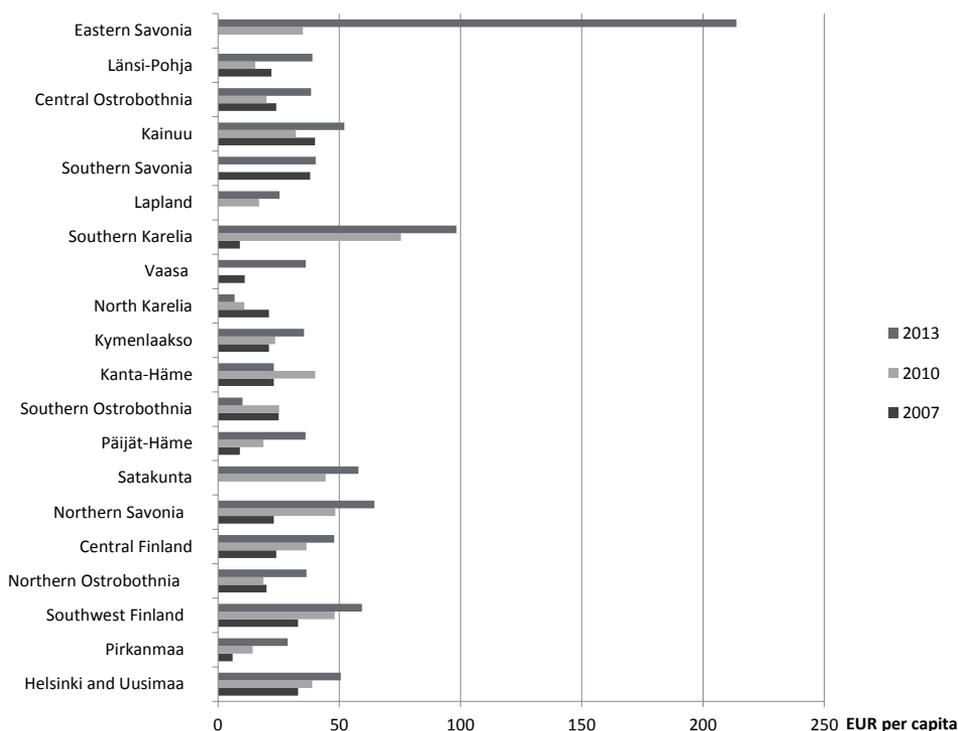
Figure 19 Annual ICT related costs (€) per capita in the 20 hospital districts (data from Åland not available) in 2007, 2010, and 2013.

Based on this information in the 2014 survey, the two highest ICT costs per capita were in the Eastern Savonia and South Karelia hospital districts (Figure 19). In South Karelia the previously separated primary, secondary and social care were merged into one organisation between 2007 and 2010, which partly explains the large increase between these time points. The biggest increase in health care per capita costs from 2010 to 2013 were in the Eastern Savonia hospital district, which was in 2013 the first organization to connect to the national Kanta archive and was also participating in the testing and documentation of the national procedure and was also subsidised for that effort. The Eastern Savonia hospital district has also shown high performance on the Healthcare Information and Management Systems Society (HIMSS) Analytics Europe evaluation following their European EMR Adoption Model, being the first one to achieve a level 6 out of 7 in Finland (Pätsi 2012). On the other hand, the per capita ICT costs in some hospital districts have decreased. This may partly be due to the change to a common regional EPR database for primary and secondary health care, and thus the ICT costs at the hospital district level may partly have been transferred to primary care.

2.9 Systems supporting the quality and delivery of health care service

2.9.1 Decision support systems

Decision support systems are information- or knowledge-based systems that support the decision-making process. The Finnish EPR systems that have long included functions that warn about pathological laboratory results. In addition, more and more hospital districts and healthcare centres use EPR systems that include reminders that inform about drug interactions or whether a patient had been prepared properly for laboratory tests or radiological examinations. EPR terminals also provide access to local, regional and national databases and guidelines with search engines. These databases can even be accessed with mobile devices.

Advanced electronic decision support systems, which could automatically give evidence-based medicine (EBM) guidelines covering a wide variety of clinical topics based on structured core data from the EPR system, have been developed by the Finnish Medical Society Duodecim [10] and its collaborators [11] and are now implemented in some EPRs. The systems can give additional information or recommendations to health care professionals. This EBMDeS (evidence-based medicine decision support system) utilises data from various EPRs, which are compatible with national EPR standards. With the help of an expert script language, EBMDeS brings context-sensitive information from a central server directly into the EPR of the patient. Databases for the decision support system have been designed for physicians, nurses and other health care professionals in primary and specialised health care. (Komulainen et al. 2006)

The Finnish Medical Society Duodecim maintains and updates the standalone online database 'Terveysportti'[12], which serves as a portal for databases dedicated to physicians ('Lääkärin tietokanta'; in English: physician's database) and for nurses ('Sairaanhoitajan tietokanta'; in English: nurse's database).

In addition, the 'Terveysportti' database is a portal for several databases concerning good clinical practice, evidence-based medicine guidelines, the Cochrane library, guide for interpreting electrocardiograms, medicines, drug interactions (e.g. 'SFINX', Swedish-Finnish-Interaction-X-referencing), international classification of medicines, libraries of common chronic diseases, etc. This portal consists of a comprehensive set of guidelines and has become very popular; it was calculated already in 2005 that every Finnish physician had read 1 - 5 guidelines a day on average via the portal (Kunnamo 2006).

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[10] www.duodecim.fi including information in English
[11] www.kaypahoito.fi
[12] www.terveysportti.fi

Connected decision support systems are available for many EPR systems at different levels. This report classifies the decision support systems into four integration levels:

1) a standalone online database on the same desktop as the EPR;
2) an online database with access by navigating from the EPR;
3) a system that automatically displays selected items on the desktop and is integrated with the EPR including a) reminders about examination results (e.g. completed laboratory test results), incentives (e.g. diverging laboratory results are displayed with a colourful font), graphics (e.g. blood pressure as a bar graph), b) reminders of administrative items (e.g. the arrival of a referral), c) drug interaction system (e.g. SFINX) and d) other similar systems; and
4) a system for the automatic integration of the EPR and a medical knowledge database that includes a) a drug interaction system, b) an intelligent system that compares the EPR contents of the patient (e.g. actual diagnosis codes of the particular patient) to the evidence-based medicine decision support database and yields remarks and reminders on the screen and c) other similar systems.

A connection to some decision support systems was available in 95% of hospital districts and 98% of healthcare centres and most of the private service providers. As explained here, the status of integration differed, with a number of overlapping solutions being used.

A standalone online database on the desktop was in use in 86% of the hospital districts, in 92% of the primary healthcare centres and in 84% of the private providers that responded to the survey.

A database with access by navigating from the EPR was in use in 67% of the hospital districts and in 61% of the healthcare centres, and 32% of the private providers. Those displaying a selected item on the desktop (reminders and drug interaction systems) were the most common solutions.

Automatic displayers of selected items were in use in 33% of the hospital districts and in 36% the healthcare centres and 16% of private providers.

Systems for automatic integration of the EPR and a medical knowledge database were in use in 48% of the hospital districts and in 37% of the healthcare centres and 8% of the private providers. The most common of these was the drug interactions system.

Compared to the earlier 2007 and 2011 surveys, the general availability of decision support systems is generally at the same high level, but the hospitals seem to have progressed slightly in automatic integration with the EPR.

2.9.2 Other systems supporting the quality and delivery of health care Service

Since 2008, public health care providers have been obligated to comply with the law to allow patient access to immediate treatment during office hours at a healthcare centre, or in the case of non-critical matters, an assessment for a course of treatment within three days. The law obligates hospitals to give the patient an assessment of the need for treatment within three weeks, and a course of treatment within six months. Public health care providers are required to report the actual waiting times at least three times a year.

Electronic monitoring systems for access time to treatment were in use in 90% of hospital districts. At hospitals, the availability of these systems has remained at the same level (around 70%) between the 2005 and 2011 surveys, but now the availability of the system has increased. In healthcare centres the availability has increased since 2007, and the change from 2011 to 2014 was from 39% to 60%.

An electronic registry for various care-related adverse events has been deployed more widely than in 2011, especially in primary care. 95% of the hospital districts and 92% of the primary healthcare centres used such a register (Table 7), while the figures in 2011 were 90% and 57%, respectively.

Accurate process information concerning the performed processes and services related to resources is essential in governing health care enterprises. Electronic data warehouse systems were available for administrative purposes in 71% of the hospital districts, in 23% of the primary healthcare centres and in 4 private service providers. The availability of data warehouse systems has not increased since 2011.

Table 7 Distribution (%) of health care organizations based on the use of some systems supporting service quality and delivery

Provider	Access to care follow-up	Registry for adverse events	Data warehouse
Hospital districts (%)	90	95	71
Healthcare centres (%)	60	92	23
Private providers (n/25)	1	10	4

For registering treatment and care, health care providers with beds are obligated to report the diagnosis, length of stay and possible surgical procedures to the national registry at the point of discharge from care. All of the hospital districts make the reports electronically. These reports are then collected and transferred to the registry. Also, ambulatory visits to specialised care are nationally registered. Healthcare centres with beds also send data to the hospital discharge register. Since

2011 the new AvoHilmo system has collected information on primary health care visits for the national health care register (Tuomola et al. 2012).

The loaning of adaptive home care medical equipment (e.g. wheelchairs, crutches, walkers) to patients is included in the services of the health care providers. 95% of hospital districts and 79% of the healthcare centres maintained electronic registers of borrowed adaptive home care medical equipment. The usage of these registers remained at the same level as in 2011.

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3 Availability and Use of e-welfare in Finland

Jarmo Kärki, Miia Ryhänen

In this section a national review of the availability and use of e-welfare in Finland is presented. An overview of the available electronic social services, implemented social welfare client information systems (CIS), and data management in different organisations operating in the field of social welfare in Finland is given.

3.1 Methods, target group and data of the e-social care survey

The e-welfare survey was conducted as part of the STePS-project funded by the Ministry of social Affairs and Health. The survey was planned in 2013 and carried out in the spring of 2014. The data collection for the survey was carried out as a semi-structured Internet-questionnaire (http://urn.fi/URN:ISBN:978-952-302-563-9). The target groups of the survey were public and private social service providers in Finland. The survey was commissioned by the National Institute for Health and Welfare (THL), and the data were collected by TNS Gallup Oy. The current survey is a continuation to the survey conducted in 2011 (Hämäläinen et al. 2013, 84–97).

The data collection took nearly two months. Reminders for the survey were sent twice to the respondents who did not initially respond. Telephone reminders were also used to improve the response rate. A total of 305 organisations providing social welfare services participated in the survey. Respondents comprised 134 representatives of the public social welfare sector and a total of 171 representatives of the private social welfare sector. All the respondents from municipalities, joint municipalities, municipal utilities, and other joint authorities belong to the public sector. The respondents from commercial enterprises, associations and foundations are counted among the private organisations providing social welfare services. Representativeness of the survey reached nearly 42% of the public recipients and 10% of the private recipients.

The survey offers better coverage in the public sector than in the private sector. The municipal organisations that participated in the survey provide all statutory duties and functions of social services. Additionally, the geographical coverage of the survey was reasonable. Respondents included social service providers operating in the public and private sectors across Finland. The questionnaires used in the survey are available in electronic format of the report (http://urn.fi/URN:ISBN:978-952-302-563-9).

3.2 Digital social services for citizens

The survey asked what kind of public electronic services the respondents organize for citizens and their customers. An informative website is the most common online service offered by municipal and private organisations alike. Only three percent of public service providers and nearly one in six private service providers have not published any website related to their social services. In comparison to the previous survey in 2011, informative websites have become more common at municipal organisations, with an increase of 8%. Private social service organisations appear to have published approximately 10% more information on their services on websites than in 2011 (Kärki et al. 2012, 40).

Nearly two out of three municipal organisations and two out of five private organisations offer citizens and service users the possibility to give feedback online. More than half of the public organisations and only 13% of the private organisations report that they provide general online information about social wellbeing, for example, on how to promote social wellbeing and information about support services. The availability of anonymous online counselling is very limited. The opportunity to give online client feedback to public service providers has increased approximately 15% compared to the survey in 2011. The opportunity to give online client feedback has increased approximately 10% in private organisations (Kärki et al. 2012, 40).

Less than half of the municipal organisations and an even smaller share of private organisations offer online services for specific target groups, including online applications for services and videoconferencing, or remote services by an employee to the client. There are still organisations which do not provide – directly or indirectly – any of the above mentioned electronic services. For online services for specific target groups there are few changes compared to the survey in 2011.

A summary of the results concerning what kind of public digital services the respondents organize for citizens and their customers is given in Figure 1.
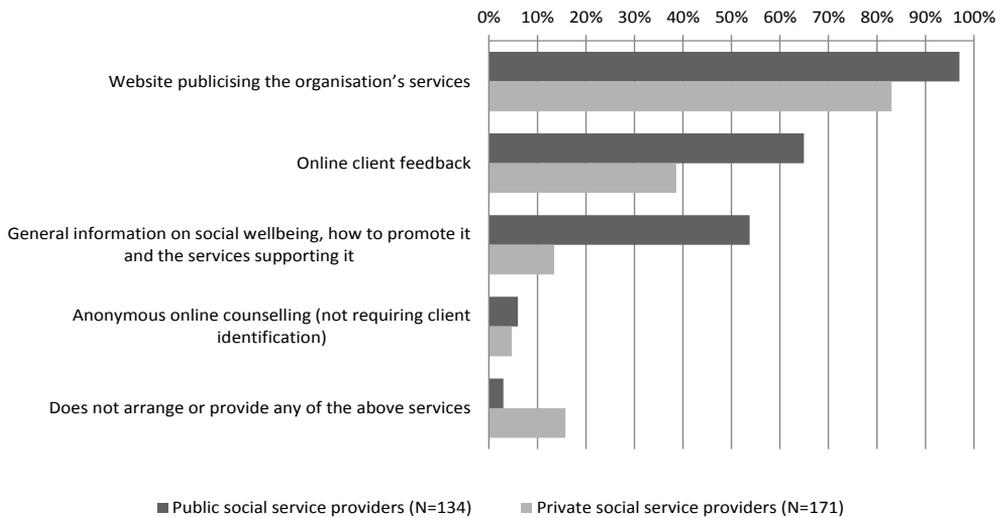
Figure 1 The distribution (%) of public and private social service organizations providing general online services for citizens or clients.

3.3 CIS and CIS contents in social welfare

Nearly all of the municipalities and joint municipal authorities have a client information system, while private service providers make somewhat less use of client information systems. However, a client information system is not in use in all social services. Often, the client information systems used by public social welfare service providers have been supplied by the largest system providers, whereas in the private sector the distribution of different client information systems is more varied. Small private enterprises generally do not have information systems at all.

Partial recording of data in electronic format is more common across all organisations than using electronic systems to record all client information. The transition from paper-based text to electronic records is more advanced in public organisations than in private organisations. The intensity of client information systems (CIS) usage is high in public social service organisations, which means that 88% of the public organisations reported that over 80% of their client work documentation was recorded electronically. At the same time nearly one in five of private social service organisations only records on paper. More detailed data is presented in Figure 2.
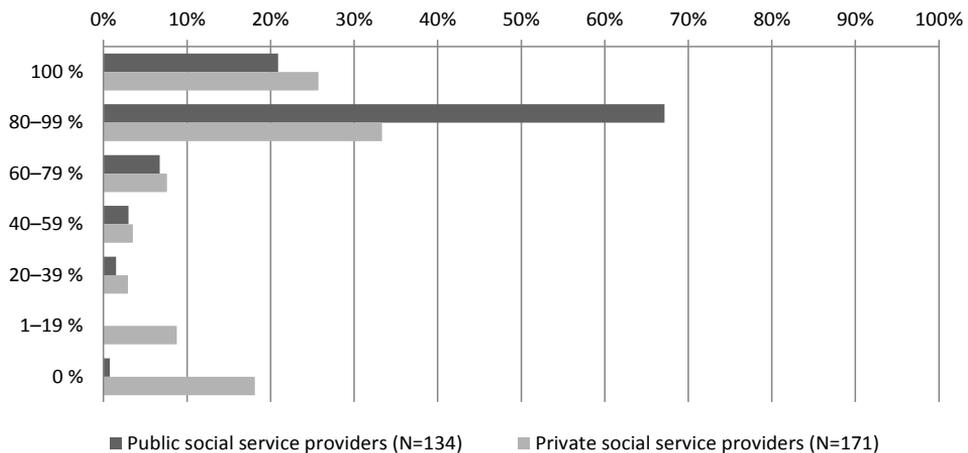
Figure 2 The distribution (%) of public and private social service providers according to the intensity of CIS usage in their client work documentation.

The content of CISs varies depending on the software and organisation in question. Classifications most commonly applied in the client information systems of municipal organisations include the national social welfare services classifications and classifications used in the national Care Register (Hilmo) for social care. Municipal organisations currently not applying any classification systems appear not to be planning on initiating their implementation. In private organisations, using classification systems and data structures in the client information systems is rare. The situation regarding public and private social welfare service provider has not changed much since 2011, with no significant changes in the use of client information systems or classifications (Kärki et al. 2012, 4–5).

THL has produced uniform descriptions of the business processes and client data model for use by social welfare service providers in Finland. The survey data were used to calculate the utilisation rate of these national descriptions. Less than half of municipal organisations have taken advantage of the national business process descriptions for social welfare services, while in private organisations, these are seldom used. Implementation of the national social welfare client data model and document definitions is relatively rare and varies across municipal organisations. Often, document definitions are customized and thus the data model has not been used in its original form. Private organisations, in particular, seldom implement the data model and document definitions and when they do, they use customised formats.

3.4 Information exchange in social welfare

The survey asked if the organisations have arranged an electronic information exchange between the CIS's and what kind of information is available for social welfare professionals from other organisations.

Some public social service organisations have arranged for their employees to have a limited access to the records of other organisations. Less than half of the municipal organisations (44%) transfer data electronically from their own client information system to that of another organisation. One in three has granted read-only access to employees of other organisations. More detailed data on information exchange between public service providers is presented in Figure 3.

%

Is information transferred electronically from the client information system of your organisation to the information systems of other organisations? (N=134)	44	56
Does your organisation have a recognised need for electronic information transfer from your client information system to the information system of another organisation? (N=75)	59	41
Have read-only access rights to the client information system of your organisation been granted to employees of another organisation? (N=134)	30	70
Does your organisation have a recognised need to provide read-only access rights to your client information system to the employees of another organisation? (N=94)	46	54

■ Yes ■ No

Figure 3 Social care information exchange and a recognized need for information exchange in municipalities and joint municipal authorities (%).

It is not common for employees of private social service organisations to have access to information contained in other organisations' systems. Only one in seven grants this kind of access to their employees. In the majority of cases, information systems are inaccessible to the employees of other organisations, and there are no plans to grant access rights. The results of information exchange at private organizations are presented in Figure 4.

The need for the electronic exchange of information across different organisations is greater than the need to expand viewing rights: 59% of public respondents and 43% of private respondents that have not yet organized an electronic information exchange recognised the need for electronic information transfer from their CIS to the CIS of another organization.

%

Is information transferred electronically from the client information system of your organisation to the information systems of other organisations? (N=171)

| 14 | 86 |

Does your organisation have a recognised need for electronic information transfer from your client information system to the information system of another organisation? (N=147)

| 43 | 57 |

Have read-only access rights to the client information system of your organisation been granted to employees of another organisation? (N=171)

| 10 | 90 |

Does your organisation have a recognised need to provide read-only access rights to your client information system to the employees of another organisation? (N=154)

| 27 | 73 |

■ Yes ■ No

Figure 4 Social care information exchange and a recognized need for information exchange at NGOs and private service providers (%).

The results show that municipal social services have good access to the SOKY system of the Social Insurance Institution (KELA), the population register system of the Population Register Centre (VRK), an accounting or payment transfer system of their own municipality, and the primary health care patient information system. Automatic information exchange is most common between municipal social services and these four systems. Access to other information systems is less common.

In private organisations, employees rarely have access to outside information systems, such as the SOKY system of the Social Insurance Institution (KELA) or the population register system of the Population Register Centre (VRK). Information exchange between these systems is quite rare. Additionally, only a small percentage of private social service professionals have access to the primary health care patient information system or the specialist medical care patient information system.

In 2011 information exchange between organisations was limited to read-only, and there was little exchange of information between information systems. Only one in five public service providers reported that digital exchange of information was possible. In private organisations, employees rarely had access to outside information systems, while information exchange between systems was extremely rare. Electronic information exchange between systems appears to have moderately increased since 2011, but the level of read-only access is still approximately at the same level as in 2011 (Kärki et al. 2012, 5).

3.5 Workstations and identification in social welfare

Not all social welfare employees in the public and private sectors have a personal workstation. Internet access, on the other hand, is very common among organisations employees. Mobile client information system applications are less commonly used in private organisations, in particular.

For user authentication, social welfare professionals most commonly use user names and passwords. Other authentication methods are significantly less common. The results were approximately at the same level as the 2011 survey (Kärki et al. 2012, 5).

A personal workstation was organised for all employees by 10% of public social welfare organisations. Three in four offer access to the Internet for all employees. Approximately half of public social welfare organisations use mobile client information systems, but the other half does not have similar capabilities. A health care smart card is used occasionally, although it is more common than an official e-transaction card. A personal user ID and password for the client information system for all of the employees was organised by 81% of public social welfare organisations, while 60% of public organisations have acquired a personal user ID for their workstation or for the workstation network.

A personal workstation for all employees was organised by 15% of private social welfare organisations, while 82% offered access to the Internet for all employees. Less than half of private social welfare organisations use mobile client information systems. Private social welfare organisations rarely use a health care smart card or an official e-transaction card. Approximately 90% of private organisations do not use these cards at all. Instead, a personal user ID for a workstation or for the workstation network is used in over 40% of private organisations. Less than 60% of private organisations have acquired a personal user ID and password for the client information system for all of their employees.

3.6 Information management in social welfare

In social welfare organisations, preparations to implement the National Client Data Repository for Social Services and structured data recording are still under way. Compared to private organisations, municipal organisations are ahead in their preparations. In municipal organisations, development committees established to prepare the implementation of national requirements are relatively rare on both the organisational and regional level. Approximately one in ten municipal organisations has initiated development projects, and even fewer intend to acquire a new information system that fulfils the national requirements.

In private organisations, establishing development committees and projects is extremely rare. Among private organisations, less than one in ten intends to acquire a new information system that fulfils the national requirements.

In addition to an information management strategy, most municipal organisations have prepared instructions on data protection and information security, and client documentation instructions for their employees. Approximately one in five municipal organisations have prepared a model for creating electronic archives (eAMS) and a description of their software architecture according to the Finnish Information Management Act (634/2011).

The majority of private organisations have prepared instructions on data protection and information security, whereas approximately half of private organisations have prepared client documentation instructions for their employees. Information management strategies, models for creating electronic archives (eAMS) and software architecture descriptions according to the Finnish Information Management Act (634/2011) are rare in private organisations.

The situation at municipal organisations has developed slightly, with the distribution of information management plans and instructions having increased 10–24% since 2011 (Kärki et al. 2012, 40). At private organisations the frequency of information management plans and instructions has also changed since 2011. Information security or data protection instructions are now 30% more common than earlier. In addition eAMS and an information management strategy have increased by 20%. However, instructions on client documentation at private organisations are at the same level as in 2011 (Kärki et al. 2012, 51).

More detailed data on information management plan and instructions used in social service providers is presented in Figure 5.
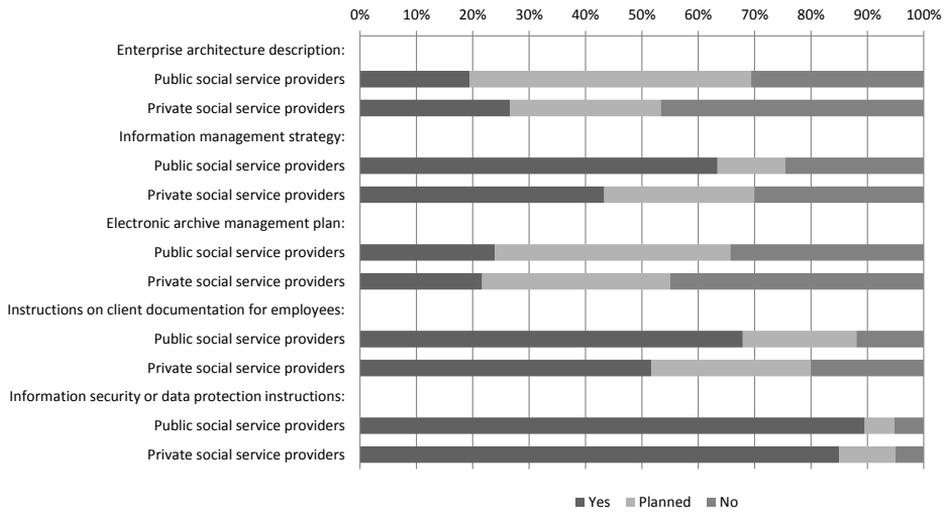
Figure 5 Public social service providers (N=134) and private social service providers (N=60) having or planning information management plans and instructions (%).

In municipal and private organisations, information systems management personnel are most commonly employed by the organisation in question. Municipal organisations typically employ information systems management personnel totalling three person-years, while in private organisations the total is one person-year. Compared to public organisations, it is more common in private organisations to have no employees in information systems management. The results were approximately at the same level as in the 2011 survey; public service providers were more likely to have their own IT personnel than private service providers (Kärki et al. 2012, 5).

3.7 Investments in ICT in social welfare

Between 2008 and 2010, the total ICT costs have remained more or less stable in organisations providing social services. Furthermore, the share of annual investment costs related to client information systems has remained at same level over recent years.

According to estimates by social welfare organisations, ICT expenditure will increase in the next few years. An ever-decreasing proportion of respondents were of the opinion that costs would remain at current level, while very few believed in a reduction in ICT costs.

Public social welfare organisations seem to invest more in ICT than private service providers. There is a large variation in the amounts of ICT investments between organisations.

3.8 Discussion on the status of ICT in social welfare in Finland

Positive alterations to legislation have been made concerning coherent information management in social welfare in Finland. The Act on client records in social welfare (254/2015) entered into force on 1 April 2015. The purpose of the Act is to implement coherent proceedings into client information management in social welfare and hence promote appropriate management of social welfare duties. The law obligates social welfare professionals to document client information in the client records. Additionally, the law prescribes how long the client documents are lodged at the active registries. At the same time the Act on electronic archiving (159/2007) was amended so that the Social Insurance Institution (KELA) can extend electronic archiving services for social welfare client records. The Ministry of Social Affairs and Health has appointed a temporary committee to elaborate the architecture and the legislation, for instance, regarding the timing of the implementation of the electronic archive in social welfare.

The results of this survey show that awareness of national information management guidance has risen since 2011. The local information management in the social welfare organisations has advanced. The digital information exchange between the CISs of municipalities has become more common over the last five years. Even so, most of the applications and solutions used in social welfare organisations are separate and local. There are signals of progress in the provision of digital social services for citizens by both public and private social service providers. Nevertheless, regarding online services for specific target groups, such as online application for services, videoconferencing, or remote services offered by the employee to the client, most social welfare clients are still awaiting progress. The organizational maturity level of ICT readiness is evidently higher in public social service providers than at private social service providers. The survey seems to indicate that the integration of certain social and health care services has developed further than previously, since nowadays many of social welfare professionals record client data in the information systems also used in health care.

The results of the survey can be leveraged in further specifying the needs, potential and capacity for implementing nationwide online client service functions in social welfare and for implementing nationwide social welfare information system services. The results may also be used when designing local and regional solutions.

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4 Physicians' use and usability of health information systems

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This chapter sets out the results of a survey on Finnish physicians' experiences of health information systems (HIS) that they primarily use in their everyday clinical work.

4.1 The 2014 survey structure and comparison to earlier surveys

A national-level electronic survey on usability of health information systems targeted to physicians of working age (N=14 411) in clinical work was first conducted at the beginning of 2010 as a joint effort of the Finnish Medical Association, THL, Oulu University and Aalto University. The results were published in national and international papers, proceedings and reports, (e.g. Viitanen, Hypponen et al. 2011, Hyppönen, Reponen et al. 2014, Martikainen et al 2012), and summarized in the e-health in Finland check point 2011 –report (Hämäläinen, Reponen et al. 2013). The survey was repeated in spring 2014 (Vänskä, Vainiomäki et al. 2014, Vainiomäki, Hyppönen et al. 2014, Lääveri, Vainiomäki et al. 2015).

The survey questionnaire is available in Finnish electronically at http://www.laakariliitto.fi/site/assets/files/1266/potilastietoj_rjestelm_t_2014_lomak e.pdf and in English at http://urn.fi/URN:ISBN:978-952-302-563-9. The method of generating the questionnaire is reported by Viitanen et. al. (Viitanen, Hypponen et al. 2011). The questionnaire consists of background questions, questions on usability, on support for work and on experienced benefits, an overall school grade, the most important development areas and best functionalities. In addition, there have been some thematic questions: in 2010 they focused on e-health related wellbeing at work and participation in e-health development.I In 2014 the themes were patient safety and management information systems. This report focuses on the main questions, leaving the thematic results for separate articles.

For the 2014 data collection, the questionnaire from 2010 was altered slightly based on new developments and experiences gained from the previous data collection: there were altogether 6 new questions and 4 questions were changed slightly. For these 10 variables, comparison to earlier data cannot be made.

A total of 3781 physicians responded to the survey in 2014 (3929 in 2010). In structure, the data from both data collection rounds form a representative sample from the target group. For this report, the data from the 2010 and 2014 surveys were combined, responses grouped into those from public sector hospitals, public healthcare centres and private providers. In addition, only the responses from the nine biggest EPR system users from these contexts were selected (used by >30 respondents), leaving responses from 5 systems in public hospitals, 4 systems in public healthcare centres and 3 systems in private clinics for analysis. System-specific differences in responses have been analysed in previous articles. (Vänskä, Vainiomäki et al. 2014, Vainiomäki, Hyppönen et al. 2014, Lääveri, Vainiomäki et al. 2015) Figure 1 shows the selection of the data.
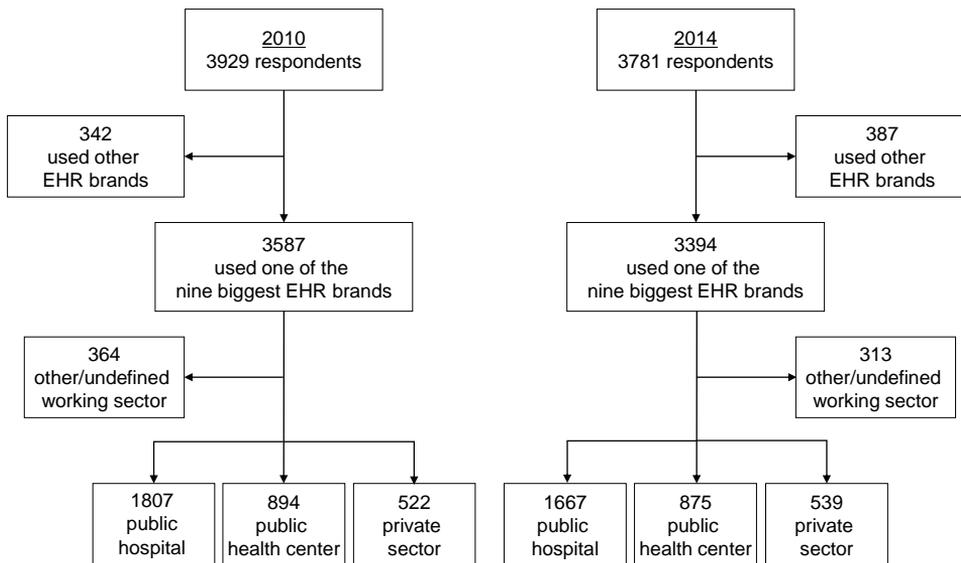
Figure 1 Selection of data for this report (Kaipio J, Lääveri T, Hyppönen H, Kushniruk A, Vainiomäki S, Reponen J, Borycki E 2016 submitted).

Different usability aspects of the information systems were assessed with 27 statements and an overall satisfaction score. The data for 21 statements were condensed by forming six sum variables based on factor analysis (Table 1). The rest of the variables are reported separately. The Likert-scale answers 'Fully agree' and 'Somewhat agree' were combined to form the category '1=Agree', and the remaining i.e. 'Neither agree nor disagree', 'Somewhat disagree' and 'Fully disagree' were combined to form the category '0=Not agree'. The sum variable scales varied from 0 (proportion of respondents that had not agreed with all individual statements) to 3 – 5 depending on the number of individual statements of the sum variable (proportion of respondents who had agreed to all individual

statements). This way of reporting condenses the data, giving a general overview of the situation and trend in the six dimensions. The sum variables hide the variation in each individual variable as well as the variation between the individual information systems, though these are reported in individual articles published from the data.

Table 1 Statements combined into sum variables

Sum variable	Statements
Technical functioning	1) The system is stable in terms of technical functionality (does not crash, no downtime). 2) The system responds quickly to inputs. 3) Faulty system function has caused or has nearly caused a serious adverse event for the patient. 4) Information entered / documented occasionally disappears from the information system.
Ease of use	1) Routine tasks can be performed in a straight forward manner without the need for extra steps using the system. 2) The arrangement of fields and functions is logical on the computer screen. 3) Terminology on the screen is clear and understandable (for example titles and labels). 4) The system keeps me clearly informed about what it is doing (for example saving data).
Key information contents	1) The EPR system generates a summary view (e.g. on a timeline) that helps to develop an overall picture of the patient's health status. 2) The patient's current medication list is presented in a clear format. 3) The system monitors and notifies when the orders given to nurses have been completed.
Intra-organisational collaboration	Information systems support collaboration and information exchange 1) Between physicians working in the same organisation. 2) Between the physician and the nurses.
Cross-organisational collaboration	1) Information systems support collaboration and information exchange between physicians across organisations. 2) Patient data (also from other organizations) are comprehensive, timely and reliable. 3) Information on medications ordered in other organizations is easily available.
Utility	1) Information systems help to improve the quality of care. 2) Information systems help to ensure continuity of care. 3) Information systems support in improving my work. 4) Information systems help to avoid duplicate tests and examinations. 5) Information systems help in preventing errors and mistakes associated with medications.

4.2 Usability of health information systems (HIS)

This chapter depicts results related to the physicians' overall satisfaction with the EPR, to the technical functioning of HIS, to the ease of use of the EPR, to the availability and usability of key functionalities, and the experiences on HIS support for intra-organisational collaboration.

4.2.1 Overall satisfaction with the EPR systems by healthcare sector

The physicians were asked to assess their principal EPR system with a school grade used in Finland (scale 4=fail, 5-6=poor, 7-8=fair, 9-10=good) (see figure 2).
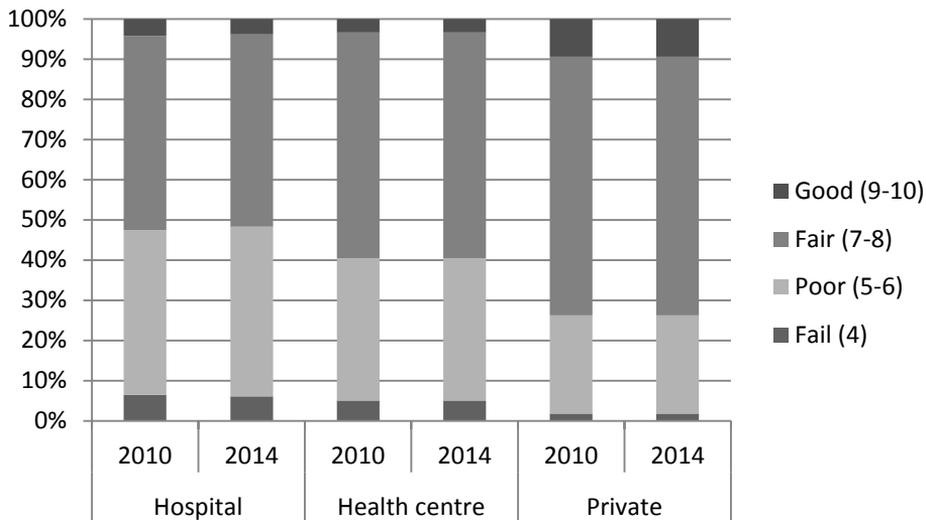
Figure 2 School grade given by physicians for their principally used EPR system.

The average school grade in 2014 across the different contexts of use for the primary EPR system was 6.6. Good grades were rare especially in public hospitals and healthcare centres, where the average grades in 2014 were 6.4 and 6.6, respectively. The private sector scored better (average grade 7.1). On average, the school grades had not changed in four years. The grade correlated with physician's age, experience of use (in years) and speciality. Those over 55 years of age and having used the EPR system for longer gave better scores, whereas surgical, psychiatric and internal medicine specialists were the most critical. (Vänskä, Vainiomäki et al. 2014)

4.2.2 Technical functionalities

The physicians' overall rating for technical functionalities of the health information systems was calculated by compiling a sum of four statements: 1) The system is stable in terms of technical functionality (does not crash, no downtime). 2) The system responds quickly to inputs. 3) Faulty system function has caused or has nearly caused a serious adverse event for the patient (scale changed to positive). 4) Information entered/documented occasionally disappears from the information system (scale changed to positive). Frequencies of the sum variable are presented in Figure 3.
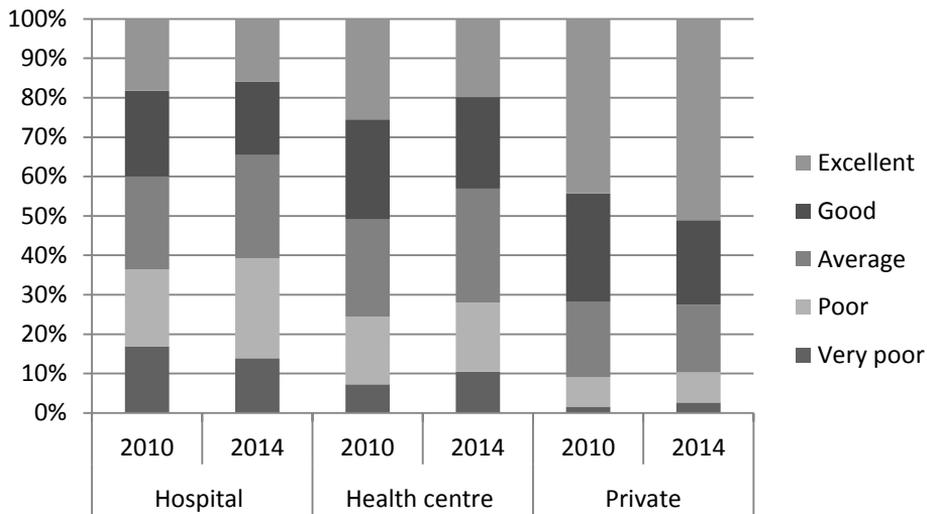
Figure 3 Technical functionality of the EPR in different use contexts [scale from 0 (very poor) = respondents disagreeing with all 4 statements, to 4 (excellent) = respondents agreeing with all 4 statements].

Mean value for technical functioning was 2.3 in 2014, with only marginal improvement in experiences on 2010 (mean 2.2). In the private sector, the technical functioning was much better than in the public sector, with an increase in excellent technical functioning -ratings. In hospitals, very poor-ratings had reduced, but poor-ratings had increased and good and very good ratings decreased. In healthcare centres, very poor- and average -ratings had increased, while good and very good ratings had decreased.

Looking at the individual statements, only in the private sector were the majority of physicians (over 70%) satisfied with the stability of their EPR system. In the public sector, dissatisfaction had increased – in hospitals, by 5 percentage points, in healthcare centres by 8 percentage points. Physicians in the private sector also gave more positive assessments to statement about adverse events caused by IT systems than four years earlier (in 2010 12% and in 2014 8% agreed with the statement) but in public hospitals about 40% and in healthcare centres about 30% of physicians still indicated that faulty functioning has caused or has nearly caused a serious adverse event for the patient (statement 24), and there was only marginal improvement. Experience of information disappearing from the IT system had become less common both in the public sector and for private providers. (Kaipio et al 2016)

4.2.3 Ease of use

Ease of use sum variable was compiled from four variables: 1) Routine tasks can be performed in a straight-forward manner without the need for extra steps using the system. 2) The arrangement of fields and functions is logical on the computer screen. 3) Terminology on the screen is clear and understandable (for example titles and labels). 4) The system keeps me clearly informed about what it is doing (for example saving data). Frequencies of the ease-of-use sum variable are presented in Figure 4.
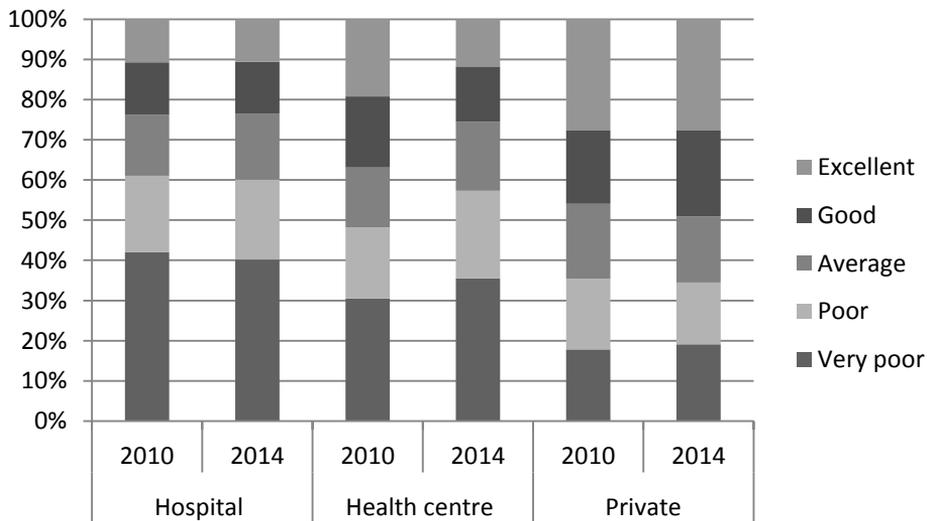
Figure 4 Ease of use of the principally used EPR system (scale 0=very poor, 4=excellent).

The mean value in 2014 for ease of use was 1.5. In 2010 the mean value was 1.6 indicating a marginal overall decrease in ease-of-use. In hospitals and the private sector, the proportion of physicians disagreeing with all four statements (very poor-category) had remained the same, whereas in the healthcare centres the proportion (i.e. the dissatisfaction with ease-of-use) had increased.

Compared to responses from the public sector, physicians working in the private sector were more satisfied with their EPR systems with regards to the usability of the EPR user interface: system's abilities to support routine tasks and keep the user informed about activities the computer is currently performing, as well as the logical arrangement of fields and functions on the screen and terminology used in the user interface. Regarding all these four issues, the assessments from physicians working in public healthcare centres were more critical than in 2010. (Kaipio et al. 2016)

4.2.4 Usability of key functionalities and information contents

The sum variable measuring availability and usability of key functionalities and information content was formed as a sum of three variables: 1) The EPR system generates a summary view (e.g. on a timeline) that helps to develop an overall picture of the patient's health status. 2) The patient's current medication list is presented in a clear format. 3) The system monitors and notifies when the orders given to nurses have been completed. Frequencies for the sum variable are depicted in Figure 5..
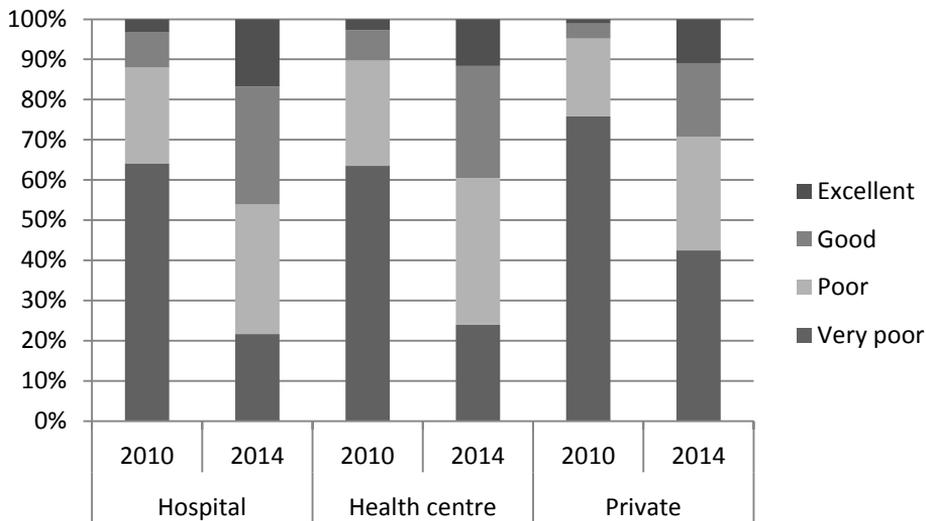
Figure 5 Usability of key functionalities and information content (scale 0=very poor, 3=excellent).

The mean availability and usability of the key functionalities and information contents had increased from 0.48 in 2010 to 1.30 in 2014. The proportion of physicians disagreeing with every statement in the sum variable (very poor-ratings) had decreased dramatically in all contexts of use, and the proportion of physicians agreeing with most or all of the statements (good and excellent-ratings) had increased. Interestingly, there was most dissatisfaction with the usability of the key information contents in the private sector both in 2010 and 2014.

Physicians in hospitals and in healthcare centres were more satisfied in 2014 than in 2010 with computer-supported help in preventing errors and mistakes associated with medications. In general, the EPR systems still lacked summary views or dashboards (in all sectors only 17-28% of the respondents agreed with the statement about the EPR generating an appropriate summary view) although in the hospital EPR systems the situation had improved (from 13 to 28%). Physicians in all sectors were dissatisfied with the systems' ability to monitor and notify when the orders

given to nurses have been completed (only 7 to 18% agreed) although the situation had slightly improved compared to 2010. (Kaipio et al 2016)

Some EPR-systems still lacked decision-support systems, which was selected as one of the functionalities that are in most urgent need of development especially in the healthcare centres but not any more in hospitals in 2014.

4.3 Support for intra-organisational collaboration

HIS support for collaboration within one's own organisation was studied with two statements: Information systems support collaboration and information exchange: 1) Between physicians working in the same organisation. 2) Between the physician and nurses. These statements were combined into a sum variable with frequencies as presented in Figure 6.
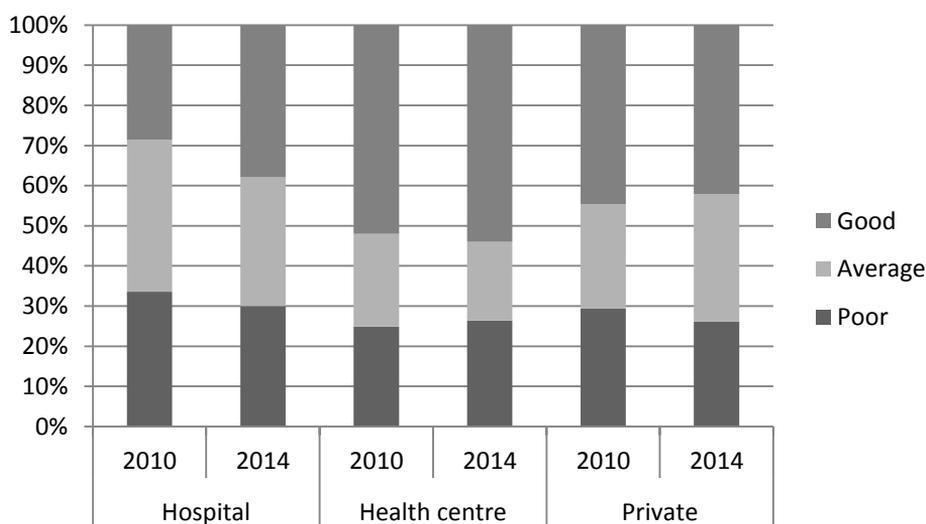
Figure 6 Support for intra-organisational collaboration (scale 0=poor, 2=good).

Mean satisfaction for HIS support for intra-organisational collaboration was 1.07 in 2010 and it had increased to 1.15 in 2014. The satisfaction for intra-organisational collaboration support was greatest among physicians in healthcare centres in both years, while satisfaction in hospitals had increased slightly and in the private sector it had remained mainly unchanged.

4.4 Experiences of structured documentation

User experiences of structured documentation were monitored with three variables in 2014, out of which only one was the same as in 2010, whereby it was not possible to generate a sum variable. The proportions of physicians agreeing with the three individual statements are presented in Figure 7, Figure 8 and Figure 9.
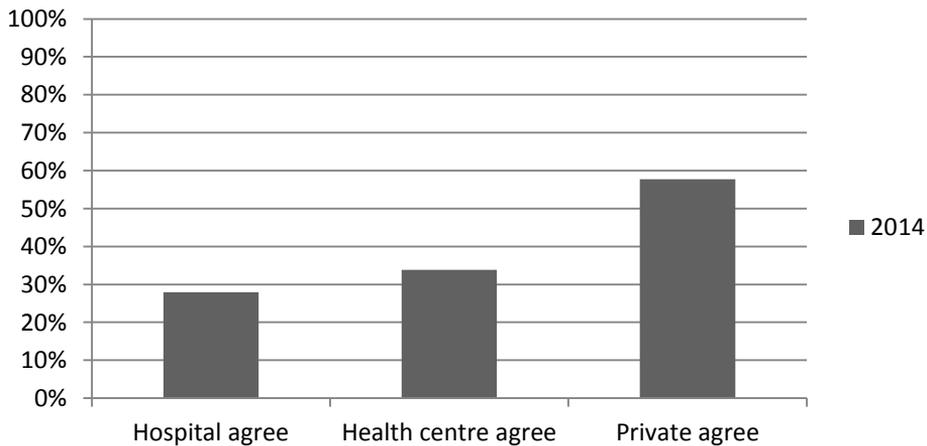
Figure 7 Proportion of respondents by EPR systems agreeing with the statement: 'Entering and documenting patient data is quick, easy and smooth'.

This statement was formulated differently in 2010, hence a comparison between 2014 and 2010 was not possible. Overall, only one third of respondents agreed that documenting patient information was easy in 2014. Public hospital doctors were the most critical. There were big EPR-system-specific differences in the public sector, though less so in the private sector, where doctors were overall more satisfied. (Vainiomäki, Hyppönen et al.2014, Lääveri, Vainiomäki et al. 2015)
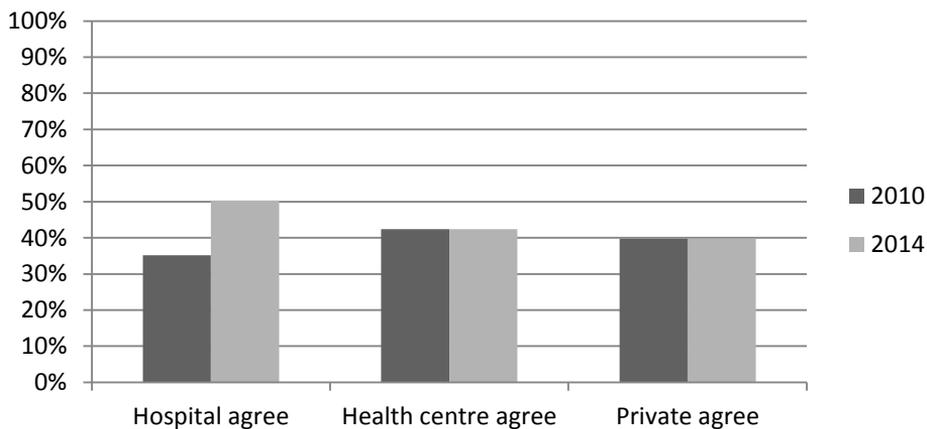
Figure 8 Proportion of respondents agreeing with the statement: 'Structured nursing documentation complicates getting an overall picture of the patient's situation'.

The criticism towards structured nursing documentation had remained constant in healthcare centres and the private sector, but increased quite dramatically among hospital doctors, where half of the respondents agreed with the statement. (Vainiomäki, Hyppönen et al. 2014, Lääveri, Vainiomäki et al. 2015)
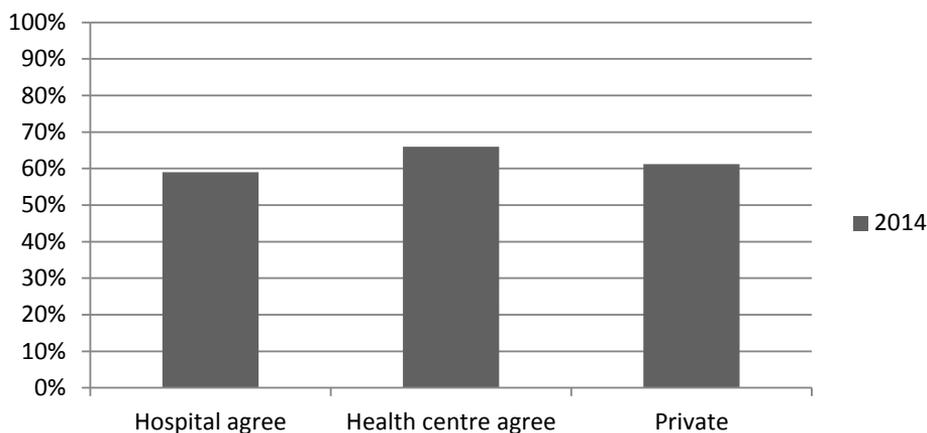
Figure 9 Proportion of respondents agreeing with the statement: 'Entering patient information in a mutually agreed (structured) way facilitates the search for and integration of information required in patient care'.

This variable was new in the 2014 survey. Again, hospital doctors were the most critical and their colleagues in the healthcare centres the least critical, even if the differences between sectors were not big. (Vainiomäki, Hyppönen et al. 2014, Lääveri, Vainiomäki et al. 2015)

4.5 Support for health information exchange

There were five key variables measuring experiences on HIS support for cross-organisational information exchange. Three of them were used to form a sum variable for cross-organisational collaboration, and two are reported separately. Key results of these are reported below.

4.5.1 Support for cross-organisational collaboration

HIS support for cross-organisational collaboration was studied with a question on the mode of cross-organisational information exchange and three statements: 1) Information systems support collaboration and information exchange between physicians across organisations. 2) Patient data (also from other organizations) are comprehensive, timely and reliable. 3) Information on medications ordered in other organizations is easily available. These were used to form a single sum variable.

The mode of health information exchange (HIE) changed dramatically from 2010 to 2014 in the public sector from using paper or a fax to using regional health information systems especially in hospitals, where the use of paper or fax reduced from 68% to 18%. In healthcare centres the reduction in paper use was more modest, from 39% to 33%. The frequencies for the sum variable are presented in Figure 10.
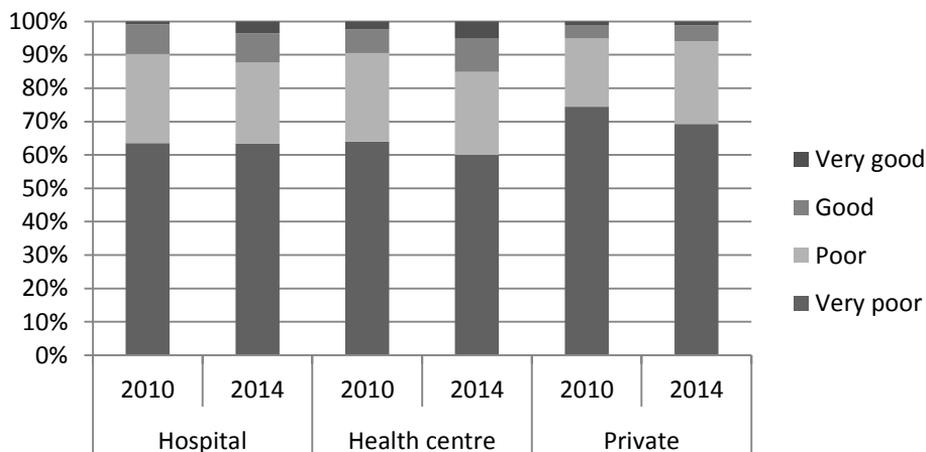
Figure 10 HIS support for cross-organisational collaboration (scale 0=very poor, 4=excellent).

Overall satisfaction with HIS support for cross-organisational collaboration was very low in 2014, and there has not been much improvement from 2010 to 2014 in any context (2010 mean = 0.45, and 2014 mean = 0.52).

Regarding the individual statements, less than 10% of private sector physicians agreed that HIS supports cross-organisational collaboration and information exchange. In the public sector 15 – 19% of physicians agreed with the statement. The ratings were even poorer for the availability of medication information (4 – 5% of respondents in all sectors agreed in 2010, 9 – 12% agreed in 2014). Satisfaction increased most among public primary care respondents in the four-year period (from 5 to 12% agreeing). Ratings for the third statement included in the sum variable, 'Patient data (also from other organizations) are comprehensive, timely and reliable' had not changed noticeably.

4.5.2 Usability of teleradiology and image distribution

Usability of teleradiology and image distribution was studied with one statement. Figure 11 presents the responses only for 2014, since the statement was altered from the 2010 survey to specify regional availability.
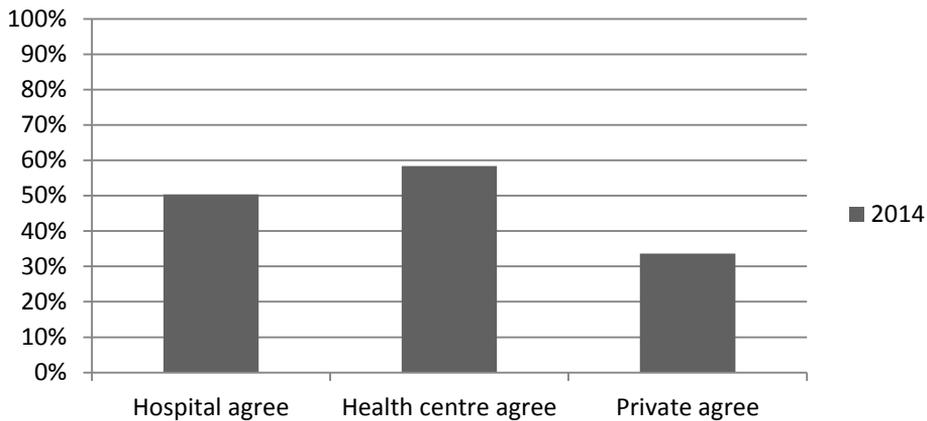
Figure 11 Proportion of physicians agreeing with the statement: 'Diagnostic imaging results are easily available on a regional level'.

Respondents in the healthcare centres were most satisfied with this functionality and their private sector colleagues were least satisfied in 2014.

4.5.3 Usability of Telelaboratory

Figure   12 presents responses to the statement: 'Laboratory results are easily available and are logically presented on a regional level'.
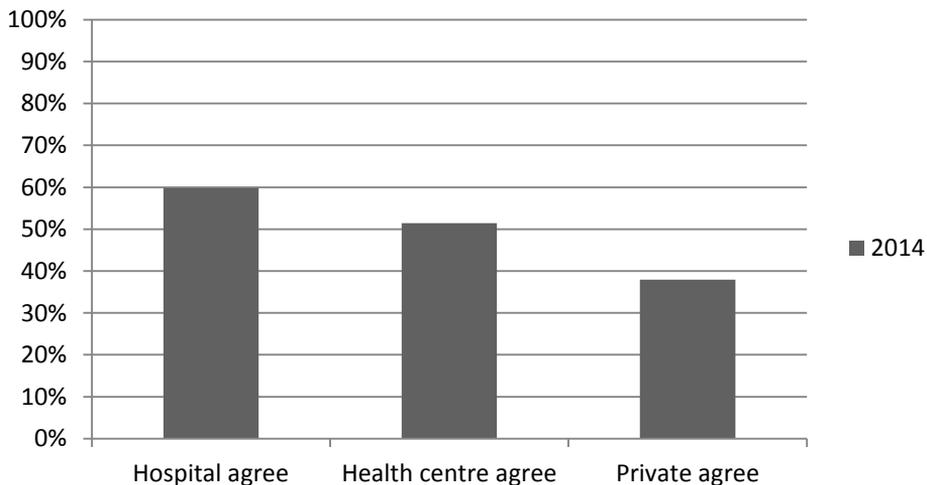
Figure 12 Usability of telelaboratory.

The results show that hospital physicians were the most satisfied with this functionality and their private sector colleagues the least satisfied in 2014.

4.5.4 Usability of e-prescription

The national e-prescription system had been implemented in the public sector but only partly in the private sector at the time of the survey. Almost half of public hospital physicians and 40% of public healthcare centre physicians regarded the usability of this functionality as one of the functionalities in most urgent need of development. (Figure 13)
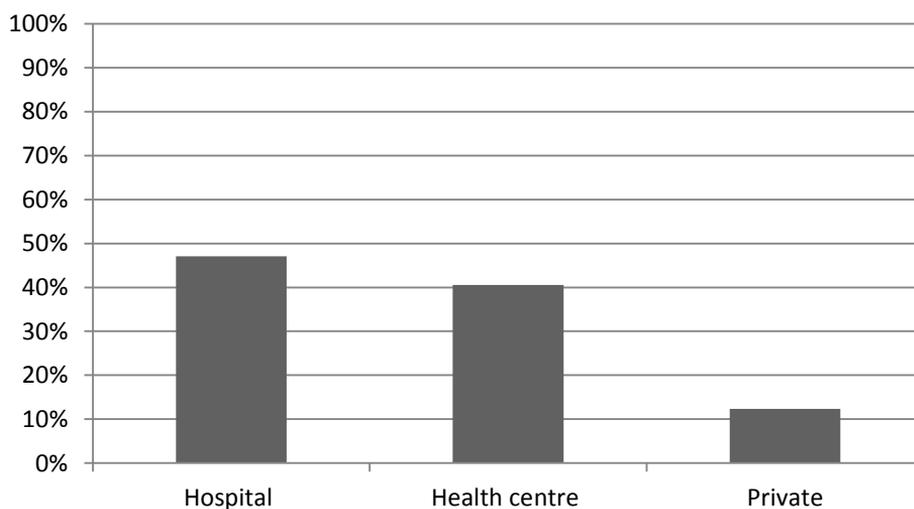
Figure 13 Proportion of respondents who selected usability of e-prescribing as one of the most urgent functionalities to be developed in their EPR system.

4.6 Support for information exchange between health care organisations and patients

Establishing e-services for citizens has been as a target in the e-health policy in Finland since the 1996 strategy. Availability of e-health and e-welfare services for citizens is presented in Chapter 2. Figure 14 a-b presents physicians' experiences of HIS support for information exchange with patients.
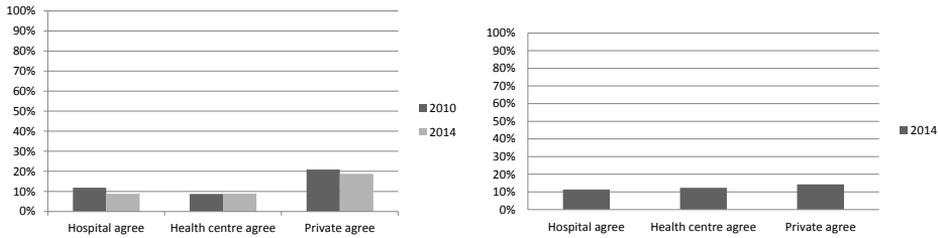
Figure 14a-b Proportion of physicians agreeing with the statements: a) 'Information systems support collaboration and info exchange between physicians and patients') and b) 'Measurement results provided electronically by the patient (e.g. via the patient portal) help to improve the quality of care' in 2014.

Figure 14a shows that more physicians in the private than public sector experienced that HIS supports physician-patient collaboration in 2014, even if the proportion had decreased slightly since 2010. One explanation may be that the private sector has been quick to implement some e-services for citizens, and e.g. in the public sector, there is lower availability of patient portal functionalities than in the private sector.

Interestingly, Figure 14b shows that the experienced utility of measurement results provided by the patients remains low in 2014 in all contexts, even if private sector physicians regard patient-provided measurements as slightly more useful. Increased information exchange with patients seems to be only one factor in physicians' evaluation of the quality of care.

4.7 Experienced utility of health information systems

The experienced utility of health information systems was monitored with five individual statements: 1) Information systems help to improve the quality of care. 2) Information systems help to ensure continuity of care. 3) Information systems support in improving my work. 4) Information systems help to avoid duplicate tests and examinations. 5) Information systems help in preventing errors and mistakes associated with medications (Table 1). The results of the sum variable are presented in Figure 15.
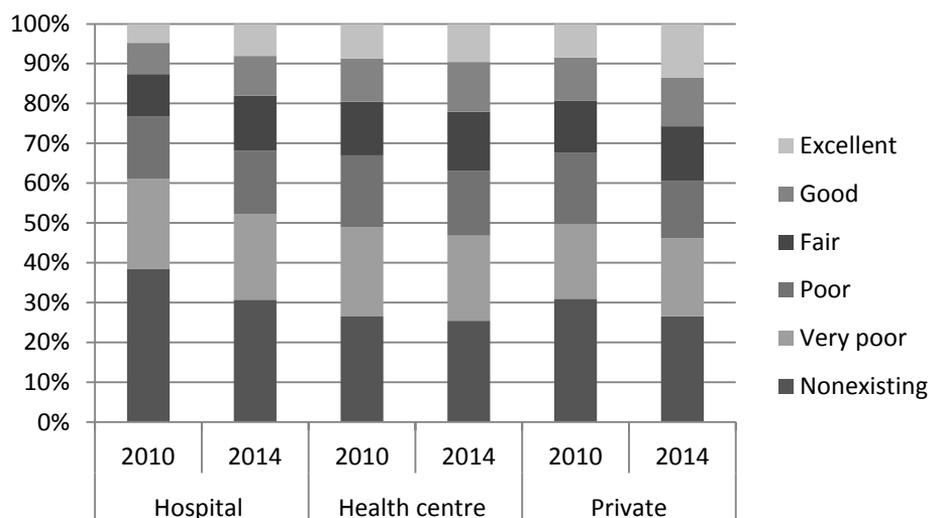
Figure 15 Physicians' estimate of health information systems utility (sum variable of 5 benefit-variables. Scale from 0 (non-existing)=proportion of respondents disagreeing with all the five utility statements, to 5 (excellent)=proportion of respondents agreeing with all the utility statements.

The experienced utility had not improved (mean 1.8 in 2014, 1.6 in 2010). In 2014 up to 30% of hospital physicians, 26% of private sector physicians and 21% of healthcare centre physicians responded with 'disagree' to all five utility-statements, and only 10% of physicians responded with 'agree' to all five statements. However, the proportion of physicians disagreeing with all the statements had slightly decreased from 2010 to 2014, and those agreeing with all 5 statements had increased.

Of the individual statements, satisfaction with HIS in preventing errors and mistakes associated with medications had improved from 28% of physicians agreeing in 2010 to 41% of physicians agreeing in 2014; the increase was highest in public healthcare centres. Overall satisfaction with HIS support for continuity of care was 41%, with a slight 4% improvement since 2010. Support for improvement of one's own work had also improved, from 19% to 23% of physicians agreeing; both the increase and satisfaction were the highest in the private sector. In 2014, 41% of all physicians were satisfied with HIS support in avoiding duplicate tests. The satisfaction had improved only marginally. One third of physicians were satisfied with HIS support for care quality, and satisfaction had increased slightly in all sectors.

4.8 Experiences on EPR learnability, proficiency of use, technical support and participation in EPR development

In parallel with the organisation survey mapping the availability and use of human and material resources (Chapter 2.8), the physician survey enquired about physicians' experiences of EPR learnability, the proficiency of use, and the technical support. The results are reported below.

4.8.1 EPR learnability

Experiences of EPR learnability was enquired with a statement: Learning to use the EPR system does not require a lot of training. The overall satisfaction with learnability had decreased from 42% in 2010 to 36% in 2014. Satisfaction had decreased in public primary care and the private sector.

4.8.2 Proficiency of use

Proficiency of EPR use was studied with two questions: 1) How long have you used the system and 2) How experienced do you regard yourself to be as a user of EPR systems (scale 1=novice to 5=proficient).

In 2010 66% of respondents and in 2014 75% of respondents had used the EPR system for over 3 years. The percentage of those with less than 6 months of experience was low: 6% in 2010 and 4% in 2010. Over 60% of the respondents rated their own proficiency in EPR use at level 4–5 (good-very good).

4.8.3 Technical support

Availability of technical support was enquired with a statement: If I have problems with the system I can easily get help. Satisfaction was highest (60% of respondents agreed) in the private sector, and had not changed in four years, whereas in public primary care, satisfaction had decreased from 52% to 45%. In public hospitals, there was also no change from the 45% agreeing with the statement.

4.8.4 Participation in EPR development

In questionnaire studies conducted in 2010 and 2014, experiences of the respondents were mapped regarding the giving of feedback and the development of currently used EPRs (results from the 2010 study published in Martikainen et.al 2012). The following four statements were presented in both years: 1) 'I know to whom and how to send feedback about the system if I wish', 2) 'The supplier of the system is interested in user feedback', 3) 'The supplier of the system performs the suggested corrections and changes as desired' and 4) 'Suggested corrections and changes are performed sufficiently rapidly'.

In general, more respondents agreed than disagreed with the statements in 2014 than in 2010, indicating a slight positive change in the users' experiences in their

participation in EPR development. The only negative change is in the results for the response to the first statement, where 42.8% agreed and in 2010 and 2014, one percent less (41.8%) in 2014.
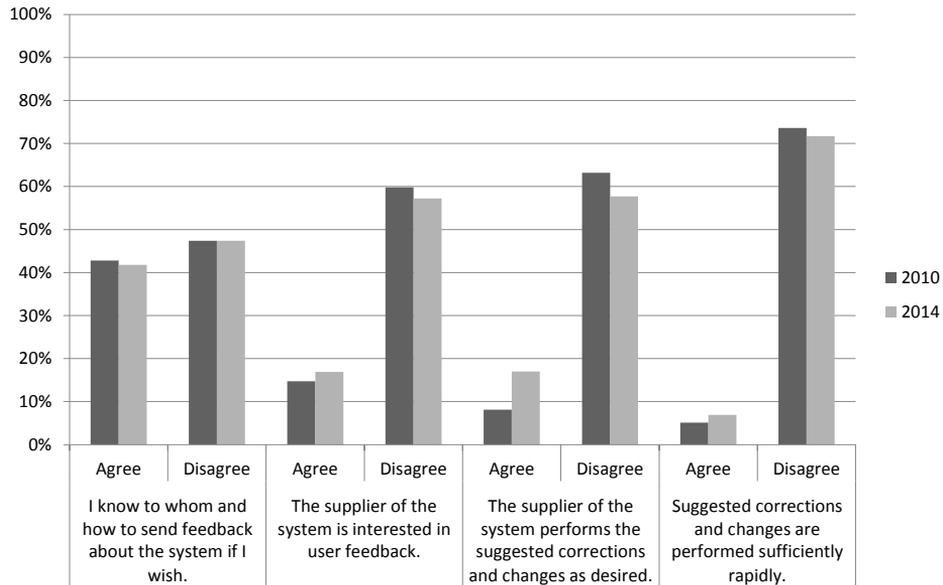
Figure 16 Frequencies of responses to the four statements measuring user participation.

In 2010, 14.7% of responders agreed with statement 2, with 2% more respondents agreeing than in 2014 (16.9%) (Figure 16). In the responses to question 3, the change between the survey years was highest: in 2010, 8.1% agreed, while almost 10% (17.00) more agreed in 2014 (17.0%). For the final question 4, the difference between the results was quite small (in 2010, 5.1% agreed, compared to 6.9% in 2014).

4.9 Summary of the key results

The table below presents the key results of the usability survey, depicting the development trend in different contexts of use as a change in mean values of the key variables or sum variables. The overall 'winners' in usability improvement are the hospital systems. They have improved in five and reduced in two usability dimensions. The private care systems show the least improved elements and healthcare centre systems show the most reduced elements regarding usability. The biggest positive change in all the contexts is the availability/ usability of key information content and the biggest negative change is in the usability of telelaboratory results. Overall, the utility trend is slowly improving. Usability of

nursing documentation has improved in the public sector, but has worsened in the private sector.

Table 2 Summary of the key usability results. Gray background on cells indicates reduction, framed cell indicates improvement of overall usability

Variables (scale)	Trend 2010->2014 (mean values)		
	Hospital	**Healthcare centre**	**Private**
Overall satisfaction (4-10)	6,4->6,4	6,7>6,6	7,1->7,1
Technical functioning sum (0-4)	2,0->2,0	2,4->2,2	3,1->3,1
Ease of use sum (0-4)	1,3->1,3	1,8->1,4	2,2->2,2
Key information contents sum (0-3)	0,5->1,4	0,5->1,3	0,3->1,0
Intra-organisational collaboration sum (0-2)	0,9->1,1	1,3->1,3	1,2->1,2
Structured documentation: data entry (1-5)	2,4	2,7	3,6
Structured documentation: nursing (1-5)	2,4->3,7	2,7->3,3	3,2->2,6
Structured documentation: search+integr. (1-5)	3,8	4,0	3,9
Cross-organisational collaboration sum (0-3)	0,5->0,5	0,5->0,6	0,3->0,4
Teleradiology (1-5)	3,2->3,4	3,5->3,6	3,4->2,8
Telelaboratory (1-5)	4,0->3,7	3,8->3,3	3,9->2,9
Patient-carer collaboration: info exchange (1-5)	2,1->1,9	2,0->1,9	2,6->2,4
Patient-carer collaboration: measurements (1-5)	1,3	1,2	1,4
Utility sum (0-5)	1,4->1,8	1,9->2,0	1,8->2,1

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5 Citizens views of e-health and e-welfare services

Hannele Hyppönen

This chapter is based on results of a national survey on citizens' views and needs of e-health and e-welfare services in Finland. The results have been reported in detail in Finnish in a THL report and in the Finnish Journal for e-health and e-welfare (Hyppönen 2015, Hyppönen, Hyry et al. 2015).

5.1 Survey background, structure and sampling

Citizens' readiness to use electronic services has increased in Finland: According to Statistics Finland, in 2014 already 90% of Finnish people aged 16–74 used internet-based e-services, and the majority of them had network connections at home (Tilastokeskus 2014). Changing health care provision and administrative structures, population aging and personnel and resource shortages will increase the interest in developing electronic services for citizens in social welfare and health care. The new e-health strategy has ambitious goals and an action plan for implementing e-health and e-welfare services in Finland by 2020 (Ministry of Sosial affairs and Health 2015). The aim is to support the social and health care reform in Finland and activate citizens in maintaining their well-being through development of social and health care information management and e-services. The strategy strives to ensure that citizens use online services and produce information on their health for themselves and for professionals. The means to achieve this include ensuring availability of reliable online information on health and well-being and services that support it, a national platform for storing and sharing citizen's own measurement results, and further development of online services developed in the Ministry of Finance in an Action Programme on e-services and democracy (SADe-programme).

In 2014, prior to the e-health and e-welfare strategy implementation, e-health and e-welfare services provided for citizens at national level included viewing of electronic prescriptions and patient data in addition to the e-government services for the health and welfare sector, which had been developed by the Ministry of Finance in SADe-programme). Already in 2010, there were numerous local internet-based services provided by the municipalities and hospital districts, as well as a wealth of development projects as depicted in Table 1 (Hyppönen, Iivari et al. 2011).

Table1 Local internet-based services and development projects in 2010

Electronic service	Healthcare centres providing in 2010 (%)	Hospital districts providing in 2010 (N)	Social care organisations providing in 2010 (%)	Development projects in 2010 (N)
Service directory	100 %	21	89 %	26
Health information	Not asked	Not asked	41 %	36
Generic information and counselling	51 %	11/21	11 %	16
Electronic booking	15 %	13/21		31
Application to services (social care)/ Patient-provided anamnesis (health care)	8 %		27 %	21
Self-assessment	19 %	3/21	10 %	26
Triage	74 %			29
Storing of patient-provided health data	1 %	1/21		45
Mediating of patient-provided health data	2 %	1/21		45
Correction of own data	6 %			
Living will	13 %	1		
Feedback on services	36 %	9/21	47 %	16

In order to produce evidence for decisions regarding further planning and directing of development of e-health and e-welfare services for citizens, it is important to know, what experiences and needs citizens have regarding these services (Steele Gray, Miller et al. 2014) prior to implementing the strategy. This information was surveyed at national level for the first time in 2014 as part of a project co-funded by the Ministry of Social Affairs and Health and the Ministry of Finance in Finland. It represents the baseline of e-health and e-welfare services in Finland in 2014 and provides a reference point against which the strategy deployment and goals can be benchmarked later as e-health and e-welfare services expand. The study questions were:

- To what extent do citizens use different health care service functionalities traditionally vs. electronically?
- What experiences do citizens have of existing electronic e-health functionalities?
- What are citizens' needs regarding e-health services/functionalities?

5.1.1 Survey design and structure

The questionnaire was designed using prior questionnaires from Finland (Jauhiainen, Sihvo et al. 2014, Kaikkonen, Murto et al. 2014), Denmark (Tornbjerg, Bertelsen 2014), Canada (HarrisDecima, The Conference Board of Canada 2012), the USA (Silvestre, Sue et al. 2009, DeSilva 2014), and Norway (Wangberg, Andreassen et al. 2009) of citizens' and patients' experiences of e-services. In addition, the goals of the SADe-programme and information needs of the developers, implementers and managers of the national e-health and e-welfare services were collected as a basis for designing the survey. A ready-made survey could not be found to meet all the information needs. A longstanding Regional Health and Well-being Study (ATH) (Kaikkonen, Murto et al. 2014) had useful questions regarding respondents' background information, health, health behaviour and use of health services, which were adopted into the questionnaire. The questionnaire contains the topics presented in Table 2.

Table 2 Citizen survey structure

Survey Topics		No. of questions	No. of sub-questions
1.	Demographics of the respondent	9	2
2.	Health, functional ability and life style	8	5
3.	Utilisation rate of health service functionalities (traditionally/ electronically)	2	21
4.	Utilisation on behalf of others	1	9
5.	Utilisation rate of specific web-services	1	18
6.	Adequacy/ sufficiency of listed services	1	14
7.	Average cost and time spent on one visit	1	2
8.	Usability and utility of electronic services	1	3
9.	Importance of goals for developing e-health and e-welfare services	1	19
10.	Barriers to uptake/ use of e-services	1	20
11.	Importance of getting listed services electronically	1	25
12.	Interest in participating in development of e-health and e-welfare services	1	
13.	Comments	1	

The electronic version of the survey questionnaire is presented in http://urn.fi/URN:ISBN:978-952-302-563-9

5.1.2 Sampling and data

A representative sample (N=15 000) of the Finnish population in terms of age, gender, municipality of residence and language spoken, who were not living in an institution and were over 18 years old, was obtained from the Population Register

Centre in May 2014. The respondents received a letter containing a cover letter, a response form, and a raffle ticket to participate in a draw for several prizes if they were to participate. In addition, a postage-paid envelope was included, in which the respondent could return the completed questionnaire. The questionnaire contained an internet address for the electronic version of the survey, as well as a personal username for those who wanted to respond electronically.

The survey was conducted in May to August 2014. There were two reminders sent to the respondents, one in the second half of June, and another at the end of July. Altogether 4703 questionnaires were returned (original response rate 35%), of which 453 were via the Internet, and the remaining 4250 were on paper. In order to accept the questionnaire into the data sample, 60% of questions needed to be answered in addition to the obligatory questions. A total of 4015 replies were accepted and included in the final analysis (final response rate 27%).

5.1.3 Representativeness and weighting of the sample

In spite of the sampling method (representative sample from the population register), it is impossible to control who will respond. Regionally and by language the respondents represented well the actual population, but age and gender variation was typical for surveys: Women and older people were the most active respondent groups. For this reason the data were weighted using population data from Statistics Finland to correspond to the population characteristics (Table 3)

5.1.4 Data analysis

Descriptive analyses (distributions and cross tables where the significance of responses was tested by the chi-square test) and logistic regression analyses were carried out mainly by a statistical analysis program from the research company TNS Gallup Oy. In addition THL used SPSS software to further analyse the data where the results were interesting to follow up and present. The results are reported using tables and graphs. The cases were weighed according to gender, age, region and language spoken in order to ensure representativeness of the data (Table 3).

Table 3 Weighing of the cases

Characteristics to be weighed	Data (N)	Desired distribution (K_i)	N * K_i	Observed distribution (n_i)	Weight (W_i)
Gender					
Male	4015	0.476	1911	1283	1.49
Female	4015	0.524	2104	2732	0.77
Age	4015				
18–35	4015	0.302	1213	921	1.32
36–50	4015	0.206	826	708	1.17
51–65	4015	0.269	1080	1351	0.80
66–75	4015	0.151	606	724	0.84
76+	4015	0.072	291	311	0.93
Region	4015				
Helsinki- region	4015	0.298	1198	1091	1.10
Southern Finland	4015	0.219	881	937	0.94
Western Finland	4015	0.248	995	1043	0.95
Eastern Finland	4015	0.119	480	516	0.93
Northern Finland	4015	0.115	462	428	1.08
Language spoken	4015				
Finnish	4015	0.944	3790	3804	1.00
Swedish	4015	0.044	178	179	1.00
Russian	4015	0.012	46	32	1.45

5.2 Respondents demographics

The age distribution of the respondents shows that there were many respondents over the age of 76 years. One third had a university-level and one third vocational intensity (Figure 1).
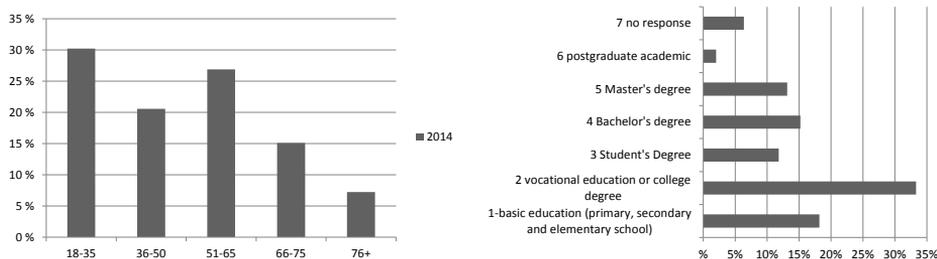
Figure 1 Respondents' age and education distribution.

A majority of the respondents (94%) spoke Finnish as their mother tongue, 4% spoke Swedish and 1% spoke Russian. One third of the respondents lived in the Southern district of Finland, one fifth in the Western district. The rest of the respondents lived in South-Western, Eastern and Northern Finland (13–16% in each). A majority (60%) of the respondents lived in cities, one quarter in suburbs and the rest in sparsely populated areas.

A majority of the respondents had access to the Internet (87%) and an ID for electronic services (85%), which is in line with the results of the survey conducted by Statistics Finland in 2012. Lack of an ID for electronic services was associated with higher age, physical inactivity, chronical illness, and infrequent use of health care services (Figure 2).
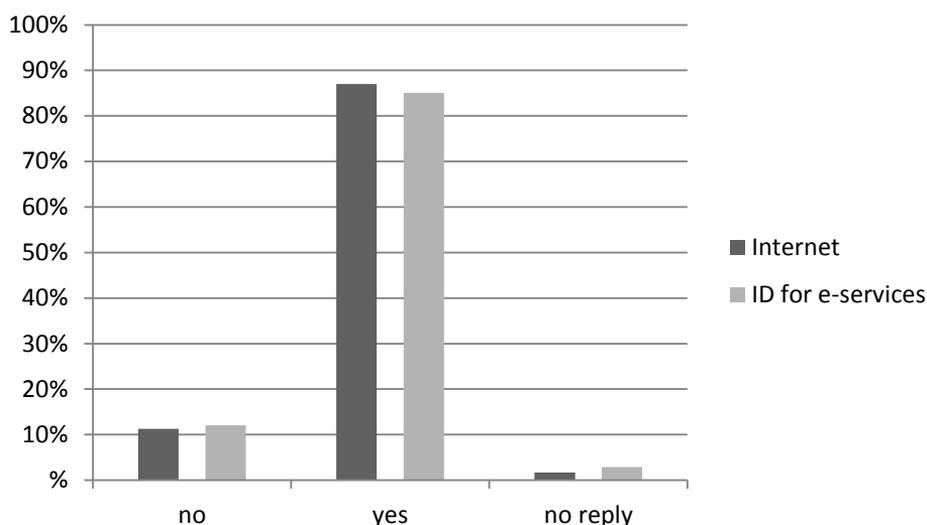
Figure 2 Respondents' access to the Internet and online service ID.

5.3 Respondents' health and utilisation of health services

Half of the respondents did not have a chronic illness, 41% had a chronic physical, and 5% a chronic mental illness. Compared to the Danish survey, there were about 10% more people reporting that they have a chronic illness in Finland than in Denmark.

Of the respondents, 13% said that they had used health care services 10 times or more during the past year. Of these, people with a chronic physical or mental illness were a majority (Figure 3).
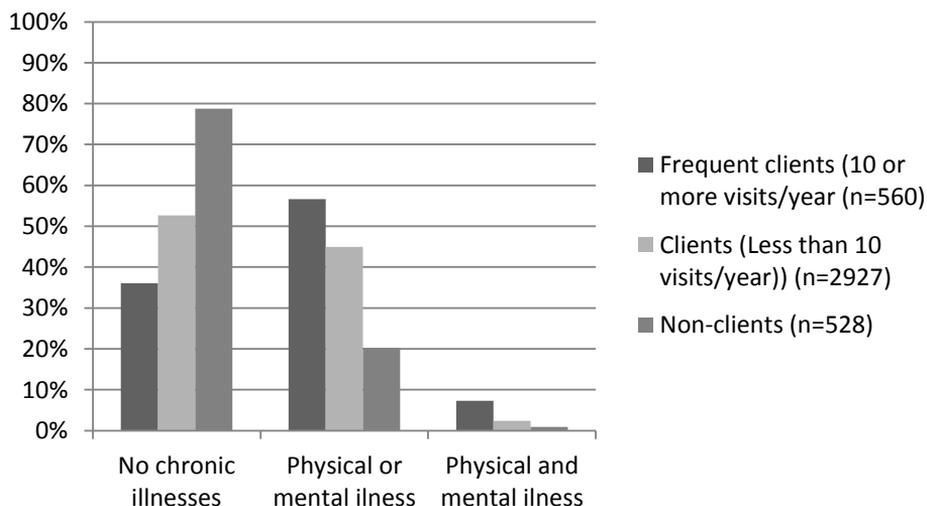
Figure 3 Respondents' chronic illness and use of health care services.

A computer had been used by 12% of respondents to contact a doctor or a nurse in the past year. Frequent use of health care services (more than 10 times in the past year) was significantly associated with the use of electronic services.
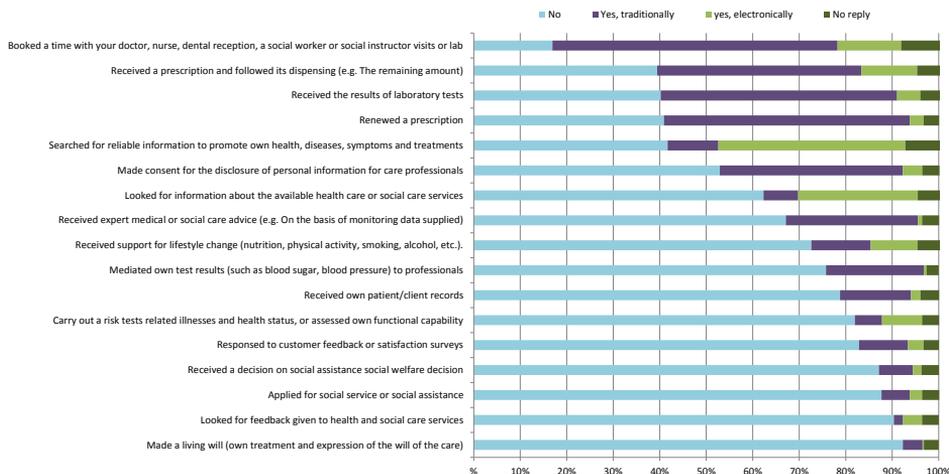
Figure 4 Frequency of services used and mode of use.

Figure 4 presents the frequency of services used by the respondents and the mode of using them. The most common service – used by 83% of respondents – was booking a time to see a doctor or nurse or to receive dental care or social care. Only 14% of respondents had done this electronically. Prescriptions had been given to approx. 60% of respondents, of whom 12% got them electronically. Laboratory

results had also been given to 60% of respondents, of whom only 5% got them electronically. Nearly 60% of respondents had sought information regarding health, illnesses and service providers, and this was the most common functionality used online (by 40% of respondents), followed by search of available services, which was done by some 40% of respondents, of which 26% did so electronically. The top three online services used to search for this information were Google (over 70% of those having searched for health or service related information had used Google), Wikipedia (some 50% had used it), the municipalities' social and health care websites (some 45% had used it) and Terveyskirjasto.fi (Online Health library, some 40% had used it).

Respondents also used services on behalf of others – for instance, children or older people that they cared for. Figure 5 shows that booking appointments was the most common service used on behalf of others. Electronically, it was most common to search for service providers on behalf of others.
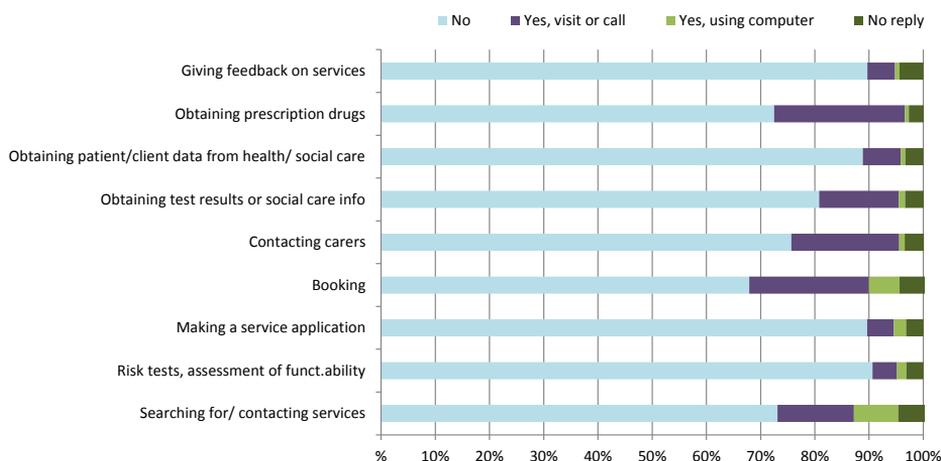
Figure 5 Utilisation services of behalf of others.

Logistic regression analysis was used to assess factors predicting the use of electronic services (Table 4). Results reveal that using health and social care services frequently is the strongest predictor of the use of e-services. Better education, younger age and use of occupational health services also predict use of e-services. Respondents living in sparsely populated areas had lower probability of using e-services.

Of the dedicated e-health and e-welfare portals, the respondents were most familiar with the municipal social welfare and health care portals. (41% of respondents had used these services in the past year). Typically these portals offer information on social and health care services and contact information, links to health and self-care information, while some also vive access to electronic booking

and messaging. One fifth of respondents had accessed the My Kanta pages, where they could at the time of the survey view their own prescriptions. The Mielenterveystalo mental health portal was the most frequently used of all the regional portals intended for specific illnesses (3% of respondents had used it).

Table 4 Factors predicting citizen's use of electronic services

Independent variables	B	S.E.	Wald	df	Sig.	Exp(B)	95 % C.I.for EXP(B)	
							Lower	Upper
Frequency of service use during past year: 1–2 times			170.33	5	0	1		
3–4 times	0.49	0.269	3.324	1	0.068	1.632	0.964	2.762
5–6 times	1.242	0.259	22.912	1	0	3.461	2.082	5.754
7–8 times	1.727	0.25	47.664	1	0	5.625	3.445	9.186
9–12 times	1.912	0.243	61.785	1	0	6.77	4.202	10.907
Over 12 times	2.305	0.23	100.545	1	0	10.022	6.387	15.725
Age group: 18–35 yrs			20.398	4	0	1		
36–50 yrs	0.198	0.155	1.636	1	0.201	1.219	0.9	1.651
51–65 yrs	0.239	0.146	2.682	1	0.101	1.27	0.954	1.691
66–75 yrs	-0.251	0.206	1.477	1	0.224	0.778	0.519	1.166
76+ yrs	-1.595	0.477	11.173	1	**0.001**	0.203	0.08	0.517
Education: Basic education			34.609	4	0	1		
Vocational degree	0.779	0.216	13	1	0	2.18	1.427	3.33
Student	1.089	0.251	18.881	1	0	2.971	1.818	4.856
Batchelor's degree	1.267	0.233	29.597	1	0	3.552	2.25	5.607
Master's degree or higher	1.144	0.232	24.295	1	0	3.14	1.992	4.949
Use of occupational health services: no						1		
Yes	0.382	0.121	10.007	1	**0.002**	1.465	1.156	1.857
Living district: Helsinki-Uusimaa			5.902	4	0.207	1		
Southern Finland	-0.335	0.157	4.561	1	**0.033**	0.715	0.526	0.973
Western Finland	-0.2	0.15	1.768	1	0.184	0.819	0.61	1.099
Eastern Finland	-0.103	0.186	0.306	1	0.58	0.902	0.627	1.298
Northern Finland	0.018	0.191	0.009	1	0.923	1.019	0.701	1.48
Type of living area: City			6.005	2	0.05	1		
Suburb	-0.189	0.134	1.999	1	0.157	0.827	0.636	1.076
Sparsely populated area	-0.396	0.174	5.184	1	**0.023**	0.673	0.479	0.946
Constant	-4.13	0.321	165.142	1	0	0.016		

5.4 Experienced usability and benefits of online services

5.4.1 Average cost -savings

Those respondents who had used e-services (12 % of respondents) estimated that use of e-services had saved them some 1.37 visits or other contacts per respondent per year (range 2.37 – 0.32 visits, depending on the e-services used). Getting support for life style changes, getting information on health and self-care and getting information to support the selection of service providers topped the list with an estimated saving of over 2 visits per respondent per year.

According to the health care statistics, there were some 4.3 visits per year per citizen in Finland in 2013. If 12% of citizens would save 1.37 visits per year, this would amount to a yearly saving of some 700 000 visits. If the real cost of each visit to the municipality is some EUR 100, saved visits would amount up to EUR 7 million in savings per year, which could be used to shorten the queues and focus on patients who cannot be helped with e-services in the municipalities.

5.4.2 Usability and utility of electronic services

Experienced usability and utility of e-services was studied with three statements, each of which had a 5-point Likert scale from disagree completely to agree completely. User experiences of the existing electronic portals were by and large positive. The most useful services in the users' opinion were the Mielenterveystalo mental health portal (88% of users considered it useful) and My Kanta pages (77% of users considered it useful).

5.5 Citizens' barriers to uptake/ use of e-services

A belief that personal contact cannot be replaced by e-services was by far the most important barrier to uptake and use of e-health and e-welfare services (Table 5). Belief was mentioned as a barrier by over 60% of respondents. Complicated terms of use and inaccessibility due to disabilities were both mentioned by about 40% of respondents (Table xx). Among the least important barriers were language barrier, lack of technology, skills or usability, and a belief that e-services do not bring added value to the respondent. About one third of the respondents to the citizen survey felt that fear of their personal health data leaking to outsiders was a barrier to e-service use, while close to 50% did not see this as a remarkable barrier.

Table 5 Most and least important barriers to e-service use

Most important barriers (>30% of respondents agreed)	Agree %
Personal contact cannot be replaced by e-services	63
Terms of use are too long and complicated	42
Electronic services are not accessible for disabled people	40
I cannot get thorough services without face-to-face contact	38

Least important barriers (<20% of respondents agreed)	Agree %
I cannot get service in my mother tongue	6
I do not have a computer and internet access	13
Electronic services slow down access to services and care	15
Electronic services do not bring any added value	17
I do not have adequate technical skills to use the services electronically	18
Electronic services are difficult to use	19

5.6 Online services needed

In the future, the main services thought to be required online (more than two-thirds of respondents regarded it as important and less than a fifth as not important) were access to laboratory test results, own EPR-data and prescriptions, being able to have their prescriptions renewed online, being able to make appointments and receiving reminders about them. Almost seen as important were access to reliable health information and care recommendations and a service directory (Table 6).

Table 6 Electronic services needed by respondents

The most important electronic functionalities in future	Important (Grades 4+5)	Not important (Grades 1+2)	Mean	No response
Access to laboratory and imaging results	70%	15%	3.92	4%
Access to own EPR	67%	16%	3.86	5%
Access to view and renew prescriptions	67%	16%	3.82	4%
SMS-reminder of an appointment	66%	16%	3.81	4%
Electronic booking of health care services	65%	17%	3.79	4%
Reliable information on health, illnesses and self-care	61%	18%	3.67	4%
Service directory	59%	19%	3.59	5%
Possibility to apply for services via internet	57%	23%	3.55	5%
Giving concent/refusal to use own EPR-data	52%	22%	3.53	5%
Possibility to make and store a living will	52%	20%	3.52	5%
Possibility to mediate own measurement data and get care instructions online	52%	23%	3.45	5%

Secure communication with professionals	50%	24%	3.36	5%
Personal health record to store own measurement and life style data	50%	24%	3.36	5%
Electronic feedback on services	50%	23%	3.39	5%
Monitoring own measurements (e.g. RR)	47%	26%	3.29	4%
Reporting patient safety incidents	45%	24%	3.3	5%
Access to own social care data	43%	34%	3.1	5%
Monitoring own life style (e.g. food and excesise)	38%	33%	3.02	4%
Electronic booking to social care	37%	39%	2.89	5%
Filling in client satisfaction and impact-surveys	35%	31%	3.02	5%
Making risk tests to assess need of care and to get self-care instructions	29%	36%	2.82	5%
Participation in making a care plan	27%	39%	2.75	5%
Electronic voucher for e-health and e-welfare services	23%	39%	2.66	6%

The most important goals for electronic services were data security, quicker access to care and services, and avoiding incorrect or unsuitable medication (more than 70% of respondents agreed).

In summary, Finland is well on the way for digitalisation of many of the health care services or functionalities most frequently used by citizens. The big challenge is to make them user-friendly and show their added value to citizens (and professionals) so as to encourage their use. Electronic services for citizens can contribute to building a new, cost-efficient and effective service structure and safeguarding equal opportunities for promoting the health and wellbeing of people living in different regions, as well as access to basic social and health care services that do not require a visit in person. Achievement of these objectives is conditional on the simultaneous renewal of service processes. It is also important to remember that electronic services and active promotion of personal health and wellbeing are beyond the reach of some citizens. Electronic services cannot fully replace face-to-face services in social and health care; they can complement the range of existing services.

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6 E-health and e-welfare in Finland: overall development and trends in light of the strategy

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The latest Information Strategy for Social and Health Care 2020 was published at the end of 2014 (Ministry of Social Affairs and Health 2015). The objective of the strategy is to support the renewal of the social welfare and health care sector and the active role of citizens in maintaining their own well-being by improving information management and increasing the provision of online services. To achieve these ends, the strategy states that it is essential to make active use of information related to social welfare and health care services and to refine it into knowledge that will support both the service system and individual citizens.

The strategy consists of six thematic areas, for which strategic objectives and measures to meet the objectives are described. In this chapter, the results of each of the individual data collections are reflected against the objectives of the thematic areas. The thematic areas are:

- Citizens as service users – Doing it yourself
- Professionals – Smart systems for capable users
- Service System – Effective utilisation of limited resources
- Refinement of information and knowledge management – Knowledge-based management
- Steering and cooperation in information management – From soloists to harmony
- Infostructure – Ensuring a solid foundation

6.1 Citizens as service users – Doing it yourself

The strategic objectives and measures for the first thematic area are:

- Citizens use online services and produce data for their own use and for professionals.
- Reliable information on well-being and services supporting its utilisation are available and assist citizens in life management and in promoting their own well-being or that of their family and friends.
- Information on the quality and availability of services is available in all parts of Finland and can be used in the selection of the service provider.

Five measures are envisioned in the strategy: 1) A platform (PHR) for managing citizens' personal information in the areas of health and well-being, where implementation will utilise the Kanta services and open interfaces; 2) implementation of self-management and online services, including clinical decision-making support for the use of citizens, risk tests, self-assessment methods regarding the need for assistance required in referral to treatment, online health checks and reminders and calendar solutions to support self-management. Particular emphasis will be placed on solutions for the making of appointments, applying for benefits or services, tracking the processing of a customer case, and secure communications. The services will be available on national, regional and local service channels. Reliable information on well-being and services supporting its utilisation are available. Information on the quality and availability of services is available in all parts of Finland; 3) Development, adoption and evaluation of online services producing well-being and health benefits; 4) Client-specific, multi-professional plan for frequent service users that enable the management of the services in use by the client both individually and as a whole, the monitoring of the plan's implementation, and the linking of the plan to the systems used by service producers.

6.1.1 Availability of e-health and e-welfare services for citizens

The most often available services were *informative web-pages*, which were available in all public and private health care organisations. These pages provide information on services and locations, but patients also had possibility to leave feed-back and actively use self-evaluation tools and question-answer-services. Organisations have clearly understood the importance of internet visibility in reaching out to patients.

Systems for receiving personal health data recorded by the patients (e.g. measurements or text data) were available only in one third of hospital districts, one sixth of healthcare centres and in few private service providers. Their availability has increased from 2010, but all the systems are restricted to organisational solutions, there are no cross-organisational or national solutions in use.

The use of *electronic appointment booking* is empowering citizens. The availability if this service has increased in all organisations since 2011. Direct internet booking through web-pages was offered by four fifths of hospital districts, half of healthcare centres and most of the private service providers. Moreover, e-mail and SMS-remainders were increasingly being used. Healthcare organisations seem to have changed their processes to make them more friendly toward patients, since not only laboratory and dental care were in the list of bookings available electronically, but also outpatient consultations with nurses and physicians.

Remote on-line health services are available in the form of health, illness and service *consultations with patient identification and e-mail and SMS contacts* to professionals by means of patient identification. Their usage however is still low: one quarter of hospital districts, a fifth of healthcare centres and a fifth in our sample

of private service providers have this direct communication channel. For health care organisations, these services require more restructuring than e.g. plain appointment booking services.

Mobile health services (m-health) are increasingly compensating for services that have been tied to a certain infrastructure or place. The transformation of citizen services to mobile platforms is just beginning. A common infrastructure for m-health software is currently missing.

Digital social services for citizens are available to varying degrees. A typical example is that an informative website is the most common online service offered by municipal social welfare organisations. There have been no remarkable changes in relation to online services for specific target groups compared to the survey outcomes in 2011. There are still organisations that do not provide any electronic services. Social welfare does not offer electronic services nationwide, which creates an unequal situation for citizens. Further, the use of digital communication between professionals and citizens is still in its early stages.

6.1.2 Physician's viewpoints on e-communication with patients

Electronic information exchange between patients and health care personnel is not used widely, although the private sector has seen more adoption. Some 20% of physicians on the private sector compared to some 10% of physicians in the public sector experienced that HIS support physician-patient collaboration in 2014. The proportion had even reduced slightly from 2010. The difference can be mainly explained by lower availability of patient portal functionalities in the public sector. The experienced usefulness of patient-provided measurement results was very low in 2014 in all contexts, while private sector physicians regard the functionality as slightly more useful. These results can partially be explained by the low availability of these functionalities, partially by the fact that it is often not the physician but the nurse that communicates with the patient about their measurement results. Another explanation may also lie in the fact that doctors are not compensated for electronic 'visits' the same way as face-to-face visits are. Physicians may also estimate that data provided by patients in electronic format have only a minor impact on overall care quality.

6.1.3 Citizen's use and needs of e-services

The majority of the citizens have access to the Internet (87%) and an ID for electronic services (85%). Lack of an ID for electronic services is associated with higher age, physical inactivity, chronical illness, and infrequent use of health care services.

Online service use and measurement data production: The most common social and health care services used by citizens were booking a time to see a doctor, nurse, or to obtain dental care or social care, obtain prescriptions, laboratory or imaging

results or to search for information on health and services. Online service use was still modest, and the most frequent electronic service used was search for health- and service-related information. Of the national health information services, the My Kanta pages had been used by 20% of respondents, where information on electronic prescriptions were available at the time of the survey. The top services citizens want to use electronically in future were access to laboratory test results, viewing of one's own EPR-data and prescriptions and online renewal of prescriptions. These services are being implemented within the Kanta services via the patient portal. Access to online booking of appointments and receiving reminders about them are services that are much needed, as well as access to reliable online health information, care recommendations and a service directory. Storing and mediating citizens' own measurement data electronically for professionals and secure communication with professionals is still rare, but 50% of respondents see these as online services they would have need for. Participation in the implementation of the care plan is less familiar to citizens. Higher age and lower education are significant predictors of non-use of e-services, posing a challenge for development. Key barriers to use of e-services include a belief that personal contact cannot be replaced by e-services, complicated terms of use and inaccessibility due to disabilities.

Use of reliable information on well-being and services: The top four sources for health- and service related information were Google, Wikipedia, the municipality social and health care websites and the online Health Library. The quality of information found via Google and Wikipedia cannot be guaranteed, and the only way for a citizen to assess the reliability of the information is to use only information that is accurate (scientific evidence is presented and data is current) and from providers they know are credible.

Use of information on the quality and availability of services: Information on quality and availability of health and social care services is not readily available yet in Finland, while use of this type of information by citizens is very rare (only 6% had looked for it, 4% electronically and 2% using traditional means).

6.2 Professionals – smart systems for capable users

The strategic objectives and measures for the second thematic area are:
- Professionals in social welfare and health care have access to information systems that support their work and its operating processes.
- Electronic applications in the use of professionals

Measures envisioned are: National criteria for the usability of information systems with increasingly comprehensive coverage of usability surveys for different professionals, decision-making support for professionals, training of professionals, and active user involvement in the development and adoption of information systems and operating models.

6.2.1 Availability of smart systems in health care and social care

Principal data systems:

Availability of the EPR has been 100% in Finnish public health care since 2007 and in our samples of private service providers since 2011. The *intensity of use* was very close to the 100% saturation point in 2014, but in specialised care for example the process in emergency rooms is not everywhere 100% digital. One typical finding was that especially in hospital care there were very many auxiliary data systems in various medical specialities that are not very well linked to the main EPR. This phenomenon deserves to be investigated further in coming surveys.

Digital imaging and PACS-RIS combination has been available and used to a high degree in 100% of the hospital districts since 2007; in 2014 healthcare centres are also now reaching the same full saturation of availability and intensity of use. The remarkable change is within the ownership of the systems: in most cases public primary care is now using the same system as the hospital district. *Digital laboratory systems* are used by all hospital districts with full 100% intensity and in primary care they are mostly using the same regional system as their central hospital. There is a trend to build PACS and LIS databases that cover many hospital districts in one university hospital special responsibility area. One can say that imaging and laboratory services are forerunners in regional integration.

Digital ECG is now available in more areas than in 2011, with only one seventh of hospital districts storing their ECGs in paper format. As there is still too much diversity in the storage standards used, interoperability problems between regions exist. The use of the teletransmission of ECGs from ambulances to health care units is increasing, but here there are also questions about interoperability, which warrants further investigations.

The availability *of electronic nursing documentation* is very close to the 100% saturation point in all public health care, and in most cases the documents are made in a structured form with the tools readily available within the EPR. There has been an increase in the utilisation of structured data since 2011.

All in all, most health data needed in patient care are available for professionals in electronic format, but there are still many data systems and user interfaces to use and their technical interoperability is not guaranteed.

Decision-support systems: A connection to some decision support systems was available in nearly all healthcare service providers. Compared to the earlier 2011 survey, the general availability of decision support systems in 2014 is generally at the same high level, but the hospital districts seem to have progressed slightly in automatic integration with the EPR. The most commonly used tightly integrated decision support system was the drug interaction warning system. The other used systems are standalone databases on desktop, systems with access by navigating from the EPR and automatic reminders within the EPR.

Training: The general IT skills of the personnel are already at a high level: In over two thirds of the hospital districts and healthcare centres at least 90% of the personnel documenting and reading patient information had the required basic computer skills. There seems be a trend that this amount is now decreasing, perhaps due to the fact that digital systems are more complicated than before and thus the requirements are more demanding. This is a challenge for both basic and further education.

Support for use: A fluent technical environment could make the use of information systems more effective. Single-sign-on to the core systems was available in about half of public healthcare providers. Digital speech recognition was used still mostly only in radiology. Technical support for users was available during all the opening hours of the organizations only in three quarters of the hospital districts and in one fifth of the healthcare centres. Although there has been progress since 2011, the availability of technical support service needs improvement.

Nearly all of the municipalities and joint municipal authorities have a client information system in social welfare services. However, a client information system is not in use in all social services. The intensity of client information systems (CIS) usage is high in public social service organisations, but the contents of CIS's vary depending on the software and organisation in question and this creates challenges. Electronic documentation is common in social care. Nevertheless partial recording of data in electronic format is more common across all organisations than using electronic systems to record all client information. There is still a lot of paper documentation in social welfare services.

6.2.2 Physicians experiences of their systems and their learnability

Information systems support for work, usability: Overall satisfaction of physicians with the EPR systems by healthcare sectors was still low in 2014: the mean school grade was 6.6 (range 4-10) with no change in four years. Satisfaction in the private sector has remained higher than in the public sector. Technical functionalities were also regarded as poor and there had been no improvement in the assessments as compared with 2010. In this regard, the situation was better in the private sector. The ease of use was considered very poor, with even decrease in satisfaction in the public healthcare centres. Usability of key information contents had improved in all contexts of use, but the physicians are still not very satisfied with their usability. Support for intra-organisational collaboration had remained poor even though it had slightly increased among public sector hospitals with the private sector lagging behind. Also the usability of nursing documentation had improved in the public, though not in the private sector, but the ratings were still critical.

Decision-support systems: Some EPR-systems still missed decision-support systems in 2014, which was selected as one of the functionalities that are in most

urgent need of development especially in the users of those systems in healthcare centres. Concerning individual EPR systems, it seems that the users of the systems that were given the best assessments had missed decision support functionalities the most. The reason behind this could be that when the user is struggling with usability and technical difficulties, the need for solutions for these precedes the need for more advanced EPR functionalities.

Training and proficiency of use: The physicians were very experienced users of the EPR's: The length of experience of use was mostly over 3 years. Over 60% of the respondents rated their own proficiency with using the EPR at a level of 4-5 (good-very good). The users rated the learnability of their HIS as being relatively high, though the trend was alarmingly decreasing (from 42% in 2010 to 36% in 2014), especially in public primary care and private care. Half of physicians feel that they can easily get help when having problems with the systems.

Participation in development: A slight positive change in the users' experiences in participation in EPR development has occurred in the 4 –year period.

6.3 Service System – effective utilisation of limited resources

Strategic objectives for this area are:

- Client and patient information is accessible to professionals and clients irrespective of changes in organisation structures, services and information systems.
- Information management solutions increase the effectiveness and impact of the service system.
- The availability and accessibility of the services is being improved through electronic solutions

The means to reach these objectives include: Drafting of uniform legislation on the use of information related to social welfare and health care services, Information resource solution implementation for social welfare implemented as part of Kanta services, further development and adoption of Kanta services in health care, development and use of online services and support for processes and operations.

6.3.1 e-health and e-welfare survey results on the service system

Increased use of integrated EPR or data repository type of Health Information Exchange (HIE) for public primary and hospital care was enabled by new legislation since 2011. At the time of the 2014 survey the National Kanta services were not fully functional.

The *regional HIE system* availability and their intensity of use seem to be at a crossroads. HIE systems built for on-demand information retrieval within one hospital district are in regular use, and there are other regional patient databases in use simultaneously. There is also a trend towards patient data registries that cater for multiple hospital districts within one university hospital responsibility area,

especially within imaging and laboratory services. On the other hand, some organisations are customers of more than one regional HIE. For health care users, there are still many user interfaces and data structures to become accustomed to. The effects of the national Patient record archive of the Kanta services need to be monitored in the further studies.

Message type of information exchange with e-referral letters, e-consultation letters and e-discharge letters are used with a very high intensity but their availability in hospital districts is slightly less than in 2011 although their availability has increased in primary care and in messaging between public and private care. These messages are needed also in the future in those situations where the responsibility of care is transferred or when specific patient consultations are needed. Therefore, on-demand type HIE cannot compensate for this service. The seemingly contradictory results in availability are explained by hospital districts having included the same consultation and responsibility transfer functionalities to their integrated EPRs (common software and database in public primary and hospital care).

Municipal social services have good access to the SOKY system of the Social Insurance Institution (Kela), the population register system of the Population Register Centre (VRK), the accounting or payment transfer system of their own municipality and the primary health care patient information system. Automatic information exchange is most common between municipal social services and these four systems. Social workers' access to information stored by the Social Insurance Institution (Kela) and the Population Register Centre (VRK) has continued to improve.

6.3.2 The usability of HIE systems

Usage of HIE: In the four years between surveys, the use of paper or fax for regional health information change had decreased dramatically especially in hospital, where paper use reduced from 68% to 18%. In healthcare centres the reduction in paper use was more modest, from 39% to 33%. However, the increased use of the regional HISs had not affected the satisfaction of the physicians for health information exchange: Support for cross-organisational collaboration by information systems was regarded very poor, with practically no improvement in 4 years. Physicians were mainly satisfied with teleradiology and telelaboratory services. According to 2010 data, HIS support for HIE varied by region (Hyppönen, Winblad et al. 5/2012, Hyppönen, Reponen et al. 2014). A separate study will focus on the regional differences of HIE usability.

Usability of the Kanta services: Of the national health information system functionalities, physicians selected usability of e-prescribing as one of the most urgent functionalities to be developed in their EPR system especially in hospitals and healthcare centres, where the system had been implemented at the time of data

collection. However, there were vendor-specific differences. The e-prescribing functionality did not seem to help in medication management: even though it had been in use for more than a year in the vast majority of public sector hospitals and healthcare centres at the time of the survey, the overall satisfaction in the availability of medication information remained very poor.

HIS-support for the effectiveness of services: Overall, physicians' experienced that the usefulness of their health information systems (support for quality of care, reduction of duplicate tests, and increase in care coordination) was very poor. However, the trend was towards improvement in all contexts of use. The utility of the patient-provided measurement results for supporting quality of care was not regarded as very high by physicians - in all contexts of use the mean remained well below 2 (scale 1-5).

6.3.3 Citizens' experiences on social and health care e-services

Of the national health information services, My Kanta pages had been used by 20% of the respondents of the citizen survey. Those, who had experience in using them, rated the national services useful: The most useful services in the users' opinion were the Mielenterveystalo mental health portal (88% of users considered it useful) and My Kanta pages (77% of users considered it useful).

The information management solutions may have an impact on the service system in the future: the top services citizens want to use electronically in future are access to laboratory test results, viewing of one's own EPR-data and prescriptions and online renewal of prescriptions. These services are being implemented within the Kanta services via the patient portal. Over half of the citizens also regard it important to be able to mediate one's own measurements to professionals and to receive instructions electronically, but very few (1%) of the respondents had used that functionality by the time of the survey.

Some impact on the service system could already be noticed: the citizen survey shows that 12% of respondents, who had used electronic services, had saved on average 1.37 visits per year, with the range between 2.37 – 0.32 visits, depending on the e-services used. Getting support for life style changes and information on health and self-care as well as support for a selection of service providers were regarded as saving the most visits. On a national level, 1.37 visits means a yearly saving of some 700 000 visits, up to EUR 7 million, which could be used to shorten treatment queues and focus on patients who cannot be helped with e-services in the municipalities. It is thus of utmost importance to develop especially such services that can replace face-to-face visits, and support citizen's recognition and use of the e-services.

6.4 Refinement of information and knowledge management – Knowledge-based management

The strategic objectives for this topic are:

- Data sets support the management of service production and decision-making in society in real time
- Data sets support research, innovation and industrial and commercial activities

Measures include legislation on secondary uses (unrelated to care or the client relationship) of social welfare and health care data, development and resourcing of the secondary use of data.

6.4.1 Availability of knowledge-management systems in health and social care

Data warehouse systems for administrative purposes were available in three quarters of hospital districts, one fourth of the primary healthcare centres and in four private service providers in the survey sample, which was in the same level as in 2011. Our survey did not reveal how the summary information of patient record systems were used to monitor the quality of care or the fluency of processes, so there is a need for more refined indicators. Nearly all hospital districts followed the access time to treatment electronically, as did two thirds of healthcare centres. These figures had increased since 2011. Similarly, an electronic registry for various care-related adverse events had been deployed more widely than in 2011; in 2014 nearly all hospital districts and also healthcare centres utilized this functionality.

From a citizen´s point of view, the service quality monitoring indicators available in healthcare in 2014 were information about services, possibility to give feedback and to be able to enter personal health information. As discussed in Chapter 6.1, information services are already well developed, while others need further work.

Classifications most commonly applied in the client information systems of municipal organisations included the national social welfare services classifications and classifications used in the national Care Register (Hilmo) for social care. Implemented client information system structures and the classifications varied according to the IT systems of different municipalities.

6.4.2 Usability survey results

Support for management: There was a separate section in the usability survey for HIS support for management, which consisted of ten statements: 1) I get up-to-date data from the information systems about the daily operations of my own unit. 2) I am obliged to put together the information needed in management from various information systems. 3) I am required to order most of the reports I need. 4) The information systems help me to monitor the implementation of the goals set by my unit (e.g. total numbers of patients, treatment times, and types of measures). 5) The

monitoring information produced by the systems is reliable and error-free. 6) The information systems have helped improve the effectiveness of my unit during the past few years. 7) I can monitor the use of personnel-, equipment- or room-related resources from the information systems. 8) By means of the information systems, I can steer daily operations. 9) I use systems that enable the monitoring of operations daily. 10) It is easy to do the searches one wishes to do with the systems that monitor operations. The results of this section will be reported in a separate study.

6.5 Steering and cooperation in information management – From soloists to harmony

The strategic objectives for this section are:

- The structures for steering and cooperation in the area of information management are clear and support the social welfare and health care service reform

The measures include: Steering and leadership of information management in social welfare and health care services, a model for cooperation between social welfare and health care regions and national operators.

The structures for steering and cooperation: The present 2014 e-health survey investigated collaboration mainly through the participation with regional HIE systems or initiatives for patient data repositories that collate information from many hospital districts. The main picture has not changed from the 2011 survey, but notably even in those regions, where a regional HIE is in use, other regional data repositories can exist. The regional architecture was variable from one district to another and only a fifth of the hospital districts together with local healthcare centres had fully utilized the possibility of the year 2011 health care act to create a common regional registry for all patient data in public health care. In those regions information management cooperation is well developed. Social and health care reform in Finland was during this survey still in preparation, as was the national reference architecture for healthcare information systems, so their consequences will probably be seen in follow-up surveys. The national Kanta services however have contributed to harmonising the data structures in existing local and regional systems and thus have made information exchange easier.

Experts from hospital districts, healthcare centres and private care providers are participating in defining national information structures. They work in expert groups, workshops, and by communications and direct contacts to the authority. Specialised care experts from hospital districts are most active participants. However, their activity level has somewhat declined between 2001 and 2015. The private sector experts seem to have most difficulties in finding time for the work in national networks. However, the activeness of the primary care sector and the private sector is rising for some forms of the activities.

The local information management in the social welfare organisations has advanced. The digital information exchange between the CIS's of municipalities has become more common over the last five years. Even so most of the applications and solutions used in social welfare organisations are separate and local. In social welfare organisations, preparations to implement the National Client Data Repository for social services and structured data recording are still under way. The Social Insurance Institution (Kela) has begun to build up the National Client Data Repository in 2015. The implementation will be phased in over forthcoming years.

6.6 Infostructure – ensuring a solid foundation

The strategic objectives for this area include:
- Interoperable and modular architecture
- Cooperation in development and procurement

Measures include the adoption of enterprise architecture, the development of standards and support for their use and dissemination, the ensuring of information security and data protection, and improving data connections of professionals and citizens

6.6.1 Availability

Interoperable and modular architecture: As discussed in the previous chapters, according to the 2014 survey most health information systems are still separate for hospital districts, healthcare centres and private service providers. The present use of regional HIEs is a partial remedy to this. While only a fifth of hospital districts have built a common system for public hospital and primary care, an even smaller subset of them (one sixth of hospital districts) had wider connectivity with social care information systems. The effects of national reference architecture are not yet seen in this survey, even though there are initiatives to increase modularity (Onion 2015).

Standards and classifications: The use of international interoperability standards like DICOM and HL7 has been on a high level already in our previous surveys and the implementation of the national Kanta services has augmented the positive development. In the same manner, the use of various classifications obtainable from the national code server has increased clearly compared to the 2011 survey. The availability of structured data content in Finnish healthcare information systems is thus steadily increasing. In discussions there have been proposals for how even the narrative texts could be entered in a structured form (Eskola 2014).

Information security and data protection: The use of professional ID cards has been solved when entering the national Kanta system, the strong authentication of personnel is now used throughout the Finnish health care system. Then next step is to facilitate secure authentication for citizens who are using various e-health and m-health services. Currently half of the hospital districts and a third of healthcare centres have used banking ID for patient authentication, though the new contenders

were an electronic citizen ID card (used by one third of healthcare providers) and a mobile ID (used by a tenth of healthcare providers). The traditional username and password was still used by a tenth of the healthcare providers. Even though the use of electronic authentication of the patient has increased since the previous surveys, there is still room for improvement in the light of anticipated extensive citizen services. Another question then is, how to ensure services to those citizens who are unable to obtain personal banking IDs. New survey targets will be patients´ electronic signatures and electronic identification within the healthcare institutions.

The *general framework for organizing data protection and information security* is well developed. All hospital districts and nearly all healthcare centres now have a written data protection policy, as well as a written data protection plan. With some exceptions, all public health care units have a designated privacy officer. In the next surveys, more emphasis could be placed in following the practical implementation of these tools. A new survey target was the readiness to react if serious disturbances in information system functionalities take place. A disaster recovery plan and business continuity plan were missing in many institutions, so a follow-up of these strategic components is needed. Finally, those organizations and systems that have joined the national Kanta services have been audited and certified respectively for their data protection and information security.

Improving data connections of professionals and citizens: The performance of data connections has not yet been included as a survey question in our studies. There is no dedicated network for healthcare services in Finland and the centralized services are heavily dependent on data connections. Therefore, it is essential to add new indicators for this purpose in forthcoming surveys.

6.6.2 Usability

Standards and classifications: Physicians experienced use of (structured) data entry as easier in the private sector than in the public sector – the situation was worst in hospitals, where the mean usability (scale 1-5) was 2.4. Usability of the nursing documentation has improved quite a lot in the public sector, especially in hospitals, but decreased in the private sector. The doctors agreed that the structured documentation does make searching and consolidating information from different sources easier.

Improving data connections of professionals and citizens: As stated in Chapter 6.1.2, physicians did not have much experience with electronic information exchange with patients, with the private sector being better adapted. Some 20% of physicians in the private sector compared to some 10% of physicians in the public sector have experienced that HISs supported physician-patient collaboration in 2014. Patient-provided electronic data was not felt to have high impact on service quality.

6.6.3 Citizen views

A majority of the citizens felt that their personal health data is secure in electronic format, but a third of respondents to the citizen survey experienced the fear that their personal health data could be leaked to outsiders as a barrier to e-service use.

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7 Benchmarking Finnish e-health

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7.1 Nordic e-health benchmarking

The Nordic countries have progressed far in the development and implementation of national health information systems. The differences in e-health policies, architectures, and implementation create a fruitful basis for benchmarking and learning from each other.

The Nordic Council of Ministers set up a Nordic e-health group to put e-health higher on the Nordic agenda in 2012. One priority for the group during the period 2012–2015 has been to benchmark the deployment and use of health IT within the Nordic countries. The group established the Research Network to develop, test and assess a common set of indicators for monitoring e-health in the Nordic countries, Greenland, the Faroe Island and Åland, for use by national and international policy makers and scientific communities to support development of Nordic welfare.
The Research Network published its first report in 2013, where a methodology was presented to generate e-health indicators, and the first common indicators were tested. (Hyppönen, Faxvaag et al. 2013) The second report presented the benchmarking results of altogether 49 common Nordic Health IT indicators, of which data were available for 48, at least from some Nordic countries.(Hyppönen, Kangas et al. 2015)

All the Nordic countries have implemented or are in the process of implementing a National Health Information System (NHIS), and Finland and Sweden also have regional repositories. Information was collected from experts on availability of specific national level HIE functionalities, and information on regional level functionalities from organisational surveys. Public specialised care organisations offered on average better access to patient information outside their own organisation than primary care. Of the 7 measured HIE functionalities, 2 ('mediating prescriptions electronically to be dispensed from any pharmacy' and 'viewing a list of a patient's prescriptions') were available in 100% of public organisations in all the Nordic countries.

The intensity-of-use data was collected from national log files, where available. Availability of the data was sporadic, and warrants further specification of usage rate indicators as well as log files to provide usage data. The proportion of e-prescriptions of all prescriptions made in 2014 exceeded 60% in all the Nordic countries. Intensity of use of the available functionalities remained surprisingly low being highest in Denmark. In Finland prescription data and in Iceland immunization data were also viewed relatively frequently. (Figure 1)
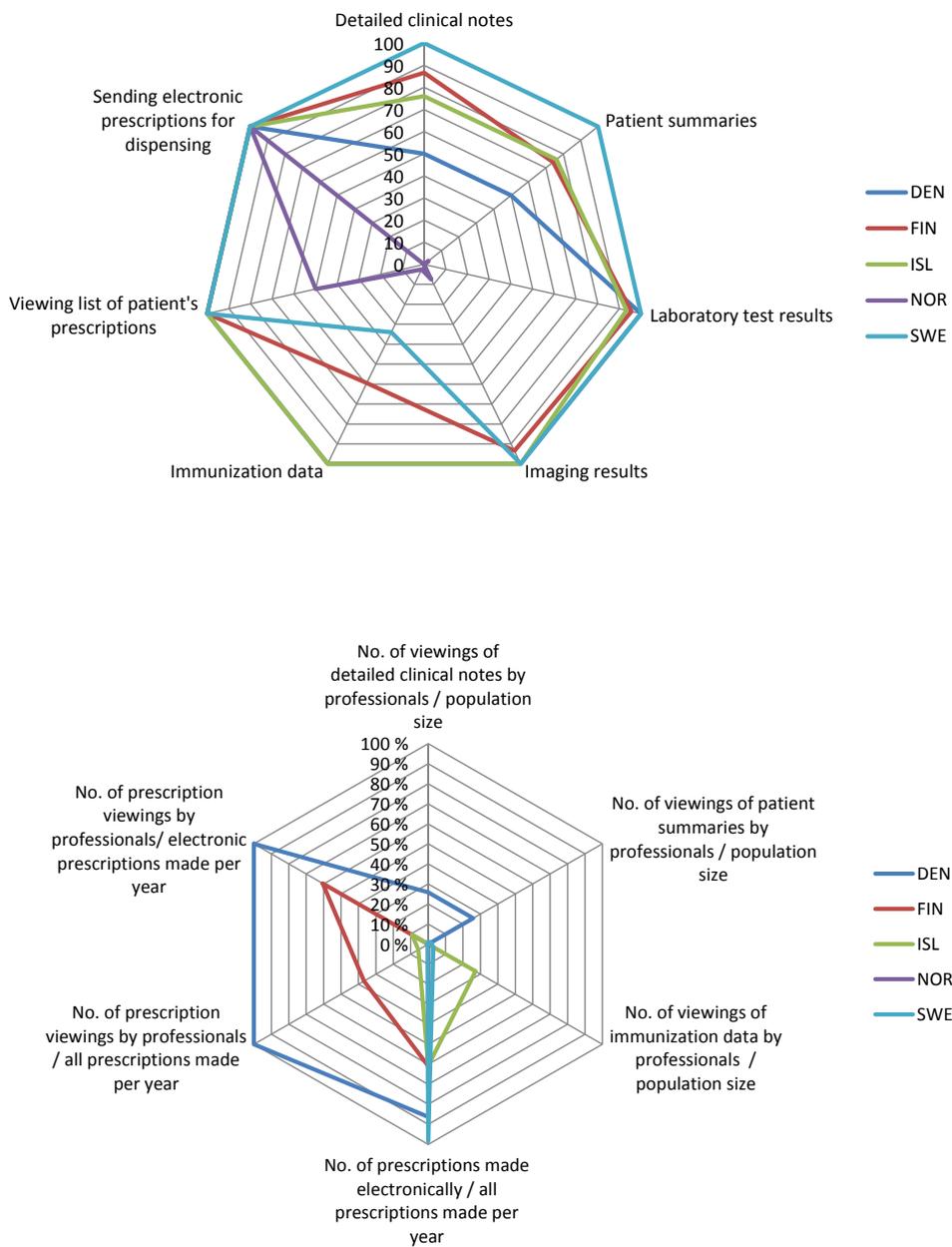
Figure 1 HIE availability (top) and intensity of use (bottom) (Hyppönen, Kangas et al. 2015).

Patient Portal functionalities were in 2014 either local or national, and availability information was collected from experts or organisation surveys (figure 2). Of the 5 measured Patient Portal functionalities, Sweden had 100% availability for 4 of them, Denmark for 3 and Finland and Norway for 1. Patient's viewing of their own list of prescriptions was the most commonly available functionality, and patient supplements of measurement data was the least commonly available. Data on intensity of use of Patient Portal functionalities by patients was low, except in Denmark. Many of the Patient Portals were still local, and for these, data on intensity of use by patients were not available (only national portal usage by patients was reported).
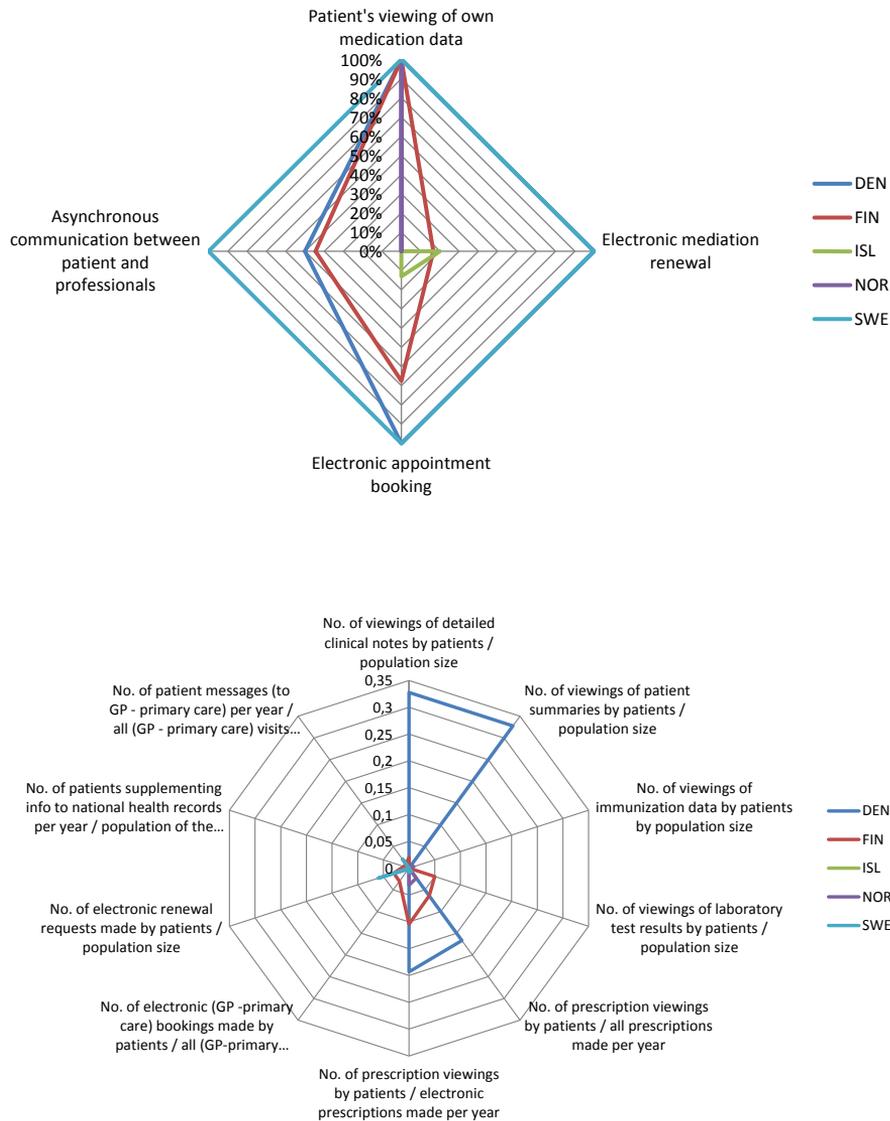
Figure 2 Patient portal availability (top) and intensity of use (bottom) (Hyppönen, Kangas et al. 2015).

Usability benchmarking data were only available from Finland and Iceland, where identical questions were used, with some variables also from Sweden and one from Denmark (figure 3). Doctors in Iceland had the most positive experiences of their health information systems (for 9 out of 14 variables). The Swedish data were from 2010 and not for all variables. Their experiences were most positive for three

variables, whereas the Finnish systems scored best in three variables: patient safety, system reliability and response time.
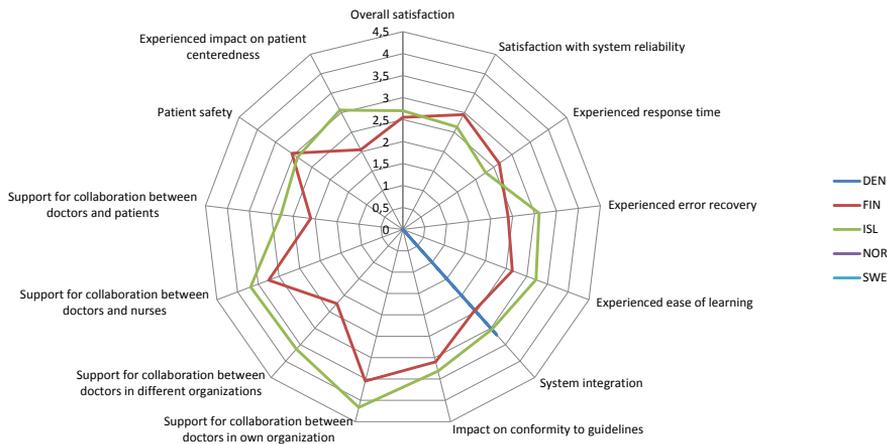

Figure 3 HIS usability (Hyppönen, Kangas et al. 2015).

There was a lack of monitoring data for many of the variables. This calls for more planning regarding the collection, analysis and reporting of e-health monitoring on a national basis. The existing - albeit fragmented - results show the potential for e-health benchmarking, with clear similarities and differences emerging. The availability of information at national level is increasing rapidly, which increases the importance of monitoring the intensity of use of the stored data, and eventually the benefits of use. Logs need to be developed and access to aggregate level data ensured for monitoring purposes. There is still a lot to do also in harmonising existing and new indicators (for new policy goals and citizens' views) and in developing a dynamic way to visualize the benchmarking results. For profound learning across the Nordic countries, comprehensive data with a more detailed comparison of the National Health Information system functionalities would also be required.

The Nordic collaboration identified some impact mechanisms for the key HIS functionalities, but did not have resources during the second mandate period to compare the availability and consistency of register-based data to benchmark these. One register-based outcome-indicator for the e-prescription system was tested: the number of medication errors reported in 2014/population rate. The data were not available in all the Nordic countries, the statistics differed and it was not possible to present a correlation with the diffusion of the e-prescription system.

Still, the current work presents a solid basis for continuing work towards the ultimate goal: generating e-health benchmarking data to support the development of Nordic welfare. The third mandate period aims at developing key indicators for e-health outcomes and citizen experiences as well as the provision of an intelligent electronic publication system for the e-health monitoring data.

7.2 OECD-level benchmarking

The OECD has led an effort to provide countries with reliable statistics to compare ICT development and policies in the health sector (Adler-Milstein, Ronchi et al. 2013), to assist governments in understanding the barriers and incentives to ICT use and to realize the far-reaching economic and social benefits from their application. In 2010, an OECD survey of countries identified four core objectives for ICT implementation: Increase the quality and efficiency of care; reduce the operating costs of clinical services; reduce the administrative costs of running the health care system; and enable entirely new models of health care delivery (OECD 2010).

The OECD developed a model survey in 2012 and 2013 to support the collection of internationally comparable measures on the use of ICTs in the health sector. It covers four focus areas: electronic health records, health information exchange, personal health records, and tele-health. Since then, a number of countries in the OECD and beyond have begun piloting the model survey and/or mapping information from existing surveys and administrative data sources to indicators derived from the model survey.

In Finland, the pilot effort is led by the National Institute for Health and Welfare (THL). The OECD model survey implementation occurred by mapping the information from existing surveys and administrative data sources to the model survey indicators, and where possible, altering or adding questions to comply with the model survey.

The piloting of the OECD Guide to Measuring ICTs in the Health Sector was integrated into two national surveys – the health care organization survey and the survey of doctors, two of the surveys of this report. The organizational survey (mapping the availability and use of ICTs) included the OECD benchmarking questions targeted to the CIOs of all public health care organizations (primary and specialised care organizations, that provide both ambulatory and institutional care), as well as to a sample of private health care organizations. The survey for doctors (including some availability measures, focused mainly on user experience of ICTs) included OECD benchmarking questions to clinicians.

Finland is planning to continue the follow-up of national e-health development and impacts via regular national surveys and also log and register data analysis. The next data collection round in Finland is planned for 2017. Finland will continue to include all the OECD model surveys questions that are feasible for national /international benchmarking of the Finnish situation. Finland is also open to piloting

possible new modules to the OECD survey within the national survey/ data collection scheme.

7.3 European e-health benchmarking

The European Commission has funded several studies on benchmarking e-health. The study in 2007 among *general practitioners* revealed that basic ICT infrastructure containing computer workstations and internet connections is within the reach of most European physicians working in the primary care. There was still space for improvement in connections and health information exchange between service providers as well as in interaction between health care providers and patients. Denmark, The Netherlands, Finland and Sweden were notified as forerunners for implementing e-health in primary care. (European Commission and Empirica 2008)

The e-health usage in European *acute care hospitals* was surveyed in 2011 (Deloitte & Ipsos 2011). This study was targeted to chief information officials and medical directors in a random sample of hospitals in 27 EU countries plus Croatia, Iceland and Norway. According to the results, Finland was above the European average in 11 of the 13 used e-health implementation indicators. The best performance was found in following four measures: all Finnish hospitals had outside network connectivity, all hospitals had a PACS in use, all hospitals exchanged laboratory results electronically and they all had clear rules how to process clinical patient information. During that survey, electronic prescription was not yet fully implemented in Finland and recovery from technical failures needed improvement. (Deloitte & Ipsos 2011)

The European Commission repeated the *acute care hospital* study two years later using the same indicators but having a different sample in various countries. However, the results could estimate development trends compared to earlier studies. Finland had now fully implemented electronic prescription and was among the best performers, the order being Denmark, Estonia, Sweden and Finland. Finland was now above the European average in all of the 13 used e-health implementation indicators. Most successful implementations have been in the use of fast broadband connections, electronic prescription and electronic referral system with EPR integration. (Joint Research Centre of the European Commission 2013a, 2013b, 2013c, 2013d, 2014)

The status survey of e-health availability and use among general practitioners was repeated in 2013 ("Benchmarking deployment of eHealth among General Practitioners II"). It was funded by the European Commission. The survey was conducted in 31 countries (EU27+ Croatia, Iceland, Norway, and Turkey) by interviewing a random sample of 9.196 GPs. The data were processed using sophisticate multivariate statistical techniques. The sample size per country varied between 50 and 572 GPs. The study calculated an overall composite index of e-

health adoption using equal weights for the selected main composite indicators (EHR, HIE, Telehealth, and PHR). The six leading European countries in e-health adoption based on this overall index were Denmark, Spain, Norway, Estonia, The Netherlands and Finland. In those four main composite indicators, Finland was the 8th in the adoption of EHR, the 4th in the adoption of HIE, the second in the adoption of telehealth consultations and the 14th in the adoption of PHR. Interestingly, Finland scored highest in the indicator which measured the availability and use of radiology test reports and images among general practitioners. The authors emphasized that the access to radiology images requires high performance of data networks. In general, a basic EHR was now available for about 93% of GPs in the study countries. However, more advanced features were not so widespread. While there was progress compared to the 2007 EU survey, the adoption of HIE, Telehealth and PHR in the primary care in Europe was lagging behind compared to the targets defined for e-health in the EU policy documents. (Codagnone & Lupiañez-Villanueva 2013)

In addition to the EU benchmarking studies, Finnish e-health developments have been peer reviewed by the European Health Telematics Association (EHTEL). The Ministry of Social Affairs and Health of Finland requested this expert panel review as a preparation for the new e-health and e-welfare strategy. The peers were senior e-health experts from a range of European and nearby countries. The conclusions of the expert workshop were published as a proceedings report in the form of a SWOT analysis (strengths, weaknesses, opportunities, and threats. The analysis highlighted main opportunities for promotion of Finland's health and social care domains through a well-conceived e-health deployment. One finding in the report was that in Finland there is a long history of e-health development and nowadays almost all records are "electronic from birth". This means that the country has direct access to valuable information and resources, making secondary use of routine health care data feasible. (Ministry of Social Affairs and Health 2013)

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8 Conclusions and Future Prospects

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Monitoring key HIS functionalities from the viewpoint of impacts on health care system structures, processes and outcomes has been a legislation-based task for THL since 2007. Surveys on the implementation of e-health solutions have been conducted since 2002, usability since 2010, e-welfare services since 2011 and now in 2015 for the first time also citizen experiences. During the time of the latest surveys that are reported in this publication, the implementations of the national Kanta services were at early stages: electronic prescription was fully implemented in the public sector healthcare centres and hospitals, but not comprehensively in the private sector. The first organisations had just joined the national Kanta archive for exchanging patient information. The set timetable is that the public sector organisations join the Kanta archive by the end of 2014. The benefits anticipated from the Kanta services (apart from the electronic prescription) had not yet had time to be realized in 2014 at the time of the data collection. The usage of electronic prescribing was increasing; usage of prescription data stored in the national database was still new, thus showing only modest rates. The next data collection point planned for the beginning of 2017 will capture the situation with the Kanta services in full use in the public sector. This will also most likely be the last time that the data are collected from the current organisational structure (currently comprising over 300 municipalities and 21 hospital districts), prior to the large social and health care reform. Each survey has given a snapshot into an evolving process of ICT-development in health and social care. Finland has a road map for the future development in its new e-health and e-welfare strategy. The snap shot of 2014 will be reflected against this strategy. The results can be used to interpret the situation of today against the strategic target for 2020.

In 2014, citizens' use of online e-health and e-welfare services was still modest, but it is expected to rise rapidly due to more patient data becoming available via My Kanta pages. Diffusion of the national SADe-services has also been rapid since the data collection in 2014, including reliable information on well-being and services to assist in health promotion, self-care and selection of services. The use and impacts of these on improving cost effectiveness and quality of care processes and outcomes still remains a question for future monitoring. The future citizen surveys can give new information on how e-health and e-welfare services influence empowerment, choices related to health promotion, self-care, and service selection and their life in general.

Professionals in health care had a wider access to information systems than professionals in social care, where partial recording of data in electronic format and paper documentation is also common. The availability of technical support still needs improvement. Physicians are on average not very satisfied with their systems, with experiences of poor stability, poor usability and poor support for HIE. The physicians have good ICT skills, and this may be reflecting in the expectations on the quality of their work tools. Implementation of the Kanta services is expected to improve HIE. Utilisation of limited resources in the service system was enhanced by increasing use of an integrated EPR or data repository type of HIE, and decreasing use or paper or fax for HIE. In social care there are several authorities with information systems that can automatically exchange information with the social care information systems. The regional HIE in health care seems to be at crossroads, with different types of data repositories. The usability of the Kanta services and the effects on health and social care processes may become visible in future monitoring.

Secondary use of patient data for knowledge management is based on structured data. The national Kanta services have contributed to harmonizing the data structures in existing local and regional systems in health care, while the availability of structured data content in Finnish healthcare information systems is steadily increasing. In social care structured data recording is still pending. For social care, use of national process and data specifications was monitored, but not participation in national information service development. Use of common process specifications in social care was not very common in 2014, and the use of document specifications varied. Structured data gives new possibilities for data usage. Use of patient data for secondary purposes is a theme that is currently a topic of national and international discussion. A new piece of legislation on the secondary use of health data is at the drafting phase in Finland. Moreover an outcome from the EU legislative work on personal data management is expected soon. The Finnish e-health and e-welfare strategy gives strong expectations in knowledge based leading and steering where data directly from the systems are used for developing processes and the quality of care.

Information management cooperation was measured by participation in national Kanta development. The participation of hospital districts was most active, while private providers have become more active after 2010, which indicates preparation to implement e-prescription and the Kanta services. The broad participation of the stakeholder groups in the development of national ICT solutions is seen as essential to the Finnish strategy.

The infostructure with its interoperable and modular architecture was measured through the availability and use of local, regional and national health information systems, the use of standards and data security. There is still room for development, although a general framework for organizing data protection and information security is well developed and the use of interoperability standards is common. The as yet minimal use of electronic patient e-ID mechanisms is an area that needs

attention. The effects of the national reference architecture were not realized in 2014, even though there were initiatives to increase modularity.

The current data collection included four separate surveys, which were planned together to try and capture specific themes across the data. Integration of health information systems and cross-organisational, even cross-country processing of patient information are emerging themes that need to be covered in the future. In future, the surveys should be flexible to include new modules for these. They should cover different professions, new electronic services for citizens, m-health-platforms, secondary use of data (e.g. for management and epidemiological purposes). Digitalisation of the Finnish health care system and integration with the social care system builds a basis for an ecosystem, which provides new opportunities also for enterprises.

Benchmarking between Finland and the Nordic countries, Europe and beyond facilitate the understanding of ICT implementation mechanisms. It will also facilitate access to information on the effects of ICT on the health and social care processes. The measures have been developed in collaboration with the OECD, which has an interest in obtaining information on impacts of ICT on societies. Collaboration is important also in the future: a number of OECD countries or groups of countries plan to continue their benchmarking efforts. For instance, the Nordic countries plan to continue their collaboration by developing e-health usability and benefit indicators for countries with advanced National Health ICT Infrastructures.

The e-health indicator and benchmarking work continues in Finland at the national level and also in the Nordic countries and the OECD. Health and social care ICT has been given a big role and high expectations to modernise the health and social care system. The expectations can be read from national and international policy documents world-wide. Effects on the system and most of all, the possible added value for patients and citizens will not become visible before the ICT use is well-established. In Finland the degree of ICT maturity is reaching a level where measuring the outcomes - impacts on social and health care system performance - finally may become possible.