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eHealth of Finland
Check point 2008

REPORT

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Abstract

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This eHealth report was produced by FinnTelemedicum, Centre of Excellence for Telehealth at the University of Oulu and STAKES (National Research and Development Centre for Welfare and Health Development, Finland) under the assignmentof the Finnish Ministry of Social Affairs and Health. The survey describes the status and trends of health care information and communication technology (ICT) and eHealth usage in Finland in 2007. It also delivers information about financial costs spent on health care ICT. This survey includes data from all the service providers in public and private medical services: hospital districts or central hospitals for secondary / tertiary care (n = 21), primary health care centres (n = 229) and a sample of private sector service providers (n = 45, including also major private service provider chains). When applicable, the results were compared to our earlier results from 2003 and 2005. Thus this third survey in its series exhibits all the ICT and eHealth achievements during the National Healthcare Project.

The results show that the usage of ICT in the Finnish health care system has continuously progressed in all the discussed application areas. Electronic patient record is now in comprehensive usage both in specialized care (hospital) and primary care (health care centres). The study found that it is used as the main source or as the only source of patient narratives in all the hospital districts, 99.1% of the primary health centres and all the private services providers included in the research. Electronic information exchange between organizations has also progressed rapidly. Electronic referrals and electronic discharge letters are in everyday use in 19 of the 21 hospital districts (compare with 16/21 in 2005 and 10/21 in 2003) and this service is utilized by 77% of the primary health care centres in their areas (compare with 44% in 2005 and 24% in 2003). Some multilateral regional electronic patient data depository is in use in 17 /21 hospital districts (9/21 in 2005) and in 64% of the primary health centres (20% in 2005). Thus fully interoperable patient data exchange is regionally in operational use in most of the health care institutions.

In more detail, electronic patient data exchange either with the help of a regional patient depository or with telemedicine is organised for EPR narrative texts in 19/21 hospital districts (11/21 in 2005) and in 62% of the primary health centres (23% in 2005) and for imaging results in 17/21 hospitals districts (16/21 in 2005) and in 61% of the primary health care centres (29% in 2005). For laboratory results the figure is 19/21 in hospital districts (19/21 in 2005) and in 72% for the primary health care centres (64% in 2005). Filmless picture archiving and communication

systems (PACS) are now in use in all 21 hospital districts and in about half of the primary health care centres.

Direct eServices to citizens like electronic appointment services, e-mail or text-message (SMS) communication or information exchange through web pages are used only in few institutions, however, the number has increased since 2005.

According to this survey, 18/21 hospital districts and half of the primary health care centres estimate that they can join the national electronic patient record archive (eArchive) by 2011. The estimated time scale for joining the ePrescription is similar.

The median of ICT costs per capita in hospital districts in 2007 was 23.7 € (19.6 € in 2005 and 14.7 € in 2003) and in primary health care centres 12.4 € (12.4 € in 2005 and 10.5 € in 2003). Total ICT costs have increased more rapidly than overall health care costs, currently representing 1.5% of the total spending on health care.

Electronic patient records in Finland were put into comprehensive use first in local institutions. By now we have reached a level of regional utilization of electronic patient data. This builds a solid basis for services provided for citizens and for a national archive of health information. The progress seen during the National Healthcare Project is remarkable. All this development has been accompanied by the intake of structured core data, national classifications and coding systems. A new collaborative working model has been created for an interoperable national sharing of electronic patient records including the management of patient consent.

Keywords: information and communication technology, eHealth, health care services, electronic patient record systems, telemedicine, regional patient data repositories, national patient data archive

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Abbreviations

CDA	*clinical document architecture*
DICOM	*digital imaging and communication in medicine*
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*
eHealth	*use of information and communication technology locally and at distance in health care*
FinnTelemedicum	*Centre of Excellence for Telehealth at the University of Oulu*
GDP	*gross domestic product*
GPS	*global positioning system*
HL7	*a set of standards*
ICT	*information and communication technology*
ISO	*international standard organization*
OID	*code object identifier code*
PACS	*picture archiving and communication systems*
PKI	*public key infrastructure*
SITRA	*Finnish National Fund for Research and Development*
SMS	*short message service*
SSL	*secure socket layer*
STAKES	*National Research and Development Centre for Welfare and Health*
TEKES	*the National Technology Agency of Finland*
VPN	*virtual private network*
VTT	*Technical Research Centre of Finland*
XML	*extendible markup language*

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1 Introduction

The Finnish Health Care System and an Overview of Health Policies in Finland

Finland is a large and sparsely populated country of 5.3 million inhabitants (Väestörekisterikeskus 2008), who live in an area of 338,000 square kilometres (Statistics Finland 2007). In the eastern and the northern parts of the country the population density is especially low and distances are great. Health care services in Finland cover all people living in Finland. The constitution states that public authorities shall guarantee for everyone, as provided in more detail by an Act of Parliament, adequate social, health and medical services and the promotion of the health of the population.

Health expenditure as a proportion of GDP was 8.2 per cent in Finland in 2006, or below the OECD average (Stakes 2008a). Many indicators of health care performance are good. Deaths from heart attacks and strokes have dropped sharply over the past 30 years and the delivery of quality medical care includes high rates of screening for cancer, a high rate of kidney transplants in proportion to patients with renal failure, and a high rate in the rapid treatment of broken hips. Finnish people are mainly satisfied with their healthcare services. However, the system has its problems. Inequalities in access to services have been identified and there is a shortage of personnel. There are waiting times to see a doctor at a health care centre, and long waiting lists for elective surgery are problems. The reform of access to non-urgent treatment has decreased the number of patients in waiting in secondary care significantly (reduction from 66,000 to 4,600 patients on waiting lists for over six months between 2002- 2008), but regional differences still exist. Waiting time problems in primary health care have not changed for the better (Ministry of Social Affairs and Health 2008a).

The Finnish health care system, like in so many other countries, now faces severe challenges. These challenges include technological changes, which are increasing the costs of hospital services and prescribed medicine; rising patient expectations; and a rate of an ageing population, which will be much more rapid than in other European countries between 2010 and 2020.

Municipalities have by law the primary responsibility to arrange social and health care services for the people living there. These include both primary and secondary care. Services are provided either by the municipalities producing themselves or in cooperation with other municipalities, or the purchasing of services from private or public providers. Currently, many Finnish municipalities are very small with less than 2000 inhabitants, but a process to re-organize the local

governance is ongoing. There are 399 municipalities in mainland Finland in 2008. The province of Åland is responsible for organising health care in the Åland Islands (www.kunnat.net). Several municipalities will join each other as a result of the so called PARAS project, the municipal and service structure reform (Act 169/2007). This will mean a cut in the numbers of municipalities by 67 in the beginning of 2009. (www.kunnat.net)

The obligation to arrange specialised care is carried out by the federations of the municipalities. The responsibility of the municipalities is outlined in *the Primary Health Care Act (1972)* and in *the Act on Specialized Medical Care* (1062/1989). The municipalities have a strong decision making power when arranging services, which also extends to the utilisation of information and communication technology (ICT).

Public health services are mainly financed by the public authorities through tax revenue. Municipalities are primarily responsible for the financing of health care and having the right to collect taxes for it. The State participates by paying a general, not earmarked, subsidy to the municipalities, which was 33% of the health care costs in 2008. The subsidy payable to a particular municipality is mostly dependent on the age structure of the people living there. Other criteria taken into account are the unemployment rate, the number of pensions for the disabled (assesses the overall state of health) and the population density. In 2006, the percentage of funding for households of operating expenses for social welfare and health care was 7.4% (Ministry of Social Affairs and Health 2008a).

The financing structure for health care expenditure, as a whole, went through considerable changes during the 1990s. Government grants to the municipalities were cut, while the proportion of expenditure borne by the municipalities themselves correspondingly rose. The economic burden on households also rose. This was due to an increase in client fees and a proportionate increase of the costs of medicines and private health care services. The Ministry of Social Affairs and Health has begun a process of renewal in Finnish health care legislation. New laws are expected in 2010 as well as changes in the organisation and roles of different players.

Alongside the municipal system, private and occupational health services also provide health care. The compulsory *Sickness Insurance Act* (1963) provides daily allowances in case of sickness and also in the case of maternity, paternity or parental leave. It also refunds part of the costs for medicine and transportation, as well as part of the costs for private sector services. All residents are insured on an individual basis, even children. Residency in Finland is defined by the Act on the Application of Residence-Based Social Security Legislation (1993).

Public Primary Health Care

Primary health care is provided in the health care centres. A health care centre can be defined as a functional unit or as an organisation that provides primary curative, preventive, and public health care services to its populace. It is not necessarily a single building or a single location where health care is provided. Every one of the 229 Finnish primary health care centres is owned by a single municipality or by several municipalities together (Figure 1). Currently, the population median of health care centres is about 9500. One of the targets of the PARAS project, mentioned earlier, is to form health centres with a population base of at least 20,000 inhabitants. There are strong intentions to encourage federations of municipalities or other kinds of new collaborative organizations to arrange health centre services.

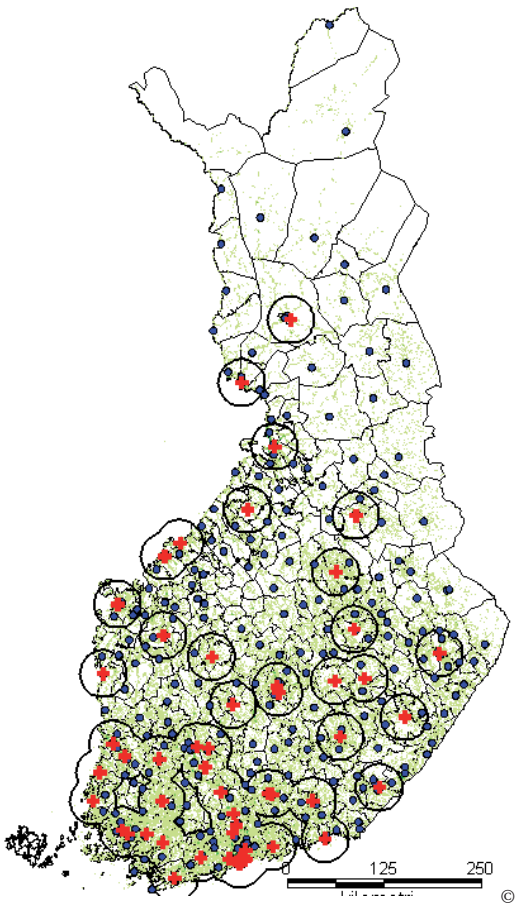


FIGURE 1. Finnish somatic hospitals (ringed) and health care centres (dark dots) with beds. The shading in the background reflects population density.

Health care centres offer a wide variety of services: out-patient medical care, in-patient 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 does not define in great detail how the services should be provided, and in most cases this is left to the discretion of the municipalities.

The number and type of personnel in each health care centre depends on the size of the population it serves and on local circumstances. The staff consist of general practitioners, sometimes medical specialists, nurses, public health nurses, midwives, social workers, dentists, physiotherapists, psychologists, administrative personnel, and so on (Table 1). The provision of local ambulance services is also one of the responsibilities of a health care centre. (Päätalo et al. 2003) Legislation does not require the municipalities to actually produce the health services. An increasing part of the services are acquired by the municipalities, either from other municipalities, or from the private sector. Also vouchers can be used for some services. Some municipalities have contracted a company to organise all the services provided by the health care centre. 8% of health care centre physicians were contracted via companies in 2007 (Parmanne 2007).

The in-patient department of a health care centre works in much the same way as the department of a hospital. A typical health care centre has 30 to 60 beds. The number of in-patient departments within a health care centre varies - large centres have several. The majority of patients in these departments are the elderly and the chronically ill. However, in remote sparsely populated areas, health care centres provide rather comprehensive short-term curative in-patient services for the general population. In the public health care service system patients need a referral to see a specialistexcept in case of emergency.

TABLE 1. The availability of common services in health care centres (n = 270*)
(Source: Päätalo et al. 2003.)

Primary care physician	100 %
Specialist consultations	42 %
Dentist services	93 %
Public nurse consultations	87 %
Physiotherapy	89 %
Psychologist services	55 %
X-ray	77 %
Laboratory test taken	95 %

* The number of health care centres in 2002.

Long-term care is given by the municipalities in wards at the health care centres and non-medical long-term care in institutions for the elderly. The latter is considered a part of the social welfare services. Several different kinds of out-

patient services have been established in order for the elderly to live in their own home as long as possible. These services include home-help services, home nursing, day hospitals and other daytime care centres, part-day nursing and service houses, which are houses where people live in their own apartments but are offered different kinds of services, such as meals, nursing and other help needed for daily living.

Public Secondary and Tertiary Health Care

Each municipality belongs to a particular hospital district, containing a central hospital. Of the central hospitals, five are university hospitals that provide specialised tertiary levels of treatment. Each hospital district organises and provides specialised hospital care for the population in its area. Finland is divided into 20 hospital districts. In addition, the semi-autonomous province of Ahvenanmaa forms its own district (Ministry of Social Affairs and Health 2008a).

A hospital district is an administrative entity. In different hospital districts the central hospital may operate in more then one location and there may be supporting regional hospitals as well. The overall number of hospitals is about 70 (Figure 1). This includes the five university hospitals, 16 central hospitals and over 40 smaller specialised hospitals. Hospitals have out-patient and in-patient departments. The range of specialised care varies according to the type of hospital. Federations of municipalities, i.e. hospital districts, own all the hospitals. The population of hospital districts varies between 61,000 and 1,500,000 inhabitants (with the exception of Åland with 27,000 inhabitants). Twelve hospital districts have a population of less than 200,000. Each municipality must be a member of a hospital district. One of the targets of the PARAS intention referred to earlier is to form hospital districts with a population not smaller then 150,000 inhabitants. Some changes in the number and organisation of hospital districts are to be expected (Ministry of Social Affairs and Health 2008a).

Private Health Care

Private health care in Finland mainly comprises out-patient care, which is available mostly in the larger cities. The most recent statistics available cover the year 2005. There are around 3,000 private health care companies in Finland. The most typical private health care provider in Finland is a physiotherapy unit (1,400). Physicians can run a practice within a private company, the number of which was 1,000 in 2005; or as a stand-alone practice (Stakes 2008a). The majority of doctors working in the private sector are specialists, whose full-time job is at a public hospital or at a health care centre. 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 either to public or private hospitals. There are only a few private hospitals,

providing less than 5% of the bed days in the country and mostly providing only beds reserved for short-stay surgery.

There are about 1750 full-time private practitioners in Finland (11% of physicians) (Suomen Lääkäriliitto 2007). Public health service doctors are also allowed to have an out-of-office time private practice and 25% of physicians do so. One out of three hospital physicians and one out of eight primary health care physicians have a private practice in addition to their public ones. About 2.4 million people visited a private physician in ambulatory care during 2005 (Stakes 2008b).

The Institutions, Policies and Procedures Relating to Regulation and Self Regulation of the Medical Profession in Finland

The National Authority for Medicolegal Affairs (TEO) (www.teo.fi), under the Ministry of Social Affairs and Health, has been responsible for licensing and monitoring in the field of health care. A new national authority for medicolegal affairs (VALVIRA), will take the task on the first of January 2009. Official proceedings in matters concerning health care professionals and organisations are instituted through complaints. Complaints of death or serious bodily injury of a patient are considered by TEO (VALVIRA). The State Provincial Offices, as local authorities, are in charge of the supervision and monitoring of health care professionals and health care organisations. State Provincial Offices give private health care organisations their licenses to operate. To receive a license the minimum requirements for providing health care services have to be fulfilled. The Ministry of Social Affairs and Health and TEO (VALVIRA) supervise health care organisations at the national level. The State Provincial Offices, are also under reorganisation during 2009–2010. New provincial officies will be formed, but the main tasks and the division of labour between the national and regional authorities will not be changed.

Overall Health Policies

The objective of Finnish health care policy is to prolong people's healthy and active lives, safeguard as high a quality of life as possible for everyone, and to reduce both health inequalities between population groups and premature mortality.

Prime Minister Matti Vanhanen's second cabinet began its period in office in April 2007. In its programme, the Government has committed itself to promoting societal development. The focal points of the Government Programme's welfare policy are, among others, to ensure a rewarding and just social protection system, comprehensive and effective social and health services, social and health care services for the well-being of families, sustainable pension policy and sustainable substance abuse policy (www.government.fi).

Some focal areas of action in health care services include the implementation of the PARAS programme in order to reform the municipality and service structure. Amendments required under legislation will be realised by 2012. The national development plan for social and health care services (KASTE) was launched at the beginning of 2008 and will be implemented during 2008–2011. This plan follows the national health care and social service projects that ended in 2007. The objectives of the KASTE programme are that social exclusion be reduced, municipal inhabitants' involvement, well being and health increase, inequalities in well being and health between population groups diminish, the quality, effectiveness and availability of services increase and regional inequalities be reduced.

The Primary Health Care Act and the Specialised Medical Care Act will be merged into a Health Care Act. The Government's proposal will be submitted to Parliament during 2009 (Ministry of Social Affairs and Health 2008b). A Health centre action plan to promote primary health care has been introduced. The use of the municipal service voucher has been extended to home health care as of the beginning of 2008. The proposal on reforming the practices for granting state subsidy to municipalities will be submitted in the spring of 2009 and the reform will enter into force as of the beginning of 2010. (www.government.fi).

Finnish eHealth Policies

The first Finnish national strategy for applying information technology to health care and welfare focused on developing and implementing ideas that would help answer the needs for an efficient, accessible, affordable and high quality health care. It was drawn up in 1996 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). The strategy was built around the principle of citizen-centred, seamless service structures. Among the main target 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 in all levels of care, combined with a nation-wide interoperability between distributed legacy systems, and being supported by a high level of security and privacy protection.

"Seamless" was understood to mean a smooth care process when two or more responsible organisations are involved in the process. The privacy protection regulation, such as the *Personal Data Act* (523/1999) sets conditions to the exchange of information (i.e. patient data) between different register controllers. There was a need to regulate the process and to define the client's or patient's role in it as an active partner in care. The legislation on *Experiments with Seamless*

Service Chains in Social Welfare and Health Care Services was adopted in 2000 (Act 811/2000, Finnish Government 2003a). The main focus of the legislation was to build regional information service systems and adapters between existing legacy systems. The first project on the implementation of the experimental legislation was called "Makropilotti" (from November 1998 to June 2001) in the hospital district of Satakunta. In 2001 three new regions, Uusimaa, Pirkanmaa, and Raahe were also allowed to start pilot-projects. Eighteen regional projects began during 2004. (Ohtonen 2002, Hämäläinen et al 2005). Between 2000 and 2003, 10 million euros were given to fund ICT projects in the health and social care sector (Sinervo 2004).

During Prime Minister Lipponen's second term in office and during the implementation phase for the experimental legislation in the four regions mentioned above, a new initiative was started to improve the health care system of Finland. The Decision-in-Principle by the Council of State on securing the future of health care was issued on the 11 April 2002. The document states that "nationwide electronic patient records 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 (Ministry of Social Affairs and Health 2003), which produced a definition of national electronic patient records and their implementation strategy. The working groups received funding of approx. 800,000 euros a year during 2003–2007 to develop the National EPR (Ministry of Social Affairs and Health 2003 and 2004). The funding given for the implementation of the programme at the regional level during 2004–2007 was 31 million euros. In addition, hospital districts and municipalities have co-funded these projects (with half of the funding coming from the state and the other half from the municipality).

The strategy document of the ministerial working group (Ministry of Social Affairs and Health 2003) describes how the implementation of the nationwide electronic patient record system can be completed by 2007. The common content and structure that should be used in every EPR system in all the organisations was defined. It included a clinical consensus on core patient data, some national services such as a code server, open standards for interoperability, and national guidelines for the safeguarding of data. The basic elements of the architecture needed for the construction of a national data transfer system and its mechanisms were also described.

After the election in 2003, a new government with Prime Minister Vanhanen was formed. The new government was also dedicated to the main principles of the Decision-in-Principle by the Council of State in securing the future of health care. (Finnish Government 2002). In addition, the government launched a new information society programme. This included an e-Welfare program in order to develop ICT for social services (Sahala 2005). TEKES (the National Technology

Agency of Finland) has also started a technology programme that will last for five years (2004–2009) (Tekes 2005). It includes a health care development programme (FinnWell).

Prime Minister Vanhanen's government decided to develop permanent legislation on regulating the use of electronic social and healthcare client and patient information. This proposal was approved by the parliament and came into effect in July 2007 (Act 159/2007). Legislation on the use of electronic prescriptions also came into effect in 2007 (Act 61/2007). The legislation on handling electronic patient information covers archive services, encryption and certification services, and patients'access to data. The creation of a common national archiving system was expected to promote patient and client care, confidentiality, and an increase in the efficiency of healthcare services. The law makes mandatory the incorporation of all public health care units into the electronic archiving system, as well as private health care units that do not use paper-based archives (Ministry of Social Affairs and Health 2006A).

In the vision for 2015 (Ministry of Social Affairs and Health 2006B), the Ministry of Social Affairs and Health view that information and communication technology can enable the efficient management of client information and process management using real-time data. It can help improve the position of the citizen by giving access to reliable information on health, welfare and the service system, and by offering citizens the option to manage their own information and to interact with the service system flexibly. Quality control of social welfare and health care services will emphasize the advancement of supervision, advice giving, guidance, and the monitoring of the information given to service providers.

Achievement of the goals by 2015 presupposes an intensified control from the authorities and a nationwide information system architecture that fulfils data protection and information security requirements. When adopting information technology applications, social welfare and health care organisations must be supported with up-to-date legislation, national guidelines, and information systems services on the national level. According to the policy documents of the Ministry, information technology provides the best support for a productive health service system when compatible joint standards and applications are used nationwide (Ministry of Social Affairs and Health 2006A). After the election of 2007, Prime Minister Vanhanen formed his second government. In its programme, the Government stated that the development of electronic information systems would be continued. The objective is to make local patient records compatible with the new national archive by the year 2011. (www.government.fi).

Act 159/2007 states that the national eArchiving service for electronic patient records will be maintained by the Social Insurance Institution (KELA). Technical planning and defining was started in 2007 and the vendor consortium was selected. The construction of the eArchive system started in late 2007. The legislature will obligate all health organisations to participate in the construction of a national IT

architecture for health. The first piloting is expected to start by the end of 2009 in the city of Kuopio. The original legal archive copy of the electronic patient records will reside in the national archive and the institutions can have their everyday operational copies in their own patient record systems. All those regional patient record projects that receive governmental financial support should obey the technical connection requirements by the end of 2009 (Reponen et al 2008).

The national eHealth architecture will include a national public key infrastructure (PKI) system for health care professionals. The system will be administered by the National Authority for Medico-legal Affairs. The national code server has been running since 2004. As of 2007 this service was included in the Act 159/2007. The system is located physically at the Social Insurance Institution (KELA), but the legal obligation to keep up the contents was given to The National Institute for Social Affairs and Health, Stakes (1.1.2009; The National Institute of Health and Welfare). The central ePrescription database, hosted by the Social Security Institution (KELA), is under construction. ePrescription pilots are expected to start in February 2009 in the first region. All organisations should be connected to the system by 2011. The Ministry of Social Affairs and Health has the coordinator role and the overall responsibility for the national eHealth architecture.

The realisation of the policy vision on offering citizens the option to manage their own information and to interact with the service system flexibly is planned to become reality via the National EPR Archive where citizens are offered a chance to browse selected personal health information – namely, reference information for the use of services, referral and discharge letters, certificates, statements and results of examinations, and access log data about the visits to the personal patient record (Reponen et al 2008, Ruotsalainen 2008). This service and electronic identification of the patient are included in the Act 159/2007. Patient access to ePrescriptions is also being built.

The Ministry of Health has started several pilot projects for future national eServices for the citizens. One of this projects was started in the beginning of 2008 by the city of Oulu. It is a self care project offering a wide range of eServices for citizens. These services comprise following: a web portal for general information of health related issues and health services, exchange of laboratory results to patients, transferring home-made point-of-care measurements (blood glucose, blood pressure, etc.) from patients to professionals, question-answer-services for the public, and building up and maintaining a personal health record file (Winblad et al 2008a).

Since 1996 Finland has had a chain of four governments that have all included promoting ICT in health care in their programmes. The policy visions created in 1996 have step by step become operational systems and deployment projects but the work goes on. During the year 2008 the main issues have been building the national eArchive, and the national ePrescription system, and starting pilots on eServices to the citizens. It is still too early to evaluate the changes in care processes

and the possible promotion of health care quality, safety and effectiveness. However, the need to follow up the change and its effects on the citizens and the professionals has been identified by the Ministry of Social Affairs and Health. The planning of a large scale evaluation of the national eHealth developments has been started. The evaluation plan will be created as a joint effort of all interested research and development parties in Finland. It is under preparation and will be finalized in April 2009 (Stakes 2008c). During the spring of 2009 the Finnish Ministry of Social Affairs and Health will work together with funding bodies to create a platform for starting the actual evaluation work. This survey can bee seen as one of the tools that can be used for the follow up of the organisational level changes.

2 Deployment of the 2003, 2005 and 2007 eHealth Surveys

The Ministry of Social Affairs and Health in Finland has regularly instructed and followed the implementation of ICT or eHealth development in health care. A comprehensive survey on the implementation and the use of ICT was conducted by the present authors for the first time in 2003 (Kiviaho et al 2004). The 2003 survey showed the prevailing situation right before the National Project for Securing the Future of Health Care began and the 2005 survey showed what had happened halfway through the project. The current 2007 survey is a continuation to the two previous surveys and it shows the situation at the end of the project. The methodology involved in the survey comprised a web-based questionnaire. Because of the fast development of ICT in Health Care, some of the questions were modified or added by the authors to the 2007 survey. In the current 2007 survey the questions are as comparable as possible with the questions of the two previous surveys. Now, changes in the past four years are systemically measurable.

The survey on implementation and usage of ICT and eHealth

The above mentioned structured web-based questionnaire was distributed by e-mail to all public health service providers or hospital districts and health care centres, and to a sampling of private health care providers. The questionnaire comprised the following: the identification of the responding organisation and the respondent; questions about the adaptation 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 usage 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 adaptation of different e-Services for patients.

The intensity of use of the main systems was also inquired. The intensity revealed the amount (%) of the action or function that was carried out by electronic means. For example, if a service provider used 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%. Several of the questions in the survey were copies

of questions from the previous 2003 and 2005 surveys by FinnTelemedicum and Stakes, using the same web-based data collection methods. The total number of the main questions was 91, including a total of 236 further detailed questions plus one question with 41 focused items. The questions for hospitals, health care centres, and private health care providers differed to some extent, depending on the nature of the services they provided.

The questionnaire was emailed in the middle of December in 2007 to all public service providers. This meant that 21 hospital districts and 229 health care centres were contacted. The questionnaire was also emailed to a sample of 45 private health care service providers offering medical care, including 30 of the largest service providers, and to those 15 which did not belong to the major service provider chains but had responded to the 2005 survey.

A full report with a detailed description of the method and all the findings of the survey was published in December 2008 in Finnish (Winblad et al 2008b).

Coverage

Responses to the questionnaire were obtained from all hospital districts (100%, n = 21), Åland included. Responses from hospital districts describe particularly the situation of their central hospitals. Responses to the most important questions were obtained after reminders and phone calls by the authors from all the 229 health care centres existing on 1 January 2008, giving the coverage of 100%. Responses to the rest of the questions were obtained from 87–96% of the health centres. The data obtained can be considered as representative and exceptionally comprehensive, which makes comparison with the previous reports reliable although the coverage was lower in 2003 and 2005.

The examination of the private service providers was problematical. Results were obtained from 28 private service providers giving the coverage of 62%. Among the respondents there were 17 providers belonging to the 30 largest providers. Private service providers are a heterogeneous group including enterprises of various sizes, from conglomerates with hospital and operative services to small part-time general practices. That is why the results concerning the private providers can be regarded only as indicative. In connection to this, it is worth mentioning that in Finland the public sector covers about 85 % of the health services.

The 2007 survey on detailed ICT costs among public service providers

The survey of costs for systems of information and communication technology was performed for the first time and it was directed only to public health care. Respondents to the detailed cost enquiry covered 12 (57%) of all 21 hospital districts and 118 (52%) of the health care centres. This sample of responses gives a suggestive conception about the national health care ICT cost situation.

The questionnaire was problematic to the respondents because many municipalities are experiencing remarkable changes in their legal situation. For example, the amount of independent municipalities was decreasing during this study and the geographical health care collaboration areas also changed. The structures of the annual budget were different at the various stages of the study and not all of the organizations were able to collect comparative information. The annual costs per capita fluctuated widely both in hospital districts and in health care centres. One part of the margin/difference is a result of registration different methods and another part is due to the timing of investments while some resulted from the different choices of the unit.

3 Electronic Patient Records in Finland

The Development of the Structured EPR

In the 1980s the Association of Local and Regional Authorities designed a set of paper-based health records, which would become widely used for primary care and specialised care. The municipalities have a strong decision-making power in arranging services, including the utilisation of information and communication technology (ICT). When health care providers started adopting EPR, there was a variety of ICTs and EPR products in use in the municipalities and other organisations, and the understanding of common health record structures diminished. Finland became a country where many organisations used different EPR. Furthermore, in general there was no interoperability to exchange EPR information between organisations. There is legislation in how to handle patient records (Ministry of Social Affairs and Health 2001), but it is not detailed enough for the digital world.

Finnish electronic patient records still mostly use plain narrative texts despite the fact that the need for structured data in the records was identified already in the Finnish eHealth strategy documents in 1998. The Finnish government stated in 2002 in the 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 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 (www.stakes.fi/koodistopalvelu). In 2007, by law, the task to keep up the technical code server application was given to the National Social Insurance Institution (Kela) and the task to provide code services (codes and classifications and other contents of the code server) was given to Stakes (1.1.2009 The National Institute for Health and Welfare, THL). ICD-10, Nordic codes for surgical procedures, national codes for laboratory tests and X-ray procedures, and some statistical codes are under production. In addition, a large list of other codes has been given out from the code server for testing and piloting purposes. The code

server stores all the common (i.e. official versions) of different core data elements. Electronic patient record products take the codes into their own products from the server (updates 1–2 per year). Code taking is free of charge.

The project for the common structures of EPR began in 2003 and was funded by the ministry, and lead by the Association of Local and Regional Authorities. "The core data" was defined in cooperation with different interest-groups (professionals, administration, software-enterprises). It was publicly available to be commented on via internet and was later finalised and published in 2004. The implementation into the existing EPR-systems has been going on since. The National Health Project includes a cluster project and a subproject for the implementation of structured core data for EPRs. The work is coordinated by the Association and the Ministry. Seven regional groups have formed clusters with software enterprises. Eleven hospital districts and 17 health care centres are involved in this project (Nykänen et al 2006). Further specifications for certain specialities are being elaborated (occupational health care, psychiatry, dental care, child health care, school health care, nursing, and emergency care). Staff training to use the core data and the newer version of EPR products is an ongoing process. The Finnish HL7 Association has defined EPR structures in several main documents, and those structures have been implemented in several products.

The work on structured electronic patient records has included work on nursing data. The National Nursing Documentation project targets a nationally unified and standardised nursing data documentation for the managing of the nursing process and for the integration of nursing documentation into the multiprofessional patient record. Already 13 out of 21 hospital districts (including three university hospitals), 17 health care centres, one regional hospital and one private hospital are involved in the pilot project itself and 14 other organisations are networked into the project (Tanttu 2006). Piloting covers special care, primary care, home care and elderly care in a total of 110 institutions.

The Usage of Electronic Patient Records

Today, the documentation of patient data in the Finnish health care system is carried out by electronic means. For health care centres the transition from paper-based to electronic records took place in the late 1990s, and for hospitals after year 2000 (Figures 2 and 3). The progression towards the saturation point of the implementation of EPR can be constructed from the grounds of the repeated surveys of the use of information and communication technology in Finnish health care (Hartikainen et al 1999, 2002, Kiviaho et al 2004, Winblad et al 2006, Hämäläinen et al 2007). The paper-based records presently serve mainly as an archive of historical data.

In public *specialised health care* an electronic patient record (EPR) for narrative texts and additional information was in use in all of the 21 (100%) hospital districts in 2007 (Figure 2). Among the 19 of the 21 users of the EPR the intensity of usage was over 90%. One hospital district had the intensity of 50-90%, and one between 25-49%. Compared to the data from the 2003 and 2005 surveys, there is a very strong progress both in the coverage in various medical specialities and in the intensity of use. Because of the complexity of secondary care (hospital) medical records, this coverage aspect is an important additional indicator of EPR penetration.

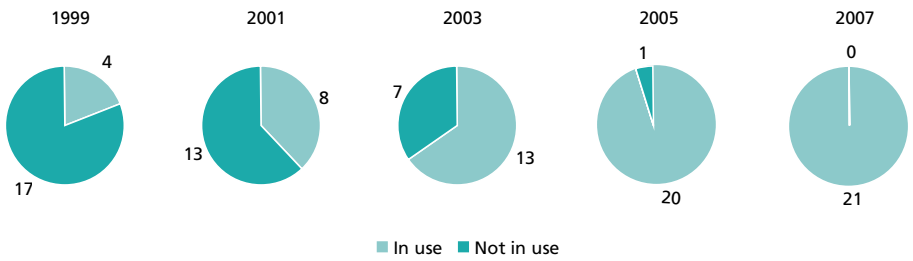


FIGURE 2. Progress in the implementation of the EPR in the 21 hospital districts. The numbers are shown as absolute numbers.

In *primary health care centres* EPR was in use in all but two of the 229 health care centres, giving a usage rate of 99.1% (Figure 3). The two primary health care centres lacking EPR were small (their total sum of citizens was 803) and remote, but anyhow, in one of them there was an electronic referral letter in use.

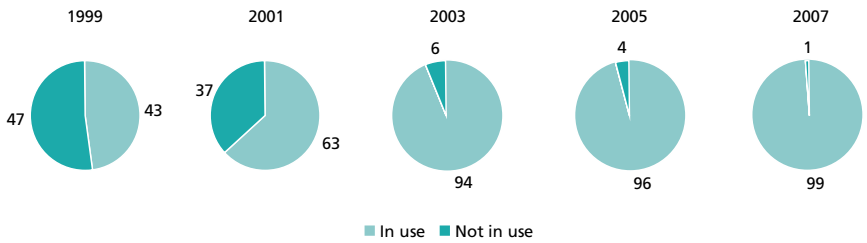


FIGURE 3. Progress in the implementation of the EPR in health care centres. The numbers are shown as percentages.

All the 28 respondents of the *private health care service providers* used EPR. Two years ago in 2005 the percentage of use amongst those who responded was 89%. The results suggest that the employment of EPR has become more common

in general in private health care but the quality of the material will not offer precise information.

The progress in hospitals has been somewhat slower due to the more complex nature of the organizations and the huge amount of information systems that had to be connected before a full utilization of EPR could be realized. Because the stage of development varied between departments, an additional parameter gives us information of the situation in four main medical responsibility areas. In hospital districts the intensity of usage was in 2007 over 90% in the responsibility areas of the conservative, operative, and emergency treatment of 19 hospital districts, and in the department of psychiatry in 18 hospital districts. Figure 4 shows the progress in the responsibility areas since 2005.

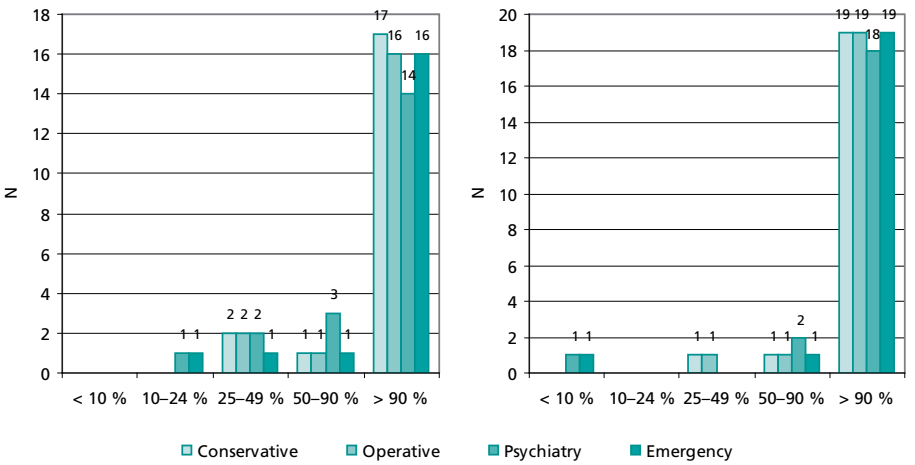


FIGURE 4. The distribution (%) of the 21 hospital districts according to the intensity of EPR usage in 2005 (left Figure) and 2007 (right Figure) in the responsibility areas of operative, conservative, psychiatric and emergency treatment

The transition from paper-based texts to electronic records took place earlier in primary health care centres than in secondary care hospitals. In the end of 2007 the median of life of EPR in primary health care centres was nine years which also suggests that EPR was in use before the change of the millennium in more than half of the health care centres. Due to the uniform nature of primary health care information systems, the intensity of use for only electronic data was high, which means that 99.1% of the responding health care centres recorded the narrative text electronically (Figure 5). The production usage was already at the same level four years earlier/ago.

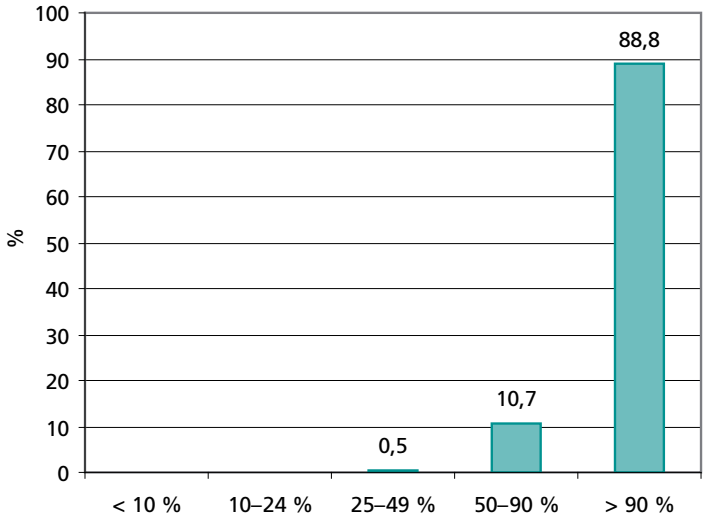


FIGURE 5. The distribution (%) of the 215 health care centres that answered the question according to the intensity of EPR usage in 2007

The Development of the Structured EPR and the Situation of the Sructured EPR and Core Data Usage

In 2007 all hospital districts used what became the basic nationally structured core data whilst in 2005 only five did so and 14 were at a testing or planning stage. A total of 83% of health care centres used ICD-10, 16% ICPC-2, 80% a nomenclature for laboratory examinations, and 67 % that of radiological examination. A total of 11 hospital districts and 17% of the health centres had an OID code of their own. Most of the 28 respondents of the private providers used ICD-10, a nomenclature of laboratory examinations and that of radiological examinations.

A total of 20 hospital districts reported that they used structured nursing documentation whilst in 2005 only six did so. Many of the health centres and private service providers reported that structured nursing documentation was in use, but because of the risk of misinterpretation of the term it is best to keep to the amount of 16 health centres according to the pilot project concerned (Tanttu 2006).

4 Intraorganisational Auxiliaries of EPR

Wireless Usage and Speech Recognition

The auxiliaries of the EPR mean the various systems and functions which support data and information management by health care professionals. *The wireless use of EPR* means mobile documenting and browsing of patient information which make work in wards and emergency/casualty units smoother and more effective. Only three of the 21 hospital districts did not have wireless access to EPR. In five hospital districts the wireless access reached outside the operational environment, for instance the doctor on call. In 64% of health care centres the wireless access to EPR was in use in bed wards, an in 9% it was available for the doctor on call. The numbers of hospitals and health centres with wireless usage of EPR doubled compared to that point two years ago.

A speech recognition system for digitally dictated doctor´s notes produces written documents almost simultaneously and offers for the health care professional a possibility to immediately check if the document is correct. The main benefit is a faster delivery of the test results or the doctor's notes to other members of the care team.

The usage of speech recognition had become more general. The system was in use in seven hospital districts and in 6% of the health care centres whilst two years earlier it was at piloting stage in five hospital districts and in use in 1% of the health care centres. Speech recognition offers incontestable benefits, and it can be expected to become more general as it develops further. The prerequisite for speech recognition is of course that the dictation process itself be transformed into digital form, which was the case already in 52% of the hospital districts and 43% of the primary health care centres in 2005.

Among the 28 *private health care service providers* one of them had a speech recognition system. Four of the providers used EPR wirelessly.

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 began appearing around 2000 (Reponen 2004).

The adoption of PACS and teleradiology in everyday practice is high in Finland. Started as early as 10 years ago, the progress, particularly in the last two years, has been especially fast for PACS. By the end of 2006 all the hospital districts finally had a PACS in use. What is more important is the percentage of PACS usage in the daily production of radiological images. Already in 2005 there were 15 out of 21 hospital districts producing over 90% of their medical images only digitally. In 2007 all hospital districts were producing over 90% of their medical images only digitally. The target is to have a totally filmless environment, which makes PACS a very real component of the EPR.

The secondary care responses to the surveys were obtained from all the hospital districts of Finland (100%, n = 21). The results from 2003, 2005 and 2007 on PACS installations are presented in Table 2.

TABLE 2. PACS installations in 21 Finnish hospital districts in 2003, 2005 and 2007

Measure:	2003	2005	2007
PACS in production phase	10/21	15/21	21/21
PACS in pilot phase	1/21	2/21	
PACS in installation phase	10/21	4/21	
PACS usage > 90%	*6/21*	*15/21*	*21/21*
PACS usage 50–90%	*3/21*	*1/21*	
PACS usage < 50%	*4/21*	*1/21*	

The adaptation of PACS to hospital districts is important and it forms a basis for regional and later for national archiving of medical images. The survey also revealed that the next challenge is to integrate PACS with workflow management and EPR software.

The geographical distribution and progress of the hospital districts in terms of PACS is shown in Figure 6 (p. 30).

In the primary health care centres, the current trend is not to have a PACS of their own, but to combine their efforts with a regional hospital or with a hospital district. There are many innovative solutions available. For instance, in the northernmost hospital district all the primary health care centres are fully digitised and they store their images at the central hospital. Those images can be accessed directly from their physician's desktop. In some areas small regional hospitals have a combined image archive and distribution with the primary health care centres.

According to the answers PACS was in use in 108 (49%) of the 220 health care centres. For the 2005 survey we had received information from PACS vendors about their customers at primary health care centres. For the purpose of that survey we had counted the so called Health Areas (which combine a small regional hospital and its neighbouring primary health care centres) as one primary care unit. According

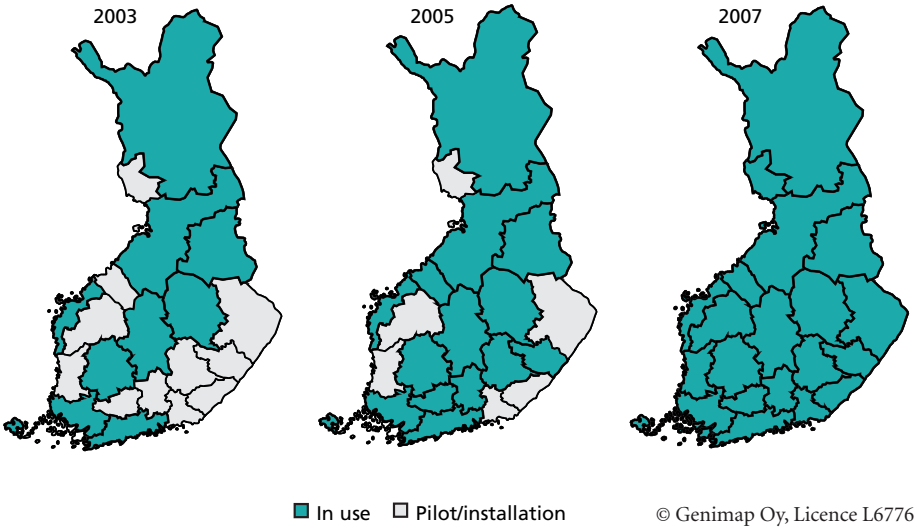


FIGURE 6. The geographical distribution and progress of PACS in the 21 hospital districts in 2003, 2005 and 2007, based on the status of implementation

to the vendors, in 2005 their systems or system components were in use in 95 out of 179 primary health care centres (53%). For the 2003 survey the PACS usage information was obtained directly from the primary health care centres and they then announced that PACS components were used in 27 (17%) primary health care centres. Even though the methodology is different, this information reveals that the use of PACS at the primary health care level has increased in Finland. In the sample of private service providers nine of 28 providers had PACS in use.

The growth rate of PACS usage in Finland has followed the general adoption of electronic patient record systems (EPR). This is natural, because the full utilisation of PACS requires the distribution of images to the end users. This has not been possible without the proper amount of computer terminals and the terminals that came with the EPR systems. The tight integration of images with narrative texts in EPR and not only with RIS (radiological information systems) has been one of the golden standards in the development. In most cases, images are very successfully embedded into the EPR interface.

Radiology and Laboratory Information Systems

Radiology information system (RIS) is an entity of software for controlling the functions of radiological units. RIS includes referral letters and orders of an appointment; it manages patient visits, transfers workflow and patient data to the

radiological equipment, keeps record on stored examinations and files radiologists' reports; it manages also the data for the statistical reports of the radiological unit. The complexity of various RSI solutions varies as well as their integration to the EPR.

RIS was in use in all of the 21 hospital districts for all their radiological examinations. Some of the hospital districts were already in the process of acquiring their second generation RIS in order to have a seamless integration with the EPR. Among the health centres 67 (35%) of those answered the question reported that they had RIS in use. Further analyses showed that some of the health centres had RIS of their own, some had some components of RIS of their own completed by the components of RIS of their hospitals districts or the whole RIS they used was that of their hospital districts. In the point of view of the users of health centres the end result was practically similar.

Laboratory information system (LIS) is an entity of software controlling the process of ordering laboratory tests electronically, identifying the patients and controlling the equipment as well as sending the test results electronically back to the ordering physicians. The systems also give guidance to the usage of the tests and statistical information about the test usage and performance of the laboratories. Today the prerequisite is to link the systems seamlessly with the EPR and present the results also through remote databases. LIS was in use in all of the 21 hospital districts. As far as health care centres are concerned, reliable figures are not available, owing to the problems of interpreting the term. There were at least some components of LIS in use but for how many of their LISs fulfilled all the criteria of the system remained obscure.

5 Exchange of Electronic Patient Information between Organisations

Two different lines of development started to take place in the exchange of electronic patient information between organisations. When bilateral and regional networking became technically possible, the organisations and regions started to define common structures for e-documents to enable the exchange (teleradiology, PACS, 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 "Makropilotti" established ways of reading EPRs of another organisation (with the patient's consent) and lessened the need for a common structure (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 interorganisational data exchange is increasing rapidly in Finland. This is due to the fact that digital data depositories in individual health care institutions are in active clinical use, and protected data connections enable the communication of electronic patient information.

Before discussing many different and yet at the same time partially overlapping forms of data exchange, a couple of definitions are needed. *Electronic referrals* are basically sent to another institution in order to transfer the responsibility of patient care. Electronic discharge letters are then returned to the sending institution once the patient's treatment is finished. The referral can evolve to 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* which can be used for consultation but also for information distribution, the same applies also to the *telelaboratory. Regional patient data repositories* or *exchanges* 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 depository for consultation services and workload distribution. They can also provide a common citizen access point to health care data. In a normal medical practise, the various forms of data distribution complement each other.

For collaboration between primary and specialised health care, the most important messages are referral letters, consultation letters, and feedback or discharge letters. In addition to a narrative text, the letters can include results of laboratory tests and radiological examinations.

eReferral and eDischarge letters

The e-Referral letter signifies a course of action by which the referring physician, usually a general practitioner, draws up a message with an intention to transfer a patient and the responsibility of care to a hospital. The role of hospitals in this kind of collaboration with health care centres is to receive referral letters, and to provide a letter showing the treatment, and to give feedback through a discharge letter.

This service is presently provided by 19 of the 21 hospital districts while in 2005 the number was 16 and in 2003 only 10 (Figure 7). Rapid progress was made during the last couple of years. In 2003 was the service available in about half of the hospital districts and in 2005 three-fourths of hospital districts used such systems. A total of 77% health care centres were able to send electronic referral letters to specialised health care in 2007. The proportion almost doubled in the last two years and tripled in last four years (Figure 8).

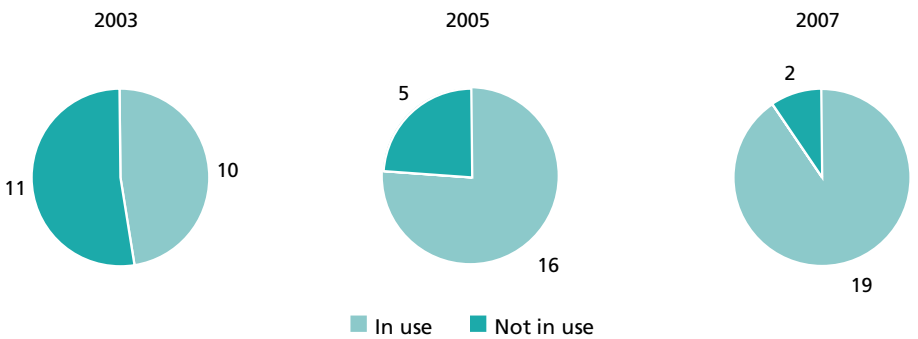


FIGURE 7. The number of 21 hospital districts using referral letter and discharge letter service in 2003, 2005 and 2007

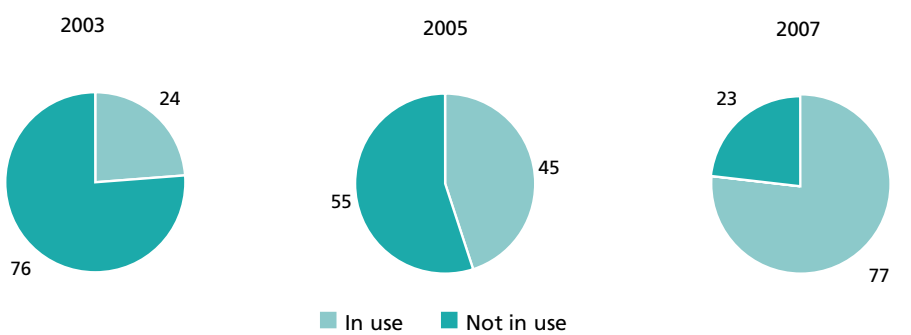


FIGURE 8. The distribution (%) of health care centres by the use of referral letter and discharge letter service in 2003, 2005 and 2007

In addition to the fact that the service was available in most of the districts, the intensity of use had increased since 2005 (Figure 9). The intensity of use was also investigated by the departments of different specialties (internal medicine, surgery, psychiatry, gynaecology, ophthalmology, etc.) of the hospitals. No prominent differences were found, except in psychiatry where the use was somewhat lower than in other specialities.

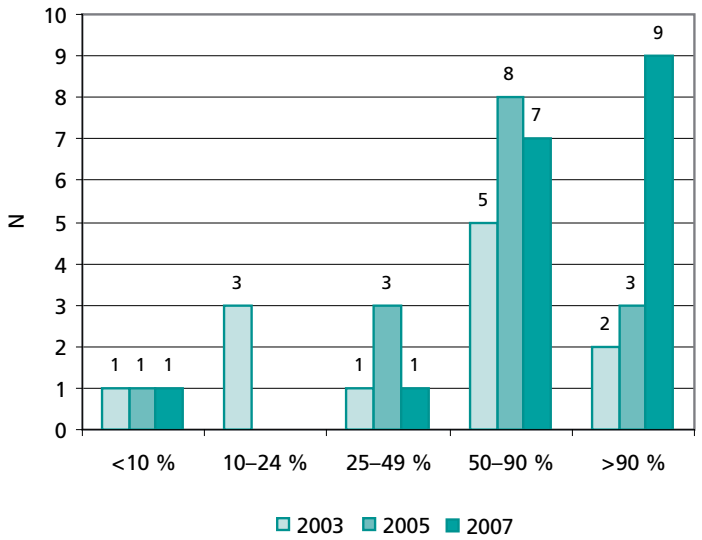


FIGURE 9. The intensity of use of the electronic referral letter and discharge letter service in the 21 hospital districts in 2003, 2005 and 2007

Once a health care centre has taken electronic referrals into usage, it seems to become the principal mode of action (Figure 10).

Hospitals mail a *discharge letter* or a feedback letter after the patient's visit at an out-patient department or bed ward to the health care centre concerned. A total of 20 of the 21 hospital districts used discharge letters and 80% of health centres (53% in 2005) were capable to receive them. Three fourths of the health care centres received discharge letters mainly in electronic form.

Four (14%) of the 28 *private health care service providers* received electronic referrals from primary health care centres. Three of the private health care service providers used electronic referrals to send patients to public specialised care.

Treatment and care in a bed ward of a hospital can continue in a bed ward of a health care centre. In these kinds of cases a *document of nursing* is attached to the discharge letter. Of the 183 health care centres which answered the question, 21% received them electronically, which means that the proportion had duplicated since 2005 when the proportion was 10%.

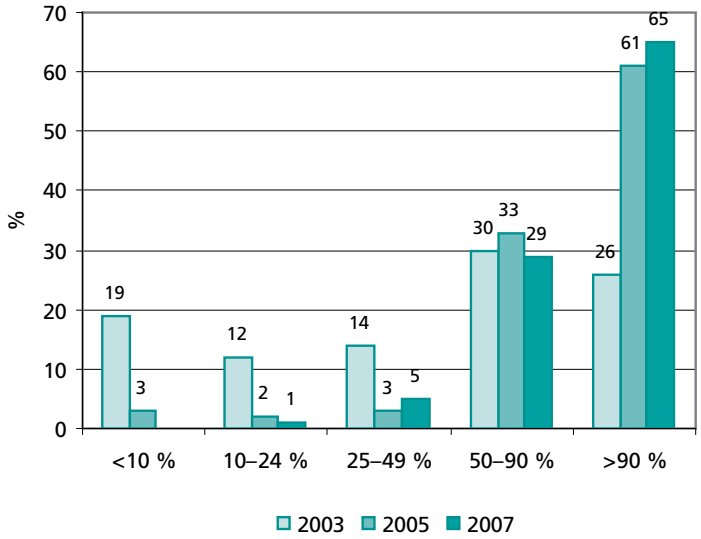


FIGURE 10. The distribution (%) of health care centres according to the intensity of use of electronic referral letters in 2003 (n = 43), 2005 (n = 69), and 2007 (n = 143). The numbers in parenthesis refer to the number of healthcare centres that answered the question

Electronic and remote consultations

The *consultation letter* signifies a mode of action by which a physician, e.g. a general practitioner, draws up a letter with the intention to have a specialist's advice or opinion for the treatment and care of a patient. The responsibility of care is not transferred to the consultant. The consultation letter is a more developed way of collaboration between primary and specialized care than the conventional referral. This is because it exploits the functionalities of electronic information exchange, such as flexible negotiations, better between the physicians before decision making.

The electronic consultations were offered by 11/21 of the hospitals districts as the situation was the same in 2005. In the health care centres the mode of action was in use in 55% of the 199 health care centres which answered the question. It had become more common in two years, because in 2005 electronic consultation letter was used by one third or 34% of the 179 health centres which had then answered the question. Similarly to the electronic referral letter, although the mode of action had become more common, the intensity of use among the users had not changed (Figure 11).

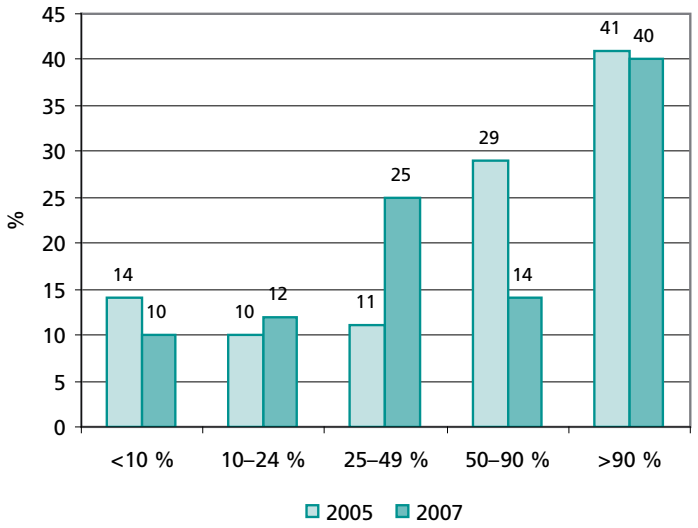


Figure 11. The distribution (%) of the health centres which answered the question in 2005 (n = 49) and in 2007 (n = 179) according to the intensity of use of electronic consultation letters

Consultations by televideo conferencing between health care centres and hospitals takes place according to the following procedure: at the health care 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. This service has increased in hospitals since 2003 and 2007 and 14 out of 21 hospital districts use it today. A total of 17% of health care centres use televideo-consultations and it has been somewhat more common since 2005 whereupon 12% of health care centres did so.

Similarly, during the period of the previous survey none of the 28 *private health care service providers* maintained televideo consultation services, but two planned to have such services later on.

The electronic referral letter and consultation letter, and televideo conferencing are means of transferring patient identifiable data. In addition to that, a primary care physician can consult a specialist *by e-mail about a patient's case without identification.* This function was in use in 2007 among eight of the 21 hospital districts and in 17% of the 189 health care centres which answered the question. Among the 28 *private health care service providers*, one used *specialist consultations without patient identification*, and one planned to implement it in 2007.

Regional data exchange systems

Due to a well developed public communications network, investing in creating a closed, healthcare dedicated network was not deemed necessary. The demands of healthcare telecommunication have been served through the use of commercial high speed public data networks and virtual private network (VPN) tunnels over the public network.

Regional patient data repositories are equally used by many health care organisations and institutions for the exchanging of data. According to this survey, 16 out of 21 hospital districts have a regional patient data repository in clinical use showing significant progress since 2005 whereupon the corresponding figure was nine (Figure 12).

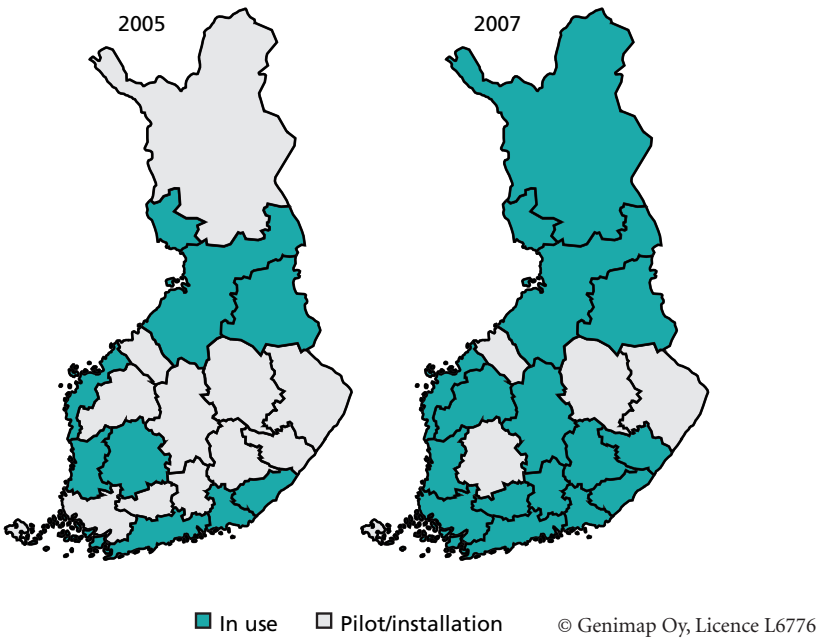


FIGURE 12. The geographical distribution and progress of the use of regional data repositories in the 21 hospital districts in 2005 and 2007

In those hospital districts which had entered the clinical phase of regional data exchange systems, five different types could be identified:

1) The *master patient index model,* or so-called "Fiale/Navitas system" was in use in eight hospital districts. Each of them has a centralised reference database of available selected information in 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 contents of the original selected data include core narrative texts, digital x-rays, and laboratory data.

2) The *web distribution model* or "Municipal ESKO" system was used in four hospital districts. Authorised users can have full access to a web based electronic record of the patient when situated in a secondary care unit. That includes all texts, images, and laboratory data that a patient has authorised for the treating physician to see. Because of web distribution, no special viewer is needed, only a secure connection.
3) *Regional sharing of electronic patient data or* "Regional Effica system" *was* used in eight hospital districts. If the patient grants permission, the physician has direct access to the electronic patient record in another institution. That includes all the texts, images, and laboratory data. In this case both the viewer and the provider are using the same proprietary software.
4) *Mixed model of patient data sharing* or "Kainuu Model" was used in one hospital district where primary and secondary care are provided by one authority. No extra viewing permission is needed, but because there are two different electronic patient record software vendors, a special solution of master patient index model with software adapters is utilised.
5) *Regional sharing of data from different patient record systems* or "Keski-Suomi Model" was in use in one hospital district.

While regional patient data repositories can exchange many different types of patient data, from images to biosignals the founding function is the transfer and *exchange of narrative texts* from different specialities. According to this survey, the regional exchange of narrative texts, including the delivery, the receiving and remote reading was being formed in 16 hospital districts, that of laboratory results in 15, images in 12, and statements of images in 13 hospitals districts, respectively.

A total of 64% of health care centres used some of the regional data exchange system. Among them exchange of narrative text was in comprehensive use, that of laboratory results was used by 87% of health care centres, images by 66%, and image statements by 58% of the institutions, respectively.

Teleradiology and Image Distribution through a Regional Archive

Teleradiology has been 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 the five university hospitals had teleradiology services (Reponen 1996). The regular

service started in the sparsely populated northern areas, but has since then spread all around the country.

The border line between teleradiology and image distribution through a regional archive is gradually vanishing with certain services. In the current survey, we investigated all the methods used for image transfer. For a regional service, the basic assumption was that a hospital should have a local PACS installed. Then, the technical infrastructure behind the implementation of a regional image distribution could differ. In some areas, image viewing is through a regional reference database. In other areas there is a dedicated common regional radiological database ("regional PACS"). A third solution is to view images through regional access to an EPR archive, which also contains images.

The results of the 2003, 2005 and 2007 surveys on teleradiology and regional image distribution/archive services by the 21 hospital districts are presented in Figure 13. Since teleradiology services could be independent of local PACS or a regional archive, a combined look at image transfer services is given. The key information is that in 2007 all out of 21 (100%) hospital districts provided some form of electronic distribution of radiological images.

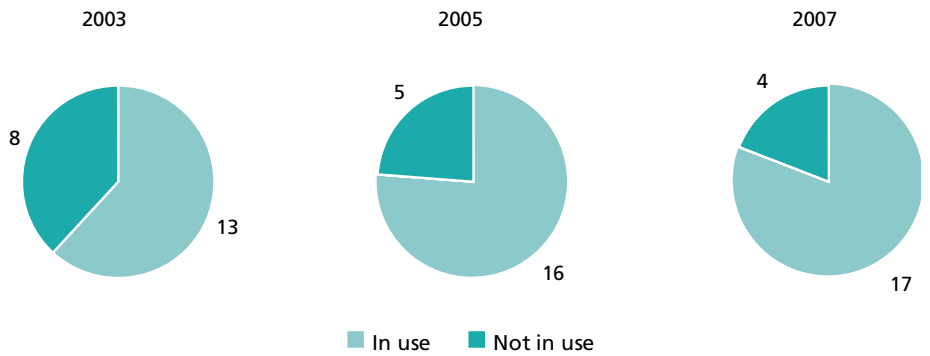


FIGURE 13. The distribution of the 21 hospital districts by teleradiology and/or regional image distribution/image archive services in 2003, 2005, and 2007

A total of 61% of health care centres utilised some form of electronic distribution of radiological images, while in 2003 only 10% did so (Figure 14).

The results show that the use of teleradiology has increased strongly during the last four years both in specialized and primary health care and currently it is the principal methodof transferring radiological images.

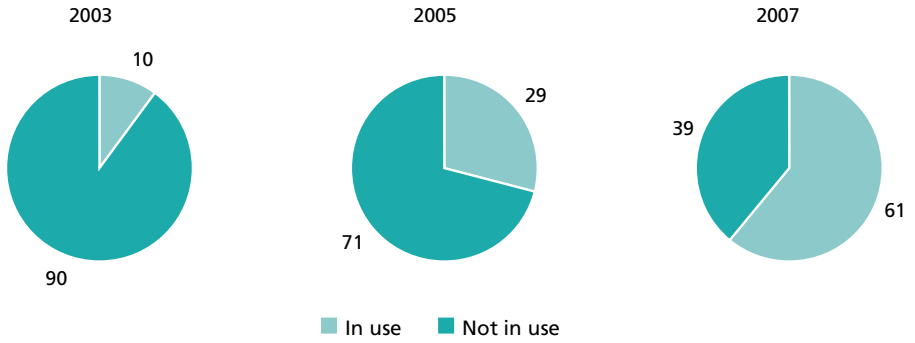


FIGURE 14. The distribution (%) of health care centres utilizing teleradiology and/or regional image distribution/image archive services in 2003, 2005, and 2007

Telelaboratory

Regional distribution of laboratory results through a regional archive or by other means was utilised by 19 (90%) out of the 21 Finnish hospital districts (Figure 15), and by 72% of health care centres (Figure 16) in 2007.

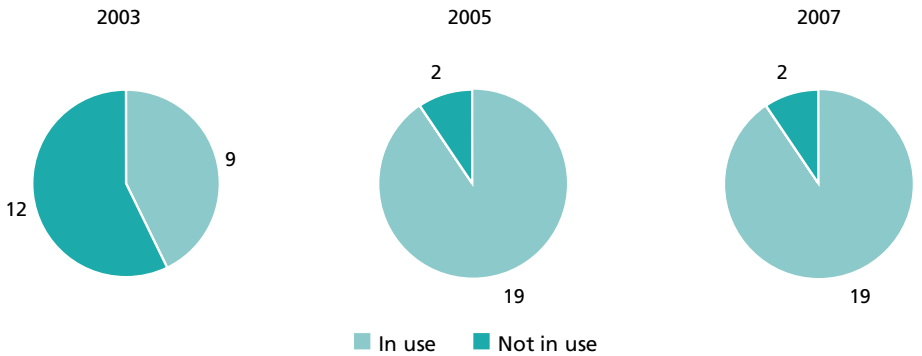


FIGURE 15. The distribution of the 21 hospital districts by telelaboratory services through a regional archive or by other means in 2003, 2005, and 2007

During the last four years the proportion of hospitals districts and health care centres utilizing some kind of telelaboratory services doubled (Figures 15 and 16). The progress seen in the figures refers to the fact that those dealing with primary care will accept new services like receiving telelaboratory data as soon as the hospital districts can provide it.

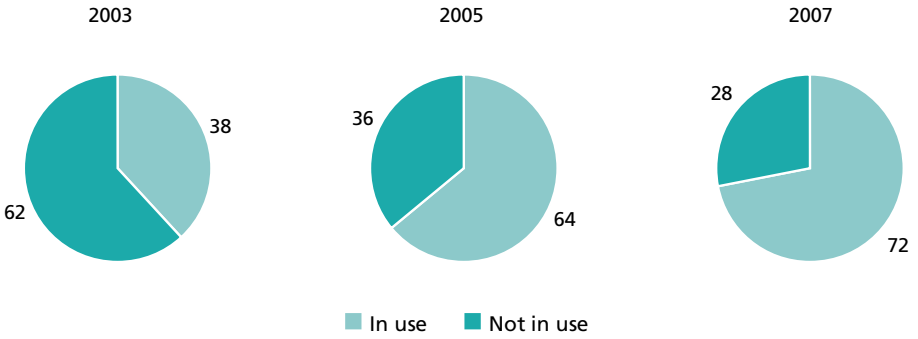


FIGURE 16. The distribution of (%) health care centres utilizing telelaboratory through a regional archive or by other means in 2003, 2005, and 2007

ePrescribing and Other Exchange of Patient Information

ePrescribing

At present all physicians use EHR application and prescriptions which are produced electronically within the electronic patient record system. The technical solution to send them as ePrescriptions from the physician's surgery to the pharmacy is not available yet but pharmacies send reimbursement information on each prescription electronically to the Social Security Institution (KELA). Finland had a national ePriscribing pilot programme during 2002–2006. The pilot was stopped because the system was not technically ready for implementation, however, all the experiences were evaluated and reported (Hyppönen et al 2006).

The pilot-project ran from 2004–2006. The system was tested in two hospital districts and in a couple of health care centres. Finland opted for a system based on a national prescription database. In the pilot-project system, a doctor creates a prescription with a legacy system, signs it with a strong electronic signature and sends the secured message to the national prescriptions database. The patient goes to a pharmacy, where the pharmacist accesses the database through the pharmacy's system. The pharmacist makes the required changes and marks the dispensing information on the electronic prescription, signs the markings with a personal smart card, and saves the markings to the prescription in the database. The medicine is then dispensed to the patient (Hyppönen et al 2006).

Stakes, the National Research and Development centre for Welfare and Health evaluated the starting points and development process of the Finnish ePrescription system as well as the clinical piloting of the system (Hyppönen et al 2006, stakes.fi). The evaluation showed that a system based on a national prescriptions database

can provide benefits especially on a national level. These benefits may include reductions in prescription fraud, harmful drug interactions and an ability to use the database for research. Immediate user benefits, for example, in terms of time saved, are not so evident. As for gaining the benefits, there are still some unsolved questions, mainly related to the patient's status, rights, and meeting the many differing needs of patients.

The law on Permanent e-Prescription was passed by the parliament and it came into effect in April 2007. The system is based on the experiences of the pilot-project. A national e-Prescription database hosted by the Social Insurance Institution (KELA) will be created and strong authentication and a smart ID-card for professionals with an e-signature system and SSL-secured messages from health care providers and pharmacies to the database will be used. The Finnish ePrescribing is aimed to be fully integrated with the different EPRs and a centralised receipt data file, to cover all pharmacies, and to contain continuously updated knowledge about all prescribed drugs of patients, all using highly secured networks (Reponen et al 2008).

The piloting of the service should start in early 2009 in the region of Turku where the health care centre of the city of Turku and regional pharmacies will join the system. The other region where the preparations to start service piloting have been made is the region of Kymenlaakso. The primary health care centre of the city of Kotka and pharmacies will join the system by the end of 2009. This survey collected data on the self reported readiness of the hospital districts and primary health care centres to join the national ePrescribing system. Data about the readiness of pharmacies to join was not collected.

The results of the survey show that 18/21 hospital districts could give an estimate of the time scale for joining the ePrescription. Five of them estimated that this would happen during 2009, six indicated the year 2010 while five hospital districts gave the year 2011 as an answer. Only haf of the primary health care centres were able to estimate the time for joining in the system. The majority of those that gave an estimate could see it happen erither in 2010 or 2011. Two thirds of the private providers estimated that they would be able to join during the legal time frame, which means by the end of 2011.

The transference of a medical certificate, for example to the Social Insurance Institution or insurance companies, has not progressed into productive use anywhere. Although there have been some pilot projects at some hospital districts, the electronic document structures have not been standardised.

The National Research and Development centre for Welfare and Health, Stakes, has organised a project, funded by the ministry of Social Affairs and Health, to work together with the different owner institutes of different certificates and other forms to do the changes need in the electronic structures of the documents to make them interoperable with the national KANTA eArchiving architecture. (Stakes 2008d) Clusters of health care provider organisations and EPR-software

vendors are working on updating the EPR-systems so that they are able to send and receive nationally standardised certificate-structures. The first standardised forms are expected to be sent to the national eAchive when the piloting starts by the end of 2009.

National Archiving Systems, the eArchive

The Government has decided that for reasons dealing with the practicality and economy, the information management structure of Finland be at least in part organised on the national, instead of the regional level. The core of the national Finnish ICT infrastructure for social and health care will reside in a *national digital archive for patient documents or eArchive* (Figure 17).

The national IT Architecture for Health care is based on legislation as of April 2007 and its implementation is mandatory by 3/2011 for all public health care providers and in addition to the private service providers using electronic documentation (Act 159/2007). The overall steering and coordination is under the responsibility of The Ministry of Social Affairs and Health. The national architecture consists of local EPRs using common data structure and technical standards, the national eArchive in which all EPRs are made available online based on patient's consent, a national ePrescription database, and an eView for citizens, providing them with access to their own patient data and log data. Data between the central organisations and health care providers is transferred via a VPN/SLL secured Internet.

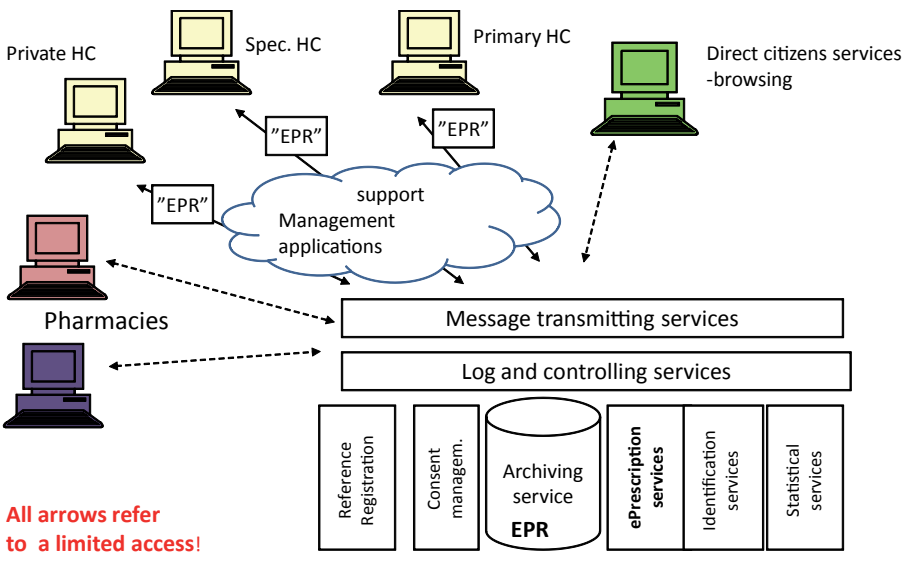


FIGURE 17. Functional scheme of the most important elements of the national archiving system

The main functional responsibility areas have been shared between national actors. The eArchive and the national ePrescription database are built and operated by The National Institute of Social Security (Kela). Cards for identification of professionals are provided by the Medico-legal authority (TEO). Nationally standardized codes and classifications are managed by Stakes and delivered via a code server.

According to this survey, 18/21 hospital districts and half of the health care centres were able to predict that they can join the national electronic patient record archive (eArchive) by 2011. The estimated time scale for joining the ePrescription is similar. Correspondingly, 60% of the health care centres estimated that they would join the national eArchive by 2011.

6 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 eArchive (Act 159/2007) and the ePrescription system (Act 61/2007).

Systems Supporting Data Security

Moving over to electronic documentation, archiving and transferring of data has induced that data security has become even more important. Legislation on data security in health care concerns different dimensions of the issue. The formal requirements of data security seemed to be documented most comprehensively among the hospital districts and the sample of private providers, and among half of the health care centres (Table 3).

TABLE 3. Proportions of health service providers with documented data security policy, plan and nominated person in charge

Provider	Data security policy	Data security plan	Person in charge of data security
Hospital districts	18/21	17/21	16/21
Health care centres	46%	53%	61%
Private providers	19/26	17/22	22/26

Management of Informed Consent

The informed consent of the patient is needed for medical practitioners in order to access the patient records in another health care organisation. A completely electronic system using an electronic signature of the patient was not in use anywhere in Finland. The table below outlines the various different currently used ways of managing the informed consent of a patient within the regional data systems by electronic or by electronic and paper means. This managing could

consist of access to reference information (date and department) or to a whole document of a treatment received in another organisation (Table 4).

TABLE 4. Managing a patient's informed consent in the hospital districts and health care centres by electronic or electronic and paper means

	Access/references		Access/whole document	
	Electronic only	Electronic and paper	Electronic only	Electronic and paper
	In use	In use	In use	In use
Hospital districts	2/21	10/21	0	13/21
Health care centres	9%	43%	15%	50%

Two of the 24 *private health care service providers* that answered the question used electronic and 11 out of 25 used electronic and paper means in order to manage the patients' informed consent to the access to reference data. Patients' consent to accessing whole documents was managed among three of the providers by electronic means and by electronic and paper among nine of the providers.

Electronic Identification of Health Care Professionals

A smart card for a strong electronic identification of health care professionals was in use in 8/21 hospital districts and in 9% of the health care centres. In the rest of hospital districts and health care centres were used a second password method with a password list or user names and passwords. In Finland the former is available as a commercial solution of the banking sector and can also be applied in health care upon regional agreement within the health care system.

The identifiers including user names and passwords had been fixed to the unambiguous identity number of an employee in 13/21 of the hospitals districts and 39% of the health care centres.

7 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 based upon these classification systems. In terms of communication and security, Finland has chosen to adopt international standards, such as HL7 and DICOM, and the ISO 17799 standard for Information Security Management (based on the BS7799).

HL7 (Health Level 7) standards will serve as the base communication standard and the use of eXtendible 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. Digital Imaging and Communications in Medicine (DICOM) standard enables users to retrieve images from digital imaging devices.

Electronic Data Interchange (EDI) was still in use in four of the hospital districts and also in about one fifth of the health care centres, just as two years earlier. Release 1 of the CDA was being used in 15/21 hospital districts and in 58% of the health care centres while the numbers in 2005 were 13/21 and 35%, respectively. Release 2 of the CDA was in use in 5/21 hospital districts, and in 16% of health care centres.

A total of 17 hospital districts and slightly over a half or 58% of the health care centers used XML messaging. The DICOM standard was in use in all of the 21 hospital districts and in 39% of health care canters.

In the sample of the private service providers the proportion of usage was about 30% for EDI, HL7CDAR1, HL7CDAR2, XML, as well as for DICOM.

Eleven out of the 21 hospitals districts and 24% of health care centres were using their own object identifier (OID) codes. Among the 28 private providers three were using it.

An Identifier for a care chain is given to every patient during their first visit, when dealing with a new or undiscovered ailment. Every contact to a medical professional dealing with that ailment by that patient carries an identifier signature. This way it is possible to use the identifier to string individual medical contacts into a care chain, allowing for better follow-up and a lessening of waiting times for treatment (Stakes 2006). The identifiers were in use in 2/21 hospitals districts and in 9% of the health care centres.

8 Information Exchange Between Health Care Organisations and Patients

General Health Information

All public health care organisations and almost all of the private service providers maintained their own *websites.* An anonymous question-answer service was being used in 9/21 hospital districts and in every fifth health care centre.

Exchange of Patient Identifiable Data

The direct *electronic order of an appointment* means that a patient can reserve an appointment with a physician over the internet. According to a recent report (Vähäkuopus et al 2006), two thirds of all phone calls to doctors office in primary health care centres concerned making an appointment. Direct electronic ordering could potentially save the time of health care staff significantly. The direct electronic ordering of an appointment to some services was in use in eight hospital districts and in 8% of the health care centres. The service has become more general; for two years earlier the service was in use in 1% of the health care centres and none of the hospital districts. In the sample of the private service providers the direct electronic ordering of an appointment was somewhat more common; six out of the 21 that answered the question used it.

Using e-mail to make an appointment was not in use in hospitals districts, but a few (2%) health centres offered it to patients. As for the private sector, an e-mail service for making an appointment was available for patients among five service providers of the sample of 28. SMS messaging for the purpose of making an appointment was available in one hospital district, in 5% of the health care centres, and in one private service provider.

It should be noted that in the context of making an appointment in Finland, the primary health care physicians have the role of a gate keeper into specialized health care. For this reason, primary health care and specialised health care differ when dealing with appointments.

Exchange of Information on Treatment and Care with the Patients

Information exchange with patients by SMS messaging was only used by 3/21 hospital districts and by 14 % of the health care centres, as for the sample of

private providers three out of those 26 answering the question offered the service to patients.

None of the hospital districts used secured e-mail in information exchange while three health care centres and nine among the private providers used it. Conventional e-mail was in use for information exchange with patients in three hospital districts, quarter of health care centres and third of the private providers. Remote browsing of EPR by the patient was not in use anywhere, but in one health care centre was possible for the patients to browse the laboratory results.

The forthcoming national eArchive will offer citizens a chance to browse selected personal health information – namely, reference information for the use of services, referral and discharge letters, certificates, statements and results of examinations, and access log data about the visits to the personal patient record.

Citizen initiated recording means a function by which a patient can transfer personally conducted laboratory tests into the patient record health care system. The service was in use in 5/21 hospital districts, in 2% of the health care centres, and two out of the private service providers.

Teleconferencing means here a situation where the physician is at one location, while the patient and the nurse are in a health care centre at another. The physician uses two monitors, one for the video and the other for the patient record. Two hospital districts offered it to health centres, and 3% of the health care centres received the service. In Finland a direct televideo-conferencing between the physician and the patient at their home has not been available so far.

9 Human and Material Resources

Professional Education and Training

Televideo-conferencing for education was maintained by 20 out of the 21 hospital districts, 32% of the health centres and two from among the sample of 28 private service providers.

Computer Skills of Health Care Personnel

In 75% of the hospital districts and over half of the health care centres 90-100% of the whole personnel had computer skills (Figure 18). In the sample of the private service providers four fifths answered that 90% of their whole personnel had computing skills. The numbers have grown since 2005 when they were already quite high.

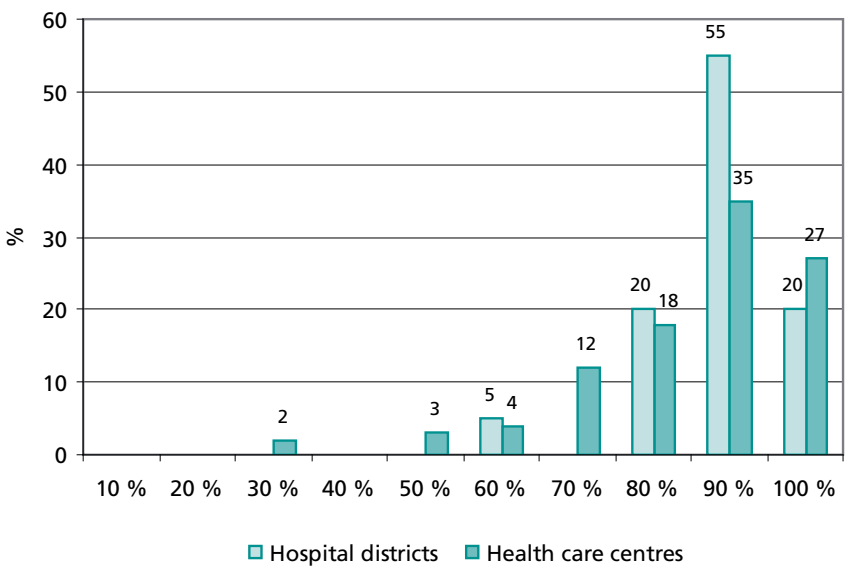


FIGURE 18. Distribution (%) of the hospitals districts and health care centres based on the proportion (%) of the whole personnel with computer skills

In over 80% of the hospital districts and health care centres at least 90% of the personnel documenting and reading patient information had computer skills. In 80% of the health care centres at least 80% of the personnel had computer skills. The private health care providers followed a similar, equally high trend (Figure 19).

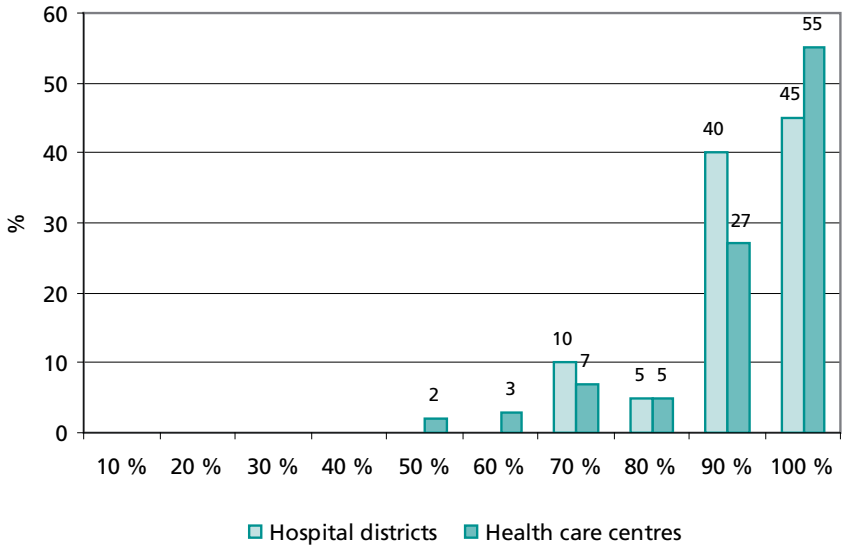


FIGURE 19. Distribution (%) of the hospital districts and health care centres based on the proportion (%) of the personnel with computer skills documenting and reading patient information

Availability of Computers and Internet Connections among Health Care Personnel

Among 90% of the hospital districts and health care centres all personnel who documented or read patient information had computers (Figure 20). The sample of the private service providers had similar figures.

With about 83% of the hospital districts and health care centres, all the personnel documenting and reading patient information with computers had access to the internet (Figure 21). The percentages were similar among the private health service providers.

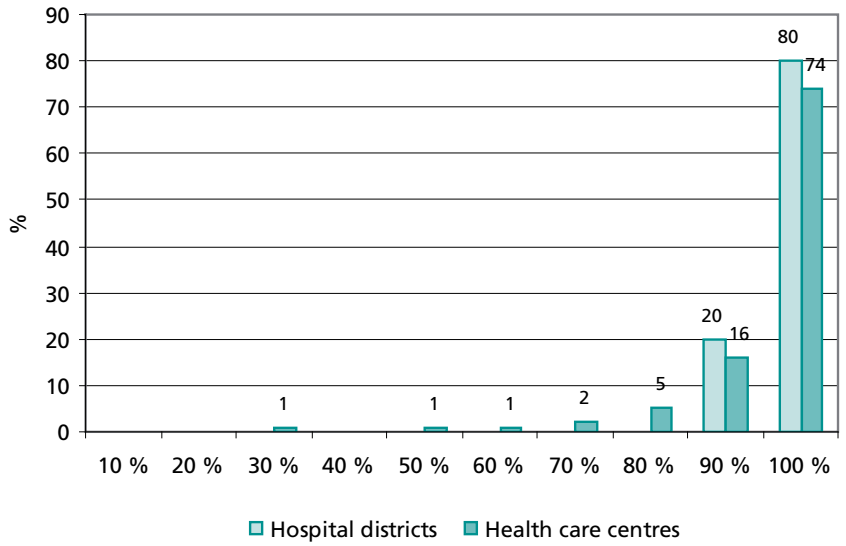


Figure 20. Distribution (%) of the hospital districts and health care centres based on the proportion (%) of the personnel documenting and reading patient information with computers

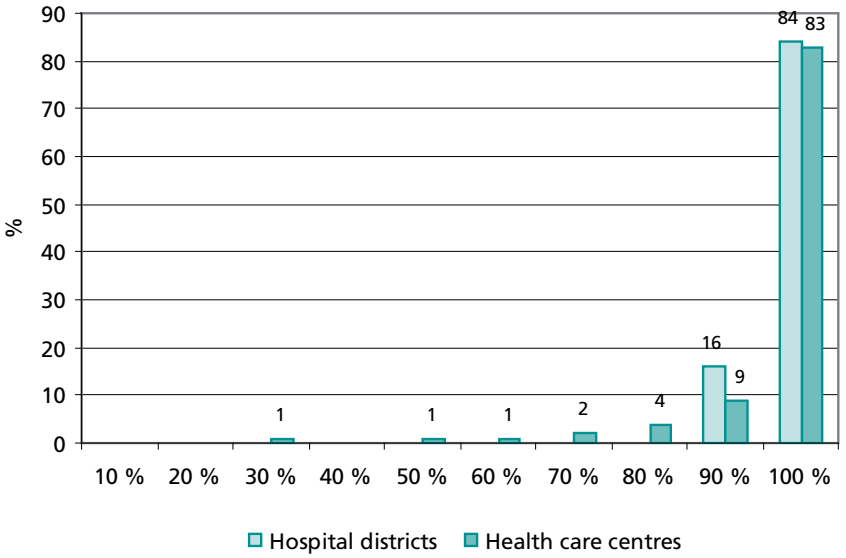


FIGURE 21. Distribution (%) of the hospital districts and health care centres based on the proportion (%) of the personnel documenting and reading patient information with computers having access to the internet

Needs for ICT Training

An investigation on the need for ICT training and teaching materials among social and health care professionals, and the challenges to enhance training was initiated by the Regional and Municipal Consulting group at STAKES in 2006 (Veikkolainen and Hämäläinen 2006). The principal aim of the investigation was to gather comprehensive, nationwide information on the need for ICT training and teaching materials among social and health care professionals working for municipalities, joint municipal boards and hospital districts, as well as for any planning or provision for training.

The study by Veikkolainen and Hämäläinen (2006) inquired in detail about the computer skills of medical staff in hospital districts. Half of the districts felt that the computer skills of their medical physicians were satisfactory, but the skills of the nursing staff were not considered to be at the same level. About two thirds of the districts felt that their nursing staff had some or major deficiencies in their computer skills. This study was conducted at the same time as the eHealth study. It shows that adequate computer skills cannot be found among all the sections of the medical staff and that a general overview may paint an unrealistic picture, unless the individual sections are reported separately.

The investigation also showed that while ICT training was provided by hospital districts and areas, municipal social care departments and health care centres, the quality and the extensiveness of training was not sufficient. Most respondents had organised basic ICT training. By contrast, training dealing with privacy and data security, the function of seamless service had been less than extensive. However, the need for further training had been recognised in several units. The ICT training programmes had been targeted in particular at medical personnel. According to reports by senior social and health care officials, there was an obvious need for training so that the goals related to the provision of seamless service and the introduction of electronic client/patient records could be met. Institutional and home care personnel in services for older people were assessed to have the greatest need for ICT training, while physicians were assessed to have the least.

Hospital districts and units in the municipal social and health sectors perceived themselves to need extensive support in order to be able to teach ICT skills to their personnel. In particular, the surveyed organisations needed financial support to organise ICT training. Support should be offered to hospital districts and municipalities for planning and organising training, and for the development of cooperation.

10 Systems Supporting the Quality and Delivery of Service

Decision Support Systems

Decision support systems are information or knowledge based systems that support the decision making process. The EPR systems used so far in Finland include mostly functions alarming about pathological laboratory results. In addition, some hospital districts and health care centres use EPR systems that include reminders informing about drug interactions or whether a patient had been prepared properly for laboratory tests. EPR terminals also had access to local, regional, and national databases and guidelines with search engines. Access to these databases is available even through mobile devices.

Advanced electronic decision support systems, which could automatically give evidence based medicine (EBM) guidelines, being able to cover a wide variety of clinical topics based on structured core data from the EPR system has achieved the testing stage by the Finnish Medical Society Duodecim (www.duodecim.fi) and its collaborators (www.kaypahoito.fi). The systems can give additional information or recommendations to the health care professionals (Figure 22). This EBMDeS (evidence based medicine decision support system) utilises data from various EPRs, which are compatible with the national EPR standards. With the help of an expert script language, EBMDeS brings context sensitive information from a central server directly to the EPR of the very 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 (www.duodecim.fi including information in English) maintains and updates the stand alone on-line database "Terveysportti" at www.terveysportti.fi 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, "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"), international classification of medicines, libraries of common chronic disease, etc. The portal consisting of a comprehensive set of guidelines has become very popular; it was calculated in 2005 that every Finnish physician read 1–5 guidelines a day on average on the portal (Kunnamo 2006).

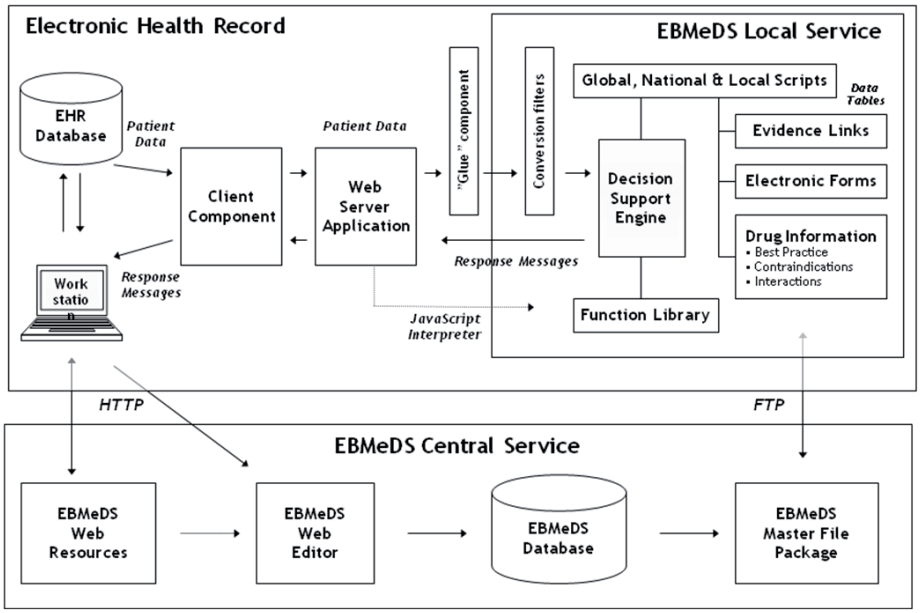


FIGURE 22. Scheme of the functional architecture of the evidence-based medicine decision support system of Finnish Medical Society Duodecim (source: the Finnish Medical Society Duodecim)

Integrated decision support systems are available for many EPR systems on different levels. In this report the decision support systems were classified in four levels, such as 1) a stand alone on-line database on the desktop; 2) an on-line database with access by navigating from EPR; 3) an automatic system which automatically displays selected items on the desktop and is integrated with EPR including a) reminders of examination results (e.g. completed laboratory results), incentives (e.g. diverging laboratory results with colourful font), graphics (e.g. blood pressure as a bar graft), b) reminders of administrative items (e.g. the arrival of referral), c) drug interaction system (e.g. SFINX) and d) other similar systems; 4) systems for automatic integration of EPR and a medical knowledge database which includes a) a drug interaction system b) an intelligent system, which compares the narrative EPR text of the patient to the evidence based medicine decision support database and yields remarks and reminders on the screen and c) other similar systems.

A stand alone on-line database on the desktop was in use in all hospital districts and health care centres and most of the private service providers. A database with access by navigating from EPR was in use in 13 hospital districts and in two-thirds of the health care centres and half of the private providers. Those displaying a selected item on the desktop (reminders and drug interaction systems) were the most common Automatic displayers of selected items were in use in 11 hospital

districts and in three-fourth of the health care centres and private providers. Systems for automatic integration of EPR and a medical knowledge database were in use in four hospital districts and in around one third of the health care centres and two of the private providers. The most common of these was the system of drug interactions.

Other systems supporting the quality and delivery of service

Public health care providers are obligated to comply with the law to allow patient access to immediate treatment during office hours at a health care centre, or with non-critical matters an assessment for a course of treatment within three days. The law obligates hospitals to give the patient an assessment for the need for treatment within three weeks, and a course of treatment within six months. At the time of the survey the law had been in effect for nine months. Electronic systems for this purpose were in use in 16 of the 21 hospital districts, but only in one of every fourth health care centre while two years earlier 15 of 21 hospital districts and one fifth of the health care centres used it (Table 5).

As far as fees of health care services are concerned, in Finland there are, with certain exceptions, patients' excess fees for treatment and care in outpatient and inpatient care. For public sector services, these excesses have an annually cumulating ceiling sum, after which treatment and care is free. Electronic system for this purpose were in use in 9 of the 21 hospital districts and almost half of the health care centres

TABLE 5. Distribution (amounts and %) of health care organisations based on the use of some systems supporting service quality and delivery

Provider	Access to care follow up	Other quality follow up*	Registry for adverse events	Registry for patient fees**
Hospital districts	16/21	5/21	11/21	9/21
Health care centres	24%	3%)	4%	43%
Private providers	3/25	2/21	2/25	Not applicable

* Systems for following up delay of care, design of care, quality of diagnoses, process management, etc.
** Only for public service systems.

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, which are then collected and transferred to the registry. The reporting by health care centres with beds falls under the responsibility of hospital districts.

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. Among 16 of the 21 hospital districts, 84 % of the health care centres, but none among the sample of the private service providers maintained electronic registers of borrowed adaptive home care medical equipment.

11 Costs for Systems of Information and Communication Technology

In *the surveys on implementation and usage of ICT, a question* requested the estimation of the proportion (%) of the sum of annual costs for purchasing, maintaining, developing information and communication technology, and training. In most of the hospital districts the proportion of the budget varied between 1–3%, similarly to the figures received two years earlier (Figure 23).

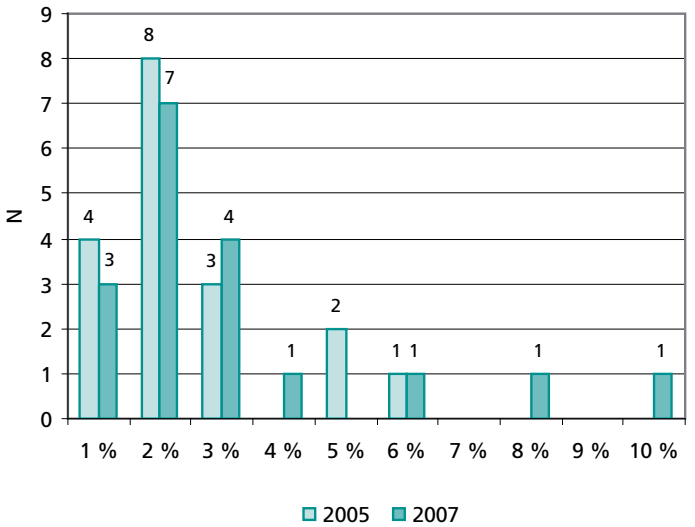


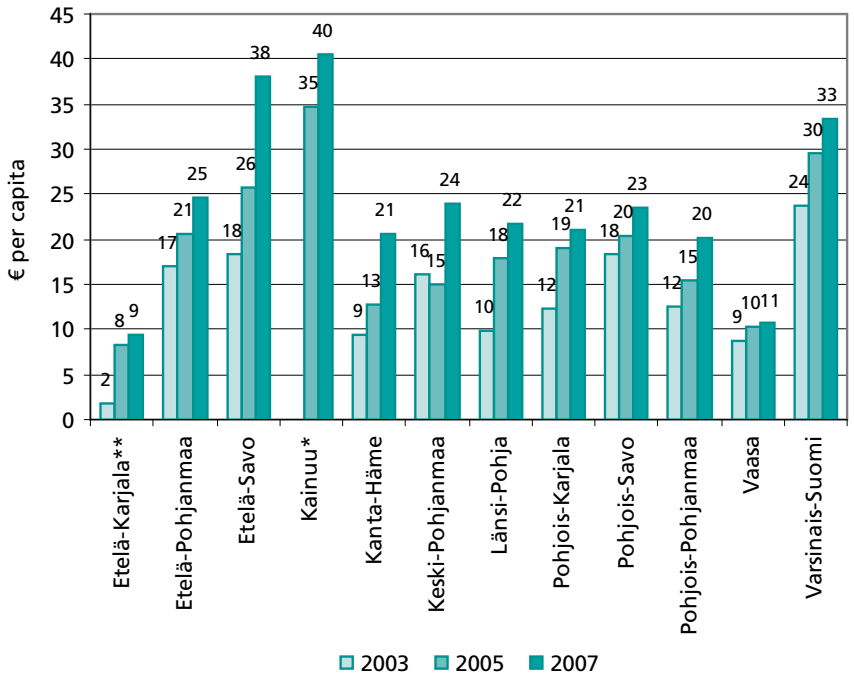
FIGURE 23. Distribution of amount by hospital districts, based on their estimations of the proportion (%) ICT-related costs in the annual budgets

In the health care centres the ICT related annual costs were estimated to be typically 1–3%, which was the same as in the sample of the private service providers.

The *detailed cost enquiry*, which was carried out four months after the survey on the implementation and usage of ICT, targeted only the public sector service providers. They were asked about the costs of hardware, software, and information management personnel in 2003, 2005, and 2007. The response rate remained quite low, despite the extension of deadline, 12/21 for the hospital districts and 52% for health care centres. The reasons for this was that among many responders budgetary structures differed from that presented in the questionnaire, which required extra

work to respond, and in addition, in many organizations there were on-going reorganisation processes of services binding the administrative resources.

For hospital districts the sums of ICT-related costs (hardware, software and personnel) in 2003, 2005, and 2007 are presented as Euro per capita in Figure 24. Per capita costs can be used, because in Finland everybody belongs to the population of a health care centre according to their residence, and a health centre has to belong to one of the 21 hospital district. The medians of annual costs per capita in hospital districts in 2003 were 14.7 € (from 9 to 24 €), in 2005 19.6 € (from 10 to 35 €), and in 2007 it was 23.7 € (from 11 to 38 €), respectively.



* Includes costs of primary health care, the current organization did not exist in 2003.
** Excluding hardware costs in 2003.

FIGURE 24. Annual ICT related costs (€) per capita in the 12 hospital districts that answered the question in 2003, 2005, and 2007

Figure 25 shows the annual progress of the medians of ICT related costs in the hospital districts. The proportion of hardware costs seem to have decreased during the four years from about 20% to 16%, those of personnel costs from about 26% to 23%, but those of the proportion of software costs increased from about 54% to 61%. In other words, software costs represent more than a half of ICT related costs and the trend of growth is the strongest one.

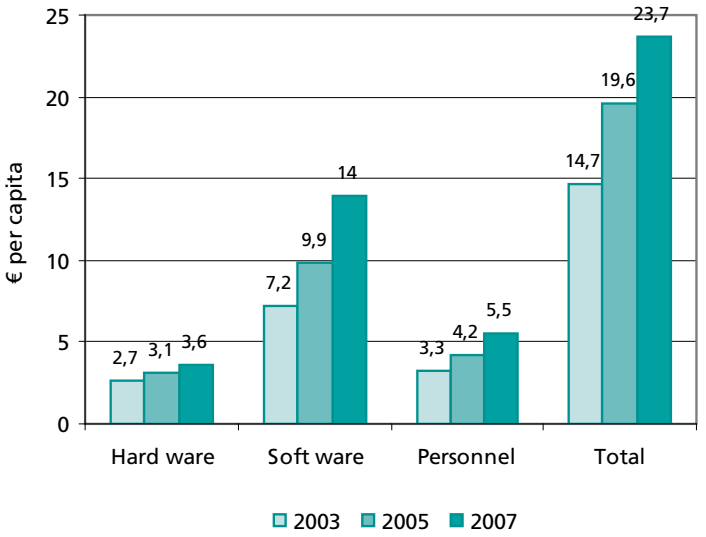


FIGURE 25. Detailed annual ICT related costs (€) per capita in the 12 hospital districts that answered the question. The medians of combined costs are calculated from the original figures

For the 118 (52%) health care centres that responded to the question the medians of the annual ICT related costs per capita in Euro increased from 12.9 € in 2003 to 15.2 € in 2007 (Figure 26). The proportions of the software costs seem to represent more than half of the costs, and the trend refers to a continuing growth. On the contrary, the hardware and personnel costs seem to remain quite unchanged and the proportions of each of them was about 20% of all ICT related costs in 2007. The trend of hardware costs suggests that the basic investments in health care centers have been done.

If it is assumed that the medians per capita are representative for the whole country, and if the medians are multiplied by the population number of the country, the end result would be that the ICT related costs of hospital districts in 2007 were 125 m€ and the preceding annual increase about 20%–25%. For the health care centres the costs in 2007 were 81 m€ and the preceding annual increase about 10%, respectively.

The budget of all health care costs in 2006 was 13.6 milliard euros (Stakes 2008a). Taking the inflation into consideration the growth from the preceding year was 2.3%. The results presented refer to the fact that the growth of ICT related costs in health care is multifold compared to the growth of all health care costs. The proportion of ICT related costs of all health care costs currently, however, does not come to more than about 1.5%.

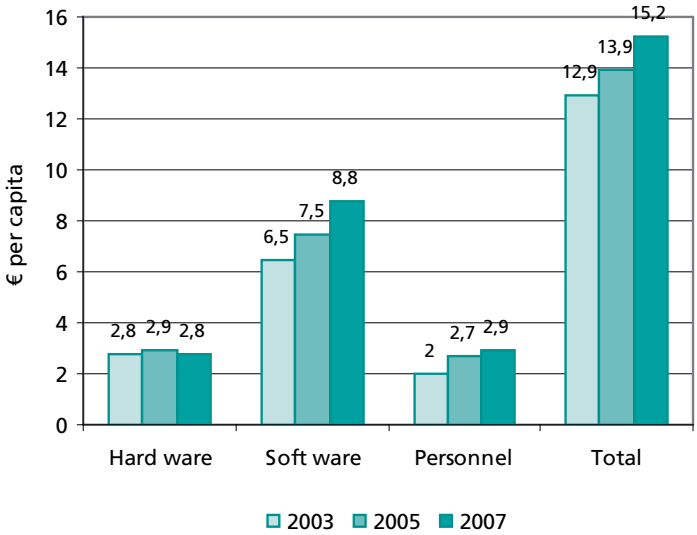


FIGURE 26. Detailed annual ICT related costs (€) per capita in the 118 health care centres that answered the question. The medians of the total costs are calculated from the original figures

12 Additional Information on Finland and eHealth

Research, Development and Training in Health Care Informatics

Funding for research and development in health informatics originates primarily from the public sector, such as the Ministry of Social Affairs and Health, the Finnish Academy of Science, the Finnish National Fund for Research and Development (SITRA) or from the semi-public sector (such as the National Technology Agency – TEKES). The allocated funds are primarily targeted at pilot-projects and the promotion of eHealth applications, as well as at the further standardisation of existing tools. Additionally, there are funds available at the local level through the regional hospital districts' own development schemes for services as well as through some local technology centres.

Research on medical imaging and bio-signal processing and analysis is performed at Helsinki University of Technology and at Tampere University of Technology. In addition, a Health Informatics laboratory operates as part of the VTT Technical Research Centre of Finland (VTT). Considerable research work on an international level is undertaken in the fields of bioinformatics and genomics. However, there has not been a direct connection created to health informatics research yet. The National Research and Development Centre for Welfare and Health (STAKES) undertakes and coordinates research work in the area of eHealth (electronic patient and welfare records, secure communications, eArchiving, evaluation ofeHealth and eWelfare developments, strategies and implementations).

Training in health informatics is currently not available as a standalone line of study, with the exception of the University of Kuopio, which offers a Master's degree programme in Health Information Management. The curricula of undergraduate studies in medicine do not include health informatics training. Rather, the emphasis has been on training healthcare practitioners to acquire the necessary IT skills. National representatives participated in a recent effort to define a healthcare specific application to the European Computer Driving License (ECDL). For detailed studies of practical implementation of eHealth and telemedicine the Open University in Oulu together with FinnTelemedicum organizers a web-course in a specific learning environment with the theme "Basics of eHealth" also in English.

Professional Activities

There are two main professional organisations active in the field of Health Informatics in Finland: Finnish Society for Telemedicine and eHealth (FSTeH) and the Finnish Social and Healthcare Informatics Association (FinnSHIA) (Reponen 2005). For more than a decade, several annual national conferences have been organised. Topic-specific seminars, workshops, and international health informatics events have been regularly hosted around the country.

Finnish representatives participate in the activities and working groups of international health informatics organisations such as the European Federation for Health Informatics (EFMI), International Medical Informatics Association (IMIA), the International Society for Telemedicine and eHealth (ISfTeH), the European Health Telematics Association (EHTEL), as well as the standardisation activities of ISO, CEN and HL7.

International Collaboration

At the Nordic level, Finnish representatives have participated in telemedicine surveys and projects supported by the Nordic Council of Ministers and the Nordic University Network (NordUNET) since the early 1990s. Finland was a founding member for the Nordic Telemedicine Association (NTA). Recently, the Nordic Council of Ministers has established "The Nordic Telemedicine Collaboration Forum" (Nordisk telemedisinsk samarbeidsforum). This forum has up to two representatives from each Nordic country, including the autonomous areas of Greenland and the Faroe Islands. Representatives mostly come from national ministries or other national bodies as well as the Nordic Telemedicine Association. The task of the forum is to investigate legal and other barriers for cross-border telemedicine between the Nordic countries. Reports on the findings from the forum will be given to the senior health officials of their respective countries.

Finland has been actively involved at the European level in discussions and preparations of eHealth issues. It gave expert and secretarial support to the Health Telematics Working Group of the High Level Committee on Health, which presented its Final Report in 2003 (European Commission 2003). It has also participated in the implementation and coordination of the European eHealth Action Plan of April 2004 (European Commission 2004). Finland has participated actively since 2005 in the eHealth Working Group, under e2005. Finland has also participated in the High Level Group on Health Services and Medical Care during 2005 (European Commission 2005).

After launching the concept of the European eHealth Area in the strategic framework of i2010 – European Information Society 2010 setting as priorities

the completion of a single European information space, Finland has actively participated in the i2010 subworking group on eHealth and also in work on eInclusion. The member states of the i2010 eHealth have been invited to form, with expert support from the National Competence Centres, ad hoc groups to work on patient summaries, patient and practitioner identifiers and the emergency data set. The Finnish Ministry of Health and Social Affairs has nominated STAKES Unif for eHealth and eWelfare to represent Finland in the ad hoc group. Finland has sent a ministerial delegation to the ministerial level eHealth conferences of Brussels 2003, Cork 2004, Tromso 2005, Malaga 2006, and Slovenia 2008. At each conference different aspects of the Finnish eHealth development were presented during the sessions and/or as part of exhibitions. The first results published in this report series were shown as an exhibit by the Finish Ministry of Social Affairs and Health in Malaga in May 2006. The results were also shown at the World Health IT Conference in Geneva, Switzerland in October 2006 as well as in many scientific conferences in Europe and Asia since then. The first results of this most recent survey were presented as a poster exhibit and in two oral presentations in the ministerial conference in Slovenia in May 2008.

Finland has also participated in some EU projects aiming at bettering European eHealth coordination and interoperability. These projects are the ERA project (www.ehealth-era.org, European Commisson 2007), The Netcards project and the Semantic Mining project. Results of the eHealth ERA project confirm the observation that interoperability issues are high on the agenda of most eHealth strategies and roadmaps of member states. (Hämäläinen et. al 2008) In the area of semantic interoperability, Finland is participating in the European discussions and looking at different possibilities of harmonising the national and the international needs for development.

The Finnish national version of an eHealth roadmap was developed by a ministerial working group and published in January 2007 (Iivari and Ruotsalainen 2007). The ideas stated in the European action plan, focussing on citizen-centred and patient-centred services, improvement of patient safety along with the full continuum of care, and the support of citizens with tools that enable them to become both well-informed and self-assured patients, and optimal medical services are not in conflict with the ideas of the Finnish roadmap. Finland supports joint efforts for more eHealth collaboration in Europe. Steps should be taken to reach out to these goals for the benefit of Europe, its citizens and its societies, and thus supporting the longer-term objectives of the Lisbon Strategy (European Council 2000).

e-Welfare and Exchange of Data between the Health and Social Sectors

The Act on Experiments with Seamless Service Chains in Social Welfare and Health Care Services (2000–2007) has been a temporary, normative measure. The new Act 159/2007 states that the national eArchiving service for electronic patient records will be maintained by the Social Insurance Institution (KELA). Social services are mentioned in the general paragraphs of this law, but there is no legislation on archiving the documents of social service clients by KELA.

The social service sector was invited to participate in the first project on the implementation of the experimental legislation called "Makropilotti" (from November 1998 to June 2001). However, in practice, the participation of social care client register controllers was quite small and according to a study conducted in 2005 (Hämäläinen et al 2005), no actual electronic client data had been exchanged between social services and health care services in the participating municipalities. However, a more in-depth analysis showed that some e-Welfare activities from the social sector could be found (Tenhunen et al 2006). For example, in the administrative region of Kainuu, where the health care and the social care belong to the same organisation, both sectors are participating in the regional health and social care network. The regional exchange of data within social care is operational, but even here the different structures of data make it difficult to exchange information between the social and health care sectors. In some municipalities, some electronic data exchange takes place between the institutional care of the elderly and home care. The need for co-operation and shared data in social welfare and health care has been recognised and expressed in a number of studies, research reports and development projects. However, challenges for actual exchange of information can be identified in both, those being in lack of defined joint data sets, and issues concerning information systems. (Hyppönen et al 2008).

During 2003 the Ministry of Social Affairs and Health launched a project to develop the use of information technology in social services is part of the wider Development Project for Social Services 2003–2007. The task of the project has been to take into account the ICT development needs in social services and describe the measures that are required to promote the use of information technology in social services at the national, regional and local levels as well as the order in which the measures should be implemented. (Ministry of Social Affairs and Health 2003b).

No systematic studies on ICT use in the social service sector has been conducted since 2001 (Hartikainen et al 2002). Drawing upon discussions with experts from different regions, the general understanding is that today in Finland the social service providers have electronic social care records commonly in use but computers are under-utilised and software is inadequate. The electronic transfer of case information between different service provider organisations is mostly

impossible. Narrative recording dominates and terminology is heterogeneous (Kärki 2008). One main focus of the project on the use of ICT in social services has been to address these problems and develop the electronic documentation of social care clients in social care service processes.

The history of client documentation of social care work has been very fragmented. National consensus on document structures has been built as a result of the work of several expert groups (Kortelainen and Kärki 2005). The second phase of the ICT in Social Welfare in Finland project (2005–2011) is funded and lead by the Ministry of Social Affairs and Health. It aims to digitalise social services and modernise the management of the client data. The work follows the developments of the Electronic Patient record in Finland. The main tasks are to define the national data architecture for the field of the social welfare and to define the data sets (contents) and datastructures needed in electronic social records and to harmonise the guidelines (legislation) for the electronic records management in social care (Kärki 2008).

By the end of 2008 most of the data sets (contents) have been defined. The technical standard used in electronic social records have been designated. XML will be used. The definition of the datastructures and guidelines for records management is in progress. The definition and modelling of data architecture has been started and the discussion of national archiving has begun (Kärki 2008). The experts have recommended joining the national eArchive system for health care but by the end of 2008 no political level decision has been made (Laaksonen et al 2008). If this decision is taken, amendments of the current legislation are needed.

13 Conclusions and Future Prospects

The overall development and trends 2003–2007

For the development of the Finnish ICT and eHealth infrastructure three steps can be identified necessary for leading to a more citizen-centered health care:

1) Infrastructure on the *local level* has changed from paper records to electronic documentation Today, documentation of patient data in the Finnish health system is being realised by electronic means. For primary health care centres the transition from paper-based to electronic patient records (EPR) has taken place in the late 1990s, and for hospitals after year 2000. The actual saturation point of the implementation of EPR has been achieved.
2) Development of the infrastructure on the *regional level* is best shown in the transition from letters to electronic data exchange.The cross-enterprise electronic data exchange has increased rapidly and includes most of the health service providers. This is because digital data depositories in individual health care institutions are in active clinical use and protected data connections enable the communication of electronic patient information.
3) Developing infrastructure on the *national level* or eArchive is a unique solution of centralized EPR repository which enables data transfer, upon a patient's permission, between health service providers and empowers patients to browse their own EPR. This signifies the progress from hierarchies to a seamless information flow.

This documentation and information exchange infrastructure built for professional use is the backbone of versatile and qualified direct eHealth services for citizens. Presently, general health related eInformation is widely available, but personalized communication between professionals and citizens is at an early stage with active ongoing development. The high eLiteracy among citizens and health care professionals and the high coverage of computers and broadband networks provide a fruitful soil for the development of high quality eServices for prevention and care and thus rapid progress towards citizen-centered health care.

The achievements in 2003–2007 can be summarised from the functional point of view as follows:

1. EPR is currently used comprehensively all over in specialized and primary health care in Finland and the usage of EPR over wireless networks within institutions is common.

2. Picture archiving and communication systems (PACS) comprehend currently all hospital districts and the intensity of usage is high. All specialized health care hospitals are filmless. PACS is utilized in every second health care centre, and the coverage has doubled in two years.
3. Electronic referrals are accepted by 19 out of 21 hospital districts and the coverage has been doubled since 2003. Three quarters of the primary health care centres use electronic referrals currently while in 2003 the corresponding proportion was one quarter.
4. An electronic consultation, or the mode of action by which a general practitioner asks for a specialist's opinion without transferring a patient to hospital, is utilized in half of the primary health care centres and is twice as common as two years ago. A half of the hospital districts provide the service.
5. Consultations by televideo-conferencing are available for primary health care centres in 14/21 hospital districts and they have become more common since 2005. While only 17% of health care centres purchases the service, the proportion of the users has, however, increased by a third in the two last years.
6. A total of 17 of the 21 hospital districts use some type of regional data repositories – or almost twice as much as in 2005. The proportion of health care centres utilizing such a one is 64%, which shows a strong progress during last two years.
7. Concerning regional exchange of patient data, either by regional data repositories or by other means, exchange of narrative texts is provided by all but two of the 21 hospital districts, while in 2003 it was done by not more than one fifth of them. Currently two thirds or more than earlier, of the health care centres use the service. Some form of teleradiology was in use in 17/21 hospital centres – the proportion were doubled since 2003. Two thirds of health care centres utilize some kind of teleradiology, while four years ago the corresponding proportion was one tenth. Some kinds of telelaboratory services are provided by 19/21 hospital districts while in 2003 the corresponding proportion was 8/21. Three fourths of health care centres utilize telelaboratory and the proportion doubled since 2003.
8. Computer literacy and access to internet are very high among health care personnel and have increased even more from the previous high level according to the year 2005 survey.
9. Electronic desicion support systems and clinical guidelines either on the computer desktop or accessed by manually navigating from EPR are already in comprehensive use. Decision support systems highly integrated into EPR and automated clinical reminders based on patient based individual medical data are becoming more common.

From the technological and administrative point of view the achievements can be summarised as follows:

In Table 6 the achievements have been reflected in the targets of the National Project for Securing the Future of Health Care. The project was in force 2003–2007, and our three surveys have covered the beginning, middle and end. The ministerial working group formed for the definition of EPRs and their implementation strategy described in 2003 how the nationwide electronic patient record system can be completed (Ministry of Social Affairs 2003). The common content and structure that should be used in every EPR system in all organizations was defined. It included a clinical consensus on core patient data, some national services such as a code server, open standards for interoperability, and national guideline for the safeguarding of data. Table 6 shows the developmental targets according to the memorandum of the working group and how they have been achieved.

TABLE 6. Targets of the memorandum of the ministerial working group (Ministry of Social Affairs abd Health 2003) formed for the definition of EPRs and their implementation strategy, and how they have been achieved

Topic	Realization on the level of definitions and national systems	Situation in the information systems of service providers
Common data structures	Core data guide[1] Collaboration of stakeholder clusters since 2006	Diagnose codes and clinical procedure codes in comprehensive use
Digital service for delivering classifications, glossaries and codes	Code server[2] has been built and is functioning. Technical interface for direct access to codes ready. Code services has legistlation	Only few of the service providers are technically able to use direct access to codes
Unambiguous identification of locations where service is provided	Use of ISO-OID-codes included in the definitions of the eArchive[4]	11/21 of hospital districts and 17% of health care centres have OID code of their own
Principles for managing electronically sharing of electronic data	Included in law (159/2007).	In 2/21 of hospital districts and 9% of health care centres solely electronic management of patient's informed consent
Strong electronic identification of professionals	Included in law (159/2007). The system is under construction by medicolegal authority	9/21 of hospital districts and 9% of health care centres use undisputable identification. Tecnically not yet completely in accordance with legislation

Table continues

Topic	Realization on the level of definitions and national systems	Situation in the information systems of service providers
Standards for interorganizational data exchange	XML/CDA R2 standard has been verified as the documenting standard of the eArchive[3]	17/21 of hospital districts and 58% of health care centres use XML 5/21 of hospital districts and 16% of health care centres use CDA-R2
Uniform protocol for use and storage of digital documents	Included in law (159/2007)	The first implementations approximately by the end of 2009
Common protocol for describing and indexing data	Included in the eArchive definitions[3]	It will be realized by implementation of the eArchive
Certification protocol for information systems	Proposal for certification criteria was given in 2008[5]	It will be realized under the supervision of the Ministry, prerequisite for joining the eArchive
Better exploiting of information system through decision support systems and desktop integration	Project for decision support system 2005–2008	Separate desktop databases comprehensively in hospital districts and health care centres In 13/21 of hospital districts and 2/3 of health care centres ability to navigate to databases from EPR, and in 11/21 and ¾ automatic displayers of selected items, respectively In 4/21 of hospital districts and 2/5 of health care centres developed integration of EPR and medical knowledge database
Developing adminstrative data systems for statistical data collection and care process monitoring (primary and secondary care statistics, waiting time management)	Statistical classifications for outpatient care have been published. Stakes compiles statistcs on hospitals waiting lists	Waiting list statistics in specialized health care in routine use, pilot health care centres start to compile out- patient statistics in 2008
Organizing the regional data exchange system	Law 159/2007 realizes the usage of the regional and national data exchange	17/21 of hospital districts and 64% of health care centres use a regional data exchange system

Topic	Realization on the level of definitions and national systems	Situation in the information systems of service providers
Skills for purchasing services, procurement collaboration, developing services	State subsidies 2004-2007, Collaboration of stakeholder clusters, Procurement office under construction	Municipalities and unions of municipalities have developed their ICT and models of collaborations

[1] Opas, Ydintietojen, otsikoiden ja näkymien toteuttaminen sähköisessä potilaskertomuksessa. Versio 2.2.31.1.2007 http://virtual.vtt.fi/virtual/hl7/cda/opas-spk-ydintiedot-2007-01-31.pdf (luettu 17.10.2008).
[2] http://sty.stakes.fi/FI/koodistopalvelu/koodisto.htm
[3] http://sty.stakes.fi/NR/rdonlyres/C0432B2A-7AB6-4D4E-AFE2-3927962AE423/12253/Tekninenratkaisu.pdf
[4] ISO-OID http://www.stm.fi/Resource.phx/vastt/tietoh/maar.htx
[5] (Ruotsalainen ym. 2008.)

Table 6 shows that all the goals of the National Project for Securing the Future of Healht Care have been realized or are being realized. The accomplishment and implementation of the structured content of data, core data definitions, and national classifications and code services have created especially the ground for collaboration between patient data systems and additional functionalities empowering professionals and citizens.

EPR is changing from a documenting and archiving tool to the means for steering care and functional processes. Structured core data EPR enables the implementation of high level automatic decision support systems. They will produce surplus value which motivates users to record patient data more precisely. The final benefit will be improving quality. Integration of hospital, radiology, and laboratory, etc. information system with patient record systems will make the work of professionals easier. A developed EPR can be regarded as a portal for better management of the processes of clinical work in accordance with best practices and better allocation of resources.

Along with technical functionalities of EPR systems it is even more important to pay attention to their usability. In their answers to open questions many of the responders of the latest survey worried about whether the systems can be used fluently and without delay especially after the implementation of the national archive. In 2007 a select committee of the Finnish Medical Association drew a mapping of the usability of the EPR systems in use and found several items to be improved (Lääveri et al 2007). Finally, the readiness of users or physicians and nurses to comply with new systems is decisive for effective use.

Along with the National Project for Securing the Future of Health Care a new action model has been created, thanks to which the development and procurement of information systems is not as scattered any more as earlier. Experts from different parts of the country have worked together on the national definitions of information systems. The Ministry has steered the implementation of the definitions through the clusters of stakeholders.

The systems and solutions of data exchange between professionals and citizens are the electronic order of an appointment and self care system. The concept of self care (Hyppönen and Niska 2008) is also a rising trend internationally. A portal to be built in the national archive, identifying the user, will enable implications of new applications, which are developed by eKAT project (www.ekat.fi). It can be expected that citizens familiar with other electronic services will use electronic self care services.

One of the major challenges for further development will be the national eArchive for patient documentation. The practical implementation of the national EPR is heavily dependent on its timetable and our survey shows that the local and regional health authorities shall have a major task in upgrading their systems to be compatible with the eArchive.

The strengths and weaknesses of the study

Each of our surveys targeted the whole public health service system comprising 85% of all Finnish health services. Because the response rates of *the implementation and usage of ICT and eHealth surveys* have been high, even 100% for public specialized health care and very high for primary health care, the surveys offer exceptionally comprehensive information about ICT and eHealth implementation in Finnish health care. The private medical service sector providing about 15% of health services comprises a lot of enterprises and stand alone practising physicians. With regard to them we had to be satisfied with samples, focusing on the biggest enterprises.

The comprehensive registers of health care service providers of Finland have been an importantsource for the high coverage of the surveys. The repeated surveys, three of them on the national, and one preceding them on regional level (Kiviaho et al 2004, in Finnish, English summary) carried out by the present authors have enabled several updating of the questionnaires according to the findings and feedback of the respondents. For the sake of comparisons, many questions have been preserved as such.The electronic web-based questionnaire proved to enable an effective delivery of the questionnaire, and was also useful for following up responses.

The long personal experience in clinical and administration work of the authors have guaranteed that the questionnaires have been focused on essential aspects and that the authors and the respondents were speaking "the same language". The strength derives also from the fact that the authors have been involved for long in developing and assessing ICT solutions for health care. The authors' familiarity with health care has been significant for assessing the reliability of the answers received by the questionnaire. Personal relationships with administrative and

clinical employees have been, no doubt, an important factor to lower the threshold of resistance to filling in questionnaires.

The surveys have focused on the existence of applications that give reliable information. The intensity of use, which tells how comprehensive the use is, is an estimate, not exact information. In addition, the results represent the situation of the main unit of each of the organizations, e.g. for a hospital district the central hospital and for health centres the head site, which are usually the best equipped. That is why the representativeness of the results may be questionable with regard to subunits of hospital districts and health centres.

Some of the concepts and terms of the questionnaire tended to be unfamiliar, especially to the clinicians of primary health care. Reformulating questions for later questionnaires was aimed at solving this problem, as well as providing it with hyperlinks to background information. However, some answers had to be checked by phone calls to the respondents concerned or they had to be interpreted on the grounds of the best available knowledge.

The structured questionnaires consisted of about 90 main questions, most of them several subquestions with multi-choice options. It included questions which necessitated collaboration between different professionals in the responding organization. The extent of the questionnaire brought about versatile knowledge but encumbered the respondents.

The 2007 survey on detailed ICT costs among public health service providers was in nature the first effort to collect comprehensive information on the topic on national level. The results give interesting information about the distribution of different ICT-related costs and their trend during the last four years. The response rates, 57% for specialized care and 52% for primary health care, means that the information has to be regarded as suggestive instead of exact one, which was targeted. Some questions of the questionnaire were found to be in need for revising due to different budget practices among the organizations.

The rapid progress of the implementation of ICT applications, shown by these surveys induces the fact that taking into consideration time delays of the realization of the surveys, the results refer to the past. Creating an up-to-date register might be one solution to the problem.

Mapping the use of ICT systems and applications like the current surveys satisfy the need for information from one important point of view. Other aspects, such as the quality, feasibility, effectiveness and cost effectiveness of the systems are important but had to be left out of the scope of the surveys. Data on the fact if an application had been assessed in terms of the aspects has been collected but have to be left for further analysis.

The surveys possess several strengths but also some weaknesses. They can, however, be regarded *en bloc* to offer versatile and up to date information for health authorities for administrative and benchmarking purposes. Moreover, they also represent internationally unique storehouse of information.

Lessons learned in Finland

Deployment of national strategies

The introduction of electronic patient records started early in our country. As a result of the relevant independence of local authorities, Finland became a country where many organisations used different EPR. Furthermore, in general there was no interoperability to exchange EPR information between organisations.

In order to improve the situation, in 2002 the Finnish government made a decision on electronic patient records announcing that "Nationwide electronic patient records will be introduced by the end of 2007" and the working group on EPR strategy 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 collaboration for creating the national structural standards brought together the best expertise in various districts of the country and guided the development to a more coherent direction. Finland took an initiative not to create a new all-in-one electronic medical record, but rather to rely on existing commercial solutions and escort them to develop a better internal consistency and mutual interoperability in their next versions. It was seen as a benefit if more competition exists on the market.

The more prominent role of the ministry was also seen in targeting the financial support to those projects which comply with the national efforts. The role of so called clusters of software providers and users has been a key issue here.

Finally the new laws of eArchive and ePresciption summarize the effort for a national health record, by defining a platform where all the information can be obtained.

Timetable of development

The usage of electronic patient documents has increased in an accelerating rate since 1990s. As discussed, most usage started as local systems, which were lacking in interoperability even within one institution. The challenges were twofold: the transition from paper and film based documents to electronic documents and digital images and at the same time the development of a usable system architecture and local and regional interoperability.

For primary health care centres the transition from paper-based to electronic patient records (EPR) has taken place in the late 1990s, and for hospitals after year 2000. The important 90% saturation point for primary health care was reached in 2003 and for secondary care hospitals in 2005. For the Picture Archiving and Communication systems the same 90% saturation level was reached in 2007,

while laboratory systems commonly followed the EPR utilizations. The fastest development rate took place at the same time as the government targeted extra support for health care ICT deployment and the overall awareness increased through the national collaboration.

Benefits of this survey

This survey together with its comparative predecessors has been able to reveal the most important phase of Finnish health care ICT development. According to our surveys, the speed of development has been the fastest during the last four years. The surveys have been able to produce a comparison series of results throughout this period of rapid development. The results can be mapped against the known financial investments and they can be related to the known administrative decisions.

The methodology used in the surveys carried out by FinnTelemedicum and Stakes in 2003, 2005, and 2007 takes into account both the distribution and practical use of various health care ICT solutions. The main emphasis has been on the clinical point of view, which is an excellent measure of the true influence of ICT technology. It has been important to measure all the relevant software components that form EPR down to such supporting annexes as decision support systems in order to have a proper general overview of the situation in the country.

Indicators of eHealth development

The saturation point of classic indicators of eHealth deployment has been reached in Finland. Firstly the Electronic Patient Record is the most important tool for health professionals in acquiring and documenting information about patient care. In Finland 99.1% of the primary health care centres and all of the 21 hospital districts used EPR as their primary tool for patient data. Secondly, the usage of PACS and laboratory systems has also reached the level of near saturation. In view of this, one can say that the penetration of EPR is no longer a measure of ICT usage and that new indicators need to be sought.

One new indicator is the exchange of information between health care institutions. In Finland, regional exchange of information has been possible as a result of the high usage of EPR systems within institutions. Regional exchange of radiological and laboratory data has been one of the first applications, but these days eReferrals and eDischage letters directly from EPR to EPR are on the increase. These all contribute to the seamless service systems of the patient. The popularity of regional data exchange has resulted in five different widely used data exchange systems, which with the patient's consent gives the physician instant access to previous patient data from other institutions through a secure connection.

Another new indicator could be the provision of eHealth services directly to citizens. What will their availability be like on the local and national level? This will give a good comparison to the targets of EU policies.

Benchmarking Finnish eHealth

The Finnish population is above the EU average in using ICT according to the EU harmonised data. In spring 2007 three quarters of the Finnish households had a household computer, mostly with internet access, and 84% of those in the age group 16–74 had used the computer, and 79% the internet. Of those who used the internet 59% searched for information related to illnesses, nutrition or health (Parjo et al 2008).

Harmonised data for comparison is not available on eHealth issues of organisations. Benchmarking eHealth developments in a systematic way is difficult because the definitions and understanding of eHealth elements vary to a great extent among the policy makers, developers, and researchers in different countries. Both the OECD and EU have identified a need to develop eHealth indicators for the follow up of change and as tools to evaluate the effects of eHealth on both the health care system and patients (OECD 2008).

The European Commission has funded some studies on benchmarking eHealth. The ICT use among general practitioners was studied in 2007 by Empirica (Dobrev et al 2008). The structured interview was addressed to individual physicians, not the organisations. The results show that in Finland computers and internet are used by 100% of the GPs (EU 27 average 87 % and 69 %). In Finland 100% of the GPs use the computers to store individual administrative patient data and in the room during a patient consultation (EU27 average 80% and 78%). Decision support software is well (97%) available (EU27 average 62%). In Finland 68% of GPs connect to other GPs, 73% to hospitals, 11% to health authorities, 7% to insurance companies, 2% to patients' homes, 89% to laboratories, and 3% to pharmacies. (Dobrev et al 2008). These results support well the results of our study and also reflect well the Finnish differences to other EU countries. Connecting to health authorities is more common in the EU 27 (17%) than in Finland, where regional systems built by hospital districts and municipalities are the current system. Since the ePrescription system in Finland is not yet running, connections to pharmacies are rare. Also connecting with patients is rare because the systems are not considered sufficient for providing the required data confidentiality and security. This situation seems to be the same in all the other EU countries except in Denmark. (Dobrev et al 2008).

The eHealth policies and the general eHealth deployment situations in the EU countries were analysed in a document based study of the eHealth ERA project (European Commision 2007). Today all EU Member States have a documented

policy on eHealth defined on a government or ministry level. Finland and Denmark were the only EU countries where documented policy level discussions on eHealth started more than 10 years ago. In Norway the history is the same. (Hämäläinen et al 2008). The most common aims set out for eHealth policies were identified as the reform of the health care system and improving health care system performance for more efficiency and quality of care. Other common aims were promoting quality of life and citizen centeredness in care. Also better data for system management and better communication among stakeholders were expected from eHealth (Hämäläinen et al. 2008). Finland had all these aims and expectations in every governmental and ministerial level eHealth strategy and programme during 1996-2007 (Hämäläinen and Hyppönen 2006). Finland is also the first country where eHealth developments are extended to the social care sector in a way where there is an eWelfare or eSocial services policy and a national deployment programme.

The main EU eHealth deployment areas identified in the ERA-project (Hämäläinen et al. 2008) were electronic health records, patient identifiers, health portals, citizen and professional card activities and telemedicine. Regional and national eHealth networks are also operational or are in the planning in the majority of the countries. In Finland, eHealth networks have been regional, not central, but the national archiving system is becoming available, too (see Chapter National Archiving Systems, the eArchive, p. 43.). The differences between the main EU trends and the Finnish eHealth deployment seem to be related to the features of the health care system structure. Since the system is based on the care being organized by the municipal authorities, there has been no strong need for developing e-cards, which are more typical in countries where the health care insurance organisations are important partners in the system. Finland has chosen not to develop a card in which health information is stored. Finland has been a forerunner in using electronic patient records and making them interoperable by structuring and coding the information in them. Finland has been slow in deploying the ePrescription, which according to the eHealth ERA study were indentified to be in the production phase in nine countries. For example, in Sweden and Denmark ePrescripition has been a routine for some time. Active eServices for patients are still rare in the EU countries. In this issue the current Finnish situation is rather typical.

Future prospects

Once the backbone for electronic management of patient data in Finland is ready, the next major challenge is the implementation of the National EPR Archive. The task has not been a minor one as the solution is unique even from the international aspect There are changes that have to be made in legislature, technology and ways in conducting daily tasks in health care. There are challenges in communication

between local and regional systems and the national archive due to the needs for changes in the current software being used in hospital districts and health care centres. In addition, the ongoing implementation process challenges human and material resources of health care service providers, and no doubt, those of the providers of technological solutions. The goal is worth every effort: increased access to personal electronic health records both for the physician and the patient any time and from any place in the country.

The national eHealth surveys show a rapid progress during the last years. The contributing factors have been governmental strategies, regional activities, and the general progress in available technology. Focused financial contribution towards technology implementation projects and the increasing collaboration of national strategies have worked in concert with published guidelines and new legislation to enhance the promotion of ICT technology.

There is a definite need to continue to chart in further surveys that the progression and targets of the National health projects are achieved. The follow-up studies should also record the progress of unified core information, usability aspects and process influences of the new e-tools. Finally, the targets of the National EPR Archive are worth evaluating.

The convergence of ICT tools into one desktop is also another noticeable trend. EPR, PACS, laboratory results, databases, and decision support systems are now all available in electronic form at the point of care. The national nursing recording project pinpointed what needs to be taken into account from different medical personnel in combining care for the patient. The next challenge is the usability of the systems. The technical functionality is not enough if normal workflow is not supported. The national core data project makes it easier to exchange information between systems and also unifies data structures. This makes it easier for medical personnel to change from using one system to using another.

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