A portfolio of e-Health Applications in European Sparsely Populated Areas

Competitive Health Services in Sparsely Populated Areas – e-Health Applications across the Urban-Rural Dimension

Competitive Health Services

Northern Periphery Programme 2007–2013

Innovatively investing in Europe's Northern Periphery for a sustainable and prosperous future

European Union
European Regional Development Fund

Preface

This report describes the context and development of e-Health innovations in the northern parts of Finland, Scotland, Sweden and Norway. The report aims at identifying some of the most important aspects of the health care sector infrastructure that influence the introduction of eHealth innovations. It also describes the most prominent eHealth services and initiatives which are currently being used in these countries.

This report is one of the outcomes of a "Competitive Health Services"-project, which is part-financed by the European Union (European Regional Development Fund) through the Northern Periphery Programme. The aim of the "Competitive Health Services"-project is to enhance provision and accessibility of health services in the sparsely populated regions of Europe by developing and implementing innovative e-Health solutions and promoting transfer of the best e-Health practices across the Northern Periphery. In order to identify e-Health services and innovations which would best benefit the residents of the sparsely populated areas, the existing e-Health practices and innovations have been mapped and identified in partner countries. This portfolio summarizes the results of the research and mapping done in Finland, Scotland, Sweden and Norway.
For an electronic version of this report, please visit www.ehealthservices.eu.

CONTENTS

Infrastructure and eHealth Innovations of the **FINNISH** Health Care System

The context and development of eHealth innovations in **SCOTLAND** with particular reference to the Highland region

The context and development of eHealth innovations in **SWEDEN**

eHealth and telemedicine in **NORWAY**

Infrastructure and eHealth Innovations of the Finnish Health Care System

Ilkka Winblad
Jarmo Reponen
Sinikka Salo

January 2009

Northern Ostrobothnia Hospital District

OULUN YLIOPISTO
UNIVERSITY of OULU

FinnTelemedicum

Infrastructure and eHealth Innovations of the Finnish Health Care System

Overview on the challenges, structure, legislation, steering, practises and developmental issues of Finnish heath care system from the viewpoint of eHealth innovation and implementation.

This report has been compiled by FinnTelemedicum (Centre of Excellence for Telehealth at the University of Oulu) for Northern Ostrobothnia Hospital District within the framework of an NPP-project "Competitive Health Services in Sparsely Populated Areas – eHealth Applications across the Urban-Rural Dimension" – and its workpackage 2.

Chapter 5, "Development of National Health Care ICT Backbone" is based on published national surveys which FinnTelemedicum conducted with STAKES (National Research and Development Centre for Welfare and Health) in 2003 and 2005 and to the preliminary results of a similar survey from 2007.

Chapter 6, "Products and Services Innovations of Finnish Companies in eHealth Sector" is based on on-going collaboration with the Finnish Society of Telemedicine and eHealth (FSTeH).

Acknowledgements:

The authors would like to thank Ms Katariina Reinikainen for her assistance in preparing the survey materials and graphics.

The authors also would like to thank Ms Minna Mäkiniemi from Northern Ostrobothnia Hospital District for her assistance in the structure and language of the final report.

1. The Concept of Innovation

In the present review the concept of innovation has been defined widely as a new product, service or production method (OECD 1997).

A product innovation is a product or a service, which differs from an earlier service on the basis of its intended use, technical solutions, novel utilization of information technology or know-how, ease of use or other feature.

A process innovation constitutes novel or substantially improved product or service production technologies or distribution methods. They have a substantial impact on the quantity of production, on the quality of products and services and on production and distribution costs.

A business or an enterprise is engaged in innovation activity when it has activity connected with product or process innovation. (Statistics Finland 2002).

A social innovation is created when a new solution is discovered from a novel angle and by developing new equipment, practices, politicians, networks or a combination of these as a response to the newly discovered need. (Taipale and Hämäläinen 2007).

Innovation as a concept has nowadays been extended to include organisation's ability to create novelty and to learn (Comission 1995).

A systemic innovation refers to changes in the processes, the organisation of operations or work instruments of an operating system. It covers the hierarchical levels of an operating system, from individual actors to the entire organistaion. (Saranummi et al. 2005).

Innovation can be defined as a radical innovation when new types of services are created to address novel types of need. (Osborne 1998).

In this review main focus will be placed on the service production innovations without drawing a clear boundary between development and innovation as defined by Osborne (1998).

2. Finnish Health Care System

Finland is a sparsely populated country with its 5.3 million inhabitants living on an area of 337000 square km. The population density is on an average 16 per square km; in the municipalities of the southern part of the country typically about 100, and in the northern part from 1 – 10 per square km (Population Register Center 2008). Health care services in Finland cover all people living in Finland. The constitution states that public authorities shall guarantee for everyone adequate social, health and medical services and the promotion of the health of the population. According to a recent report by OECD (2005) the Finnish health system performs in general well. Health spending is low-cost compared with the GDP (7.4% in 2004). Many indicators of health care performance are good. There are, however, inequalities in access to services of a general practitioner.

The organization of public health services (covering 85 % of all health services) is the responsibility of the 419 municipalities (www.kunnat.net), which either provide them themselves or in cooperation with other municipalities, or purchase services from private or public providers. Many Finnish municipalities are very small with less than 2000 inhabitants.

Municipalities have by law the primary responsibility to arrange social and health care services for the people living there. 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 obligation to arrange specialised care is carried out by the federations of the municipalities.

2.1. Public Primary Health Care

Primary health care is provided in 230 health care centres, each of them is owned by a single municipality or by several municipalities together. Health care centres as organizational units are decreasing because of intentions for bigger municipal units (see PARAS-plan). Presently the size of the population mean is 23000, but the median is 9500 ranging from only 250 to 560000.

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 population. 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 consists of general practitioners, sometimes medical specialists, nurses, public health nurses, midwives, social workers, dentists, physiotherapists, psychologists, administrative personnel, and so on. The number of inhabitants per health care centre doctor varies, averaging at 1500–2000. According to the ratings of Finnish Medical Association there were in 2007 a total of 3600 physicians in primary health care.

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. Legislation does not require the municipalities to actually produce the health services. An increasing part of the services are out-sourced by the municipalities, either from other municipalities, or from the private sector. The provision of local ambulance services is also one of the responsibilities of a health care centre (Päätalo et al. 2003).

In health care centres there are a total of 318 in-patient departments. They work in much the same way as a hospital department. A typical health care centre has 30 to 60 beds. The number of in-patient departments within a health care centre varies. 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 inpatient services for the general population. Patients need a referral to see a specialist in the public health care service system, except in emergencies.

In addition to in-patient care, municipalities provide long-term care in non-medical long-term care institutions for the elderly. They are a part of the social welfare services. Several different kinds of out-patient services have been established for the elderly as well as for the disabled, in order to support independent home living for 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. The latter are houses where people live in their own apartments and different kinds of services, such as meals, nursing and other help needed for daily living are available.

2.2. Public Secondary and Tertiary Health Care

Each municipality has to belong to one of the 21 hospital districts (the semi-autonomous province of Ahvenanmaa included here), each containing a central hospital. Federations of municipalities, i.e. hospital districts, own all the hospitals. 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.

A hospital district is an administrative entity. In different hospital districts the central hospital may operate in more than one location and there may be supporting regional hospitals as well. The overall number of hospitals is about 70 including the five university hospitals, 16 central hospitals and over 40 smaller specialised hospitals. Larger regional units are formed through special responsibility areas (ERVA).

Each of the hospitals have out-patient and in-patient departments. The range of specialised care varies according to the type of hospital. The population of hospital districts varies between 27000 (Ahvenanmaa) and 1,477 000 inhabitants, the mean 252000 and median 171000.

According to the ratings of Finnish Medical Association there were in 2007 a total of 7500 physicians in specialized health care.

2.3. Private Health Care

Private health care in Finland mainly consists of out-patient care, which is available mostly in the larger cities. There are around 3,000 private health care providing companies in Finland. The most typical private health care provider is a physiotherapy unit. Physicians can run a practice within a private company, the number of which was 1000 in 2005; or as a stand-alone practice (Stakes 2006). Physicians working at private clinics are allowed to send patients with a referral also to public hospitals. There are only a few private hospitals, providing less than 5% of the bed days in the country.

There are about 1600 full-time private practitioners in Finland (8 % of physicians). Physicians of the public health service are also allowed to have an out-of-hours private practice. 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 2006).

The private service sector provides about 15 % of health care services (Saranummi 2005), but the share is continuously increasing especially in occupational health care.

2.4. Financing Health Services

Public health services are mainly financed by the public authorities through taxes. Municipalities are primarily responsible for the financing of health care and have the right to collect taxes for it. The State participates by paying a general subsidy to the municipalities, which averages 20% of the health care costs. The subsidy payable to a particular municipality is mostly dependent on the age structure of the inhabitants. Other criteria taken into account are the unemployment rate, number of pensions for the disabled (assesses the overall state of health) and the population density. Patient fees cover around 9% of the public health care costs. (Järvelin et al. 2002)

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 concerning Residence- Based Social Security (1993). The Social Insurance Institution runs the public sickness insurance.

3. Challenges of Finnish Health Care as Innovation Environment

The Finnish health care system faces severe challenges. These challenges include the rapid aging of population, technological changes, which increase the costs of services and medicines, rising patient expectations, shortage of labour force and emigration of the working aged population, especially from peripheral sites of the country. The internal migration within Finland is substantial, leaving rural and remote areas with a significantly reduced active population and rising health costs (Finnish Government. 2002 B). Medical technology typically needs more highly educated professionals.

3.1. Ageing population

The ageing population with rising demand for social and health care services is one of the biggest current societal challenges. In Finland, the proportion of persons aged 65+ is estimated to rise from the present 16% to 26% by 2030 and to 27% by 2040. The numbers of persons aged 85+ will rise from the present 94 000 to 220 000 by 2030, and to 349 000 by 2040. The proportion of working aged population will diminish from the present 66,5% to 57,5% by 2040 (Statistics Finland 2006). Keeping the proportional per capita consumption of social and health services constant, the amount of the employees for the services should rise from the present 350 000 to 480 000 by 2030, and to 550 000 by 2040 (Parkkinen 2007). Increase of this magnitude is entirely unrealistic. (Parkkinen 2007). The challenge is how to provide sufficient health services for citizens under the circumstances.

3.2. Health Care Organization

3.2.1. Leadership in the Public Service System

In public health care, the highest decision making authority is given to a democratically selected council of elected officials, which nominate members of the board, which is responsible for the enforcement together with the leading office holders as stipulated in the standing order.

A person elected in a position of trust will authorize decisions in key areas: he/she sets the operational goals, allocates resources and monitors their implementation. New models for a politically managed administrative organisation have been sought for (STM 2004:9), including the relationship between a person elected in a position of trust and the authority of an elected official.

3.2.2. Management of a Health Care Organization

The management of a public health organisation is influenced by legislation concerning specialized health care, an obligation to respond to service needs and its un-predictability, obligations imposed by ethics and justice, the interests of regional politics and the problems of funding, guidance, measurement and incentive systems.

The organisations in specialized medical care do possess leadership and management skills and resources, but the situation is problematic in smaller units, such as health care centres. The basic curriculum of medical doctors includes very little training in management and team work. "Health centres 2015"-working group therefore suggests that the management systems in health centres should be further developed, including both political decision making and operative management. Management requires monitoring of operations and information systems dealing with operational descriptions, productification, monitoring of the care quarantee, human resources, skills and finances (STM2006).

The problem health care, and primary care in particular, is facing is that operations have been monitored as performance and not enough attention has been paid to efficiency, productivity and resource assessment (Sarasnummi et al. 2005). Surveys concerning the usage of electronic information systems have revealed that usability, efficiency and cost effectiveness have been minimally assessed (Kiviaho et al. 2004, Winblad et al. 2006). Electronic operating environment has nevertheless enabled utilization of electronic management tools providing operational guidance for both the organisation and individuals, e.g. doctors (Winblad et al. 2007).

3.2.3. Functional Environment

Municipal service production has been critized for placing too much focus on the routine production of services. The service production of municipalities should however, be better equipped to produce analysis of the operating environment, R&D, product development, service production process modelling and assessment, productization and cost accounting.

A central problem of municipal service production is presented through the numerous actors: ministeries, state regional government, municipalities and municipal federations, regional councils and Finland's Slot Machine Association (RAY), non-profit organisations, chambers of commerce, enterprises and businesses. A comprehensive guiding system and a coherent view is lacking (Melin 2007).

The disconnectedness of the structure and the funding of operations give rise to a system which lacks incentives on the organisational level. An organisation which develops and introduces new service innovations does not benefit from it, another actor does (Linden 1998).

3.2.4. Constructed Environment

Finnish hospitals and health care centres have been built according to health care process chart completion dates. They represent care practices from the 1960s, 1970s, 1980s and at the latest 1990s. This presents a problem in the implementation and introduction of new operating models.

If new models are to be implemented, it if often a better solution to construct a new environment than to continue maintaining the old. Nowadays the aim is to create hospitals which are capable of adapting to chances in the care processes (Terveysteknologian….2007).

3.2.5. Organization of Work in Health Care

A health care unit is a combination of an expert organisation and a service organisation. An expert organisation is composed of trained professionals and is very effective when successful, as expertise entails a motive for self development (Saranummi et al. 2005). Managing an expert organisation is challenging and therefore leadership and management training is being increasingly valued.

Health care organisations tend to be hierarchial and the boundaries between different professions are clearly defined. However, recently more emphasis has been given on team work in health care and projects dealing with restructuring of duties between doctors and nurses are in progress.

The health care sector in Finland includes both functional organisations, where each speciality has been organised into a separate unit and process organisations, where grouping is done around processes which produce value to the customer. Typical functional organisations in health care are university hospitals, which produce high-quality services efficiently.

Process organisations are most efficient with repetitive tasks. This necessitates a distinction between core processes and support processes, the latter of which can be standardized and defined in detail and therby also potentially out-sourced.

Functional and process driven organisation of work are not mutally exclusive and a rational inclusion of both might be the best solution (Lillrank and Parviainen 2004). This is increasingly common when health care centres and hospitals create care chains for the treatment of diabetes or cancer co-operatively.

The divison of duties between doctors and nurses is being re-evaluated in Finland. This re-evaluation stems from demands which are being placed on the health care sector, demands for increasing quality, more efficient and specialized service. In order to achive these goals, the health care sector is expected to adopt a new way of thinking and to have highly trained professional staff, especially in the university hospitals.

Duties which can be transferred from doctors to nurses include evaluations on care needs, care of mild health problems and follow-up of long-term patients and giving patient guidance.

3.2.6. Providing Services

Separate legislations for primary care and specialized medical care in Finland present a problem for the development of operations. The boundary between these two is further highlighted by the fact that municipalities have different levels of contol over them. This situation has been critisized because an individual municipality cannot influence the extent of the specialized care or the development of costs. If under economic distress, a municipality is forced to direct its saving efforts to primary care and social care, which it can control (STM 2006:56).

The cooperation between health care centres and public specialized medical care is defined by a contract management system, which is used in the making of binding agreements on the services the public needs. Financial incentives are used as its' instruments on the organisational level. If invoicing for the services a municipality has bought exceeds the amount specified in the contarct, it may be entitled to a discount based on the exceeding amount. From the local authorities' point of view, this system allows buffering from unexpected increases in specilized medical care expenses.This financial guidance may also provide a profit responsibility on the specialized medical care unit towards the municipality.

Renewal of the health care act is in progress. Its objective is to join the legislation concerning primary care and specialized medical care into one act which covers both.

3.2.7 Problems of Municipal Innovation System

In his summary on innovations and good practises in municipalities, Melin (2007) states that product development is insignificant in municipalities. It has mostly been funded by the Ministry of Social Affairs and Health (STM), Finland's Slot Machine Association (RAY) and Tekes, the Finnish Funding Agency for Technology and Innovation. Projects have often remained separate because integration with the municipal service provider has not been possible.

Melin summarises the reasons behind the disfunctionality of the innovation system as follows: 1) lack of incentives, 2) the reward system, 3) legal protection against dismissal, 4) the threat of bankruptcy, 5) prohibitive or backward legislation, 6) narrow reforms, 7) inadequate transparency in costs, 8) support systems which distort competition, 9) entertwining of service provision and political decision making structures, 10) officials' and politicians' fear of loosing power and also the fact that the increased power generated through purchaser-provider model has not received clear evidence.

3.3. Summarising Challenges of Finnish Health Care as Innovation Enviroment

The public sector provides a majority of health services and they are politically strongly controlled (Saranummi et al. 2005).

Only a handful of final reports are available from projects initiated during the national health project. It appears that not enough attention has been paid on measuring the impact and productivity.

It seems to be common in health care development projects to allocate minimal resources to the project evalution and to accomplish it within a short time-frame. The end result might be conclusions drawn from interviewing key administrative people in the unit where the project was implemented or from seminars arranged for the personnel, even if "hard" indicators for project activities would have been available fairly easily. The lack of objective evidence on efficacy and productivity does not support the dissemination of a practise even if it is good.

3.3.1. National Health Project

One of the most significant impacts of the National Health Project is that it promoted cooperation and the different actors in the health care sector worked together to achieve goals. Funded projects were expected to be functionally and regionally extensive. This is a marked chance when compared to the past, when the health care units competed with one another in the funding of often narrow developmet projects.

It must be stated that traditionally health care centres, with the expection of the largest, allocated minimal funds to R&D in their annual budgets. Preparation of the national project undoubtedly prompted the smaller health care units to seek collaboration with other partners.

One of the most important challenges of the Finnish innovation system is to promote the readiness of companies to discover and utilize the latest knowledge and technology which is produced in the best knowledge centres (Hautamäki 2008).

3.3.2. National Architecture of Information System

A data management system such as the Finnish national architecture is the first of its' kind in the world. Implementation of the national eArchives and the related ePrescription has required and will require considerable effort from the Social Insurance Institution of Finland (KELA), system providers and health care organisations due to the breadth of operations, system integration needs, data security issues and renewal and adoption of work processes and practises. In the coming years this undertaking will undoubtedly take most of the resources of the participating parners allocated for electronic data management.

The situation might paradoxically result in a decrease of productivity in the near future, when resources are no longer available for the betterment of the functionality of the systems needed at work and for the development of ergonomy.

As electronic management of patient data is becoming more common and part of the mainsteam, critical opinions concerning everyday problems in patient care have been raised in the public. Patient data is easily archived, but retrieval and fast access to relevant information, e.g. in the care of critical patients, has in some instances been slowed down.

A complex data security system has also raised concers, particularly among the doctors. Attention has been directed to the artificially created boundaries between different units and the following definition of the regional registrar. This often cuts the flow of information in the care chains between primary care and specilized medical care. Because patients are being treated by a virtual care team and the preliminary examinations and continued care of specilized medical care are carried out in primary care, the information systems should be able to support this without interphases requiring consent (Winblad et al. 2007). It has been suggested that the New Health Care Act will include definitions for the regional registrars.

The electronic patient record system has been critized for premature commerilization, resulting in product development being done whilst doing patient work, thereby compromising and slowing down care. This is particularly problematic to the hospital patient records, where integration of several separate systems is often needed (Kujansuu 2007, Lääveri 2008).

The chosen architecture and its implementation can be expected to increase patient's freedom to choose services and thereby also competition between service providers. With patient's consent, data is easily available for the service provider patient has chosen, both public and private. Patient or client participation and their role as a health service user will also be strengthened as they will have on-line access to their own data e.g. from their own home computer. The ePresciption service allows patients to buy their medicine from any pharmacists as before, but it also offers an easy tool for monitoring their own prescriptions and medications.

The continuity of innovation must be guaranteed. A new way of operating presupposes active and commited actors in the participating organisations.

3.3.3. Shortage of Effective Incentive System in Public Sector

The public sector lacks an efficient incentive system
The most substantial benefits are not gained by the organisations who were involved in the development, but other actors
The public sector is not interested in developing services due to lack of competition. Services are used whether they are good or not.
The public sector is not able to reward developers who can generate cost-effective solutions. The salary is the same whether one develops practises or not.

3.3.4. Organizational Inflexibility of the Public Service System

Public sector health care organisations are inflexible and traditional which has in practice blocked buying and selling of services from outside organisational boundaries.

Municipalities are unwilling to buy services from each other as this is thought to weaken job opportunities of their staff and thereby contributing to decreased tax revenues. Municipalities may also experience neighborhood envy and fear of supporting another municipality by given them duties that could be accomplished internally.

3.3.5. Traditional Working Practices

A deeply entrenched traditional working culture is another major barrier to the embedding of new service innovations. There is no in-built development function present in public – or private – health care service systems (vs. ICT companies).

Similar problems related to attitudes, the organisation of work and staff shortages prevent the wider use of teleconsultation in other specialities, even though the procedure has been proven functional and cost-effective. Similar factors have prevented usage in health care centres.

One might give a provocative statement: the hospital district does not expand practises because there was is demand for the service in the health care centres and health care centres do not ask for the service because it was not provided.

The hierarchical organisation of work and tight boundaries between different professions are also elements which inhibit creativity and innovativeness in health care.

3.3.6. Organization Management

The management and control of different production processes in health care is becoming increasingly challenging, particularly in complex care chains. One might ask whether a governing body which is politically elected is competent to decide on these issues.

In a municipal organisation, the same administrative unit decides on the service need and provision of service. Moreover, success of implementation is assessed by auditors, who are appointed from the same administrative unit.

The health care sector should introduce new, sophisticated management tools, which can be used to measure the effectiveness of work.

The quality and effectiveness of work are not reflected in the quantity of deliverables. Placing the main focus on the quantity of deliverables gives a fallacious picture of individual employee's and organisation's success at work.

A functional and unifying operational guiding system is missing. The result is sub-optimisation, as no one is responsible for the comprehensive view.

3.3.7. Notation

The structural framework and the hindrances of innovation activity in the health care system have been described above. Several of the portrayed problems should not be generalized to include the whole system, as determined and productive development has been achieved in many places. The Ministry of Social Affairs and Health and other administrative organisations are involved in several development projects which this report refers to. Those projects are a promising soil to further innovation activity.

4. Overall Health Policies

The Government Resolution on the Health 2015 outlines targets for Finland's national health for the next 15 years. The main focus of the resolution is on health promotion. The program is based on cooperation reaching over various sectors, which are often seen as being outside the traditional health sector, such as lifestyle, living environment, and quality of products (Finnish Government. 2002 A).

The government had also introduced the National Health Program with the aim to identify problems and challenges of the future. The main challenges include securing health services to an aging population, where the public health personnel equally face important turn-over rates due to retirement

In addition, a program to create proper care recommendations is being carried out. The aim is to improve the quality in care and to reduce the differences in customary practice. The national best practice guidelines are available to all health care professionals and the general public through the internet (www.terveysportti.fi).

4.1. Role of Information Technology in Health Care Policy

The first Finnish national strategy for applying information technology to health care focused on developing and implementing ideas that would help answer the needs for an efficient, accessible, affordable and high quality health care. It was following the initiation of an information technology development program during Prime Minister Lipponen's first term in office in 1995 (Finnish Government 1995).

This Strategy for the Utilisation of Information and Communication Technologies in Welfare and Health was first established by the Ministry of Social Affairs and Health in 1996. The strategy was built around the principle of citizen-centred, seamless service structures, based on existing social policy strategies. The main targets were the horizontal integration of social, primary, and secondary care services and the development of shared, coordinated services delivered closer to home. Citizens and patients were envisioned as informed and participative actors in the healthcare delivery process.

The utilisation of information and communication technology became an absolute necessity for the realisation seamless services. The partnership between service providers and industry was encouraged, as well as a new contract-based model between municipalities and private service providers. The updates strategy in 1998 emphasised 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 (Hämäläinen et al 2007).

The privacy protection regulation, e.g. the Personal Data Act (523/1999) sets conditions to the exchange of information (i.e. patient data) between different organizations. 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 (Hämäläinen et al 2007).

The program of Prime Minister Lipponen's second term in office (1999–2003) included the enhancement of seamless health and social care service chains (Finnish Government 1999). A decision-in-principle to fund the national ICT development was given in 2000, the aim being to promote Finland as an information technology society (Finnish Government 2000 The national Health Care for the 21st Century project strengthened the regional cooperation of different development projects (Ministry of Social Affairs and Health 2002).

The legislation on Experiments with Seamless Service Chains in Social Welfare and Health Care Services was adopted in 2000. This pilot ended in 2007 (Act 811/2000, Finnish Government 2003 A). The main focus of the legislation was to develop regional cooperation for seamless services, the continuity of care, and 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 2001 new regions were allowed to start pilot-projects in accordance to the seamless service chains legislation. These regions started building reference databases to enable true usability of patient data across organisational boundaries. (Hämäläinen et al 2005, 2007, Ohtonen 2002)

The experimental legislation on seamless service chains (811/2000) was made open to all applicants in 2004 and all hospital districts and most municipalities in the country applied and were included.

The Decision-in-Principle by the Council of State on securing the future of health care was given 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 electronic patient records and their implementation strategy.

The strategy document of the ministerial working group (Ministry of Social Affairs and Health 2003) describes the implementation of the nationwide electronic patient record system 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 (Hämäläinen et al 2007).

In 2003, a new government with Prime Minister Vanhanen was dedicated to the Decision-in-Principle by the Council of State in securing the future of health care, the main principles of which were included in the programme of the new government (Finnish Government 2003B). In addition, the government launched a new information society program. This included an e-Welfare program in order to develop ICT for social services (Sahala 2005). TEKES (the National Technology Agency of Finland) also has started a technology program that will last for five years (2004–2009) (Tekes 2005). It includes a health care development program (FinnWell).

4.2. New National Legistlation

In 2007 the legislation (Act 159/2007) on handling electronic patient information covers archive services, encryption and certification services, and the patient's access to the data. It creates a national IT Architecture for Health care and is mandatory for all health care providers by 3/2011. The over all Steering and coordination is under the responsibility of The Ministry of Social Affairs and Health. The national architecture consists of local EHRs using common data structure and techical standard, national eArchive in which all EHRs available online by patients consent, national ePrescription database, and eView for citizens comprising of access to their own patient data and log data. eArchive and the national ePrescription database are built and operated by The national Institute of Social Security. Cards for identification of professionals are provided by the National Authoritys for Medicolegal Author TEO, and nationally standardized codes and classifications are managed by the National Research and Development Centre for Welfare and Health Stakes and delivered via a code server. Data between the central organisations and health care providers is transferred via VPN/SLL secured internet.

4.3. Vision for 2015

The vision for 2015 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 (Ministry of Social Affairs and Health 2006B). It will 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. Information technology provides the best support for a productive health service system when compatible joint standards and applications are used nationwide (Hämäläinen et al 2007).

5. Development of National Health Care ICT Backbone

The Finnish national strategies towards the information society have given emphasis to the social and health care sector as one of the main targets for the past 10 + years. The Ministry of Social Affairs and Health has regularly instructed and followed the implementation of eHealth, which has been documented in regular reports (Kiviaho et al 2004, Winblad et al 2006, Hämäläinen et al 2007, and a report to be published 2008)

5.1. Deployment of the 2003, 2005 and 2007 eHealth Surveys

A 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 offering physicians services for each of the 2003, 2005, and 2007 surveys. The questionnaire comprised of 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 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 body of the questionnaire remained constant but for the 2005 and 2007 surveys some topics of the questionnaire was updated in order to take into account to the changes which had happened or were supposed to happen in the field of health care. The total number of the questions varied about 95. 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.

For each of the surveys the questionnaire was emailed between to all public service providers. That is to 21 hospital districts and all health care centres. The questionnaire was also emailed to a sample of private health care service providers. The 2005 survey included also providers of ambulance or emergency transportation services which were investigated with a specifically tailored web-based questionnaire.

5.1.1. Coverage

Responses to the questionnaire were obtained from all the hospital districts in each of the survey years (100 %, n=21). As far as health centres are concerned, in 2003 the survey covered 69 %, in 2005 71 %, and in 2007 a total of 96 % of the present 229 health care centres.. Some additional was completed by phone from the health care centres which had not responded.

Results were obtained from 44 private service providers in 2003, and 28 in 2005 and 2007 surveys representing a sample of big, medium sized and small enterprises, conglomerates with hospital and operative services, to small part-time general practices. Because the private providers are a heterogeneous group, the results concerning them can only be regarded as indicative.
The 2005 covered 62 % of the 227 ambulance service providers which were found of the register available.

5.2. Results of the surveys

5.2.1. Infrastructure on Local Level: from papers to electronic documentation

In *specialised public health care* EPR was in 2005 in use in all but one of the 21 hospital districts, and according to our preliminary results EPR was used in 2007 in all of the hospital districts (Figure 1). Compared to the data from the 2003 survey in which the coverage was 62 %, there is a very strong progress in the coverage during the last four years. Because of the complexity of secondary care (hospital) medical records, the coverage aspect is an important indicator of EPR penetration.

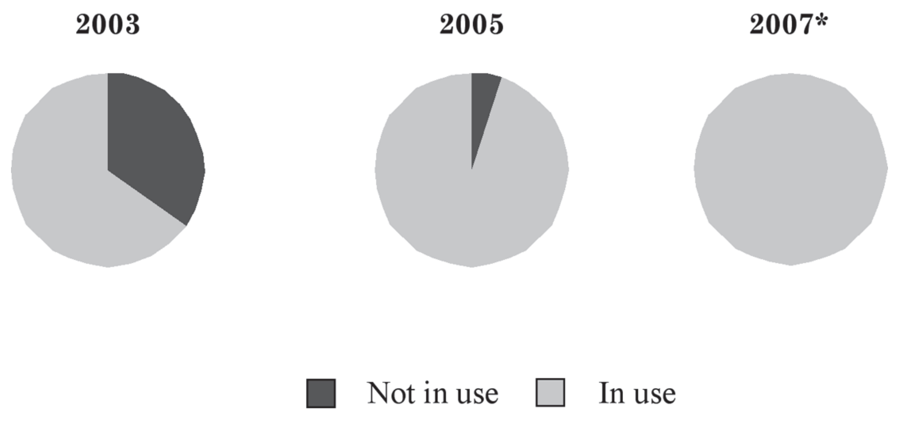


Figure 1. Progress of the coverage of EPR in hospital districts. * STAKES 2008

In *primary health care centres* EPR seemed to be in use practically in all health care centres in 2007. The coverage was on the same high level already in 2005 (95,6%) and even in 2003 (94%) (Figure 2).

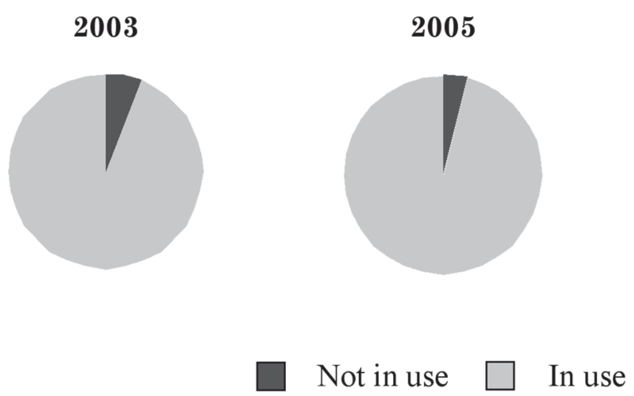


Figure 2. Progress of the coverage of EPR in health centres. * STAKES 2008

The results of the use of EPR in public health care refer to the fact that the coverage is near saturation point. It is worth of noting that the intensity of the use has increased high both in primary health care and even in all special departments of hospitals. This means that today, documentation of patient data in the Finnish health system is being realised by electronic means. For health care centres the transition from paper-based to electronic records has happened in the late 1990's, and for hospitals about six years ago. The intensity of the usage of EPR has developed strongly. The paper-based records presently serve mainly as an archive of historical data

Among the samples private health care providers of the surveys, the coverage of EPR was 100 % in 2007, and on the level of about 80 - 90 % in 2003 and 2007

5.2.2. Infrastructure on Regional Level: from letters to electronic data exchange

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. The high rate of utilisation of the EPR has made information exchange between institutions feasible.

In terms of collaboration between primary and specialized health care a very frequent patient information exchange concerns referral letters. The *e-Referral letter* signifies a course of action by which the referring physician, usually a general practitioner, draws up an electronic 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 provide a letter showing the treatment, and to give feedback through a discharge letter.

In spite of a couple of the 21 hospital districts, all could accept referral letters from primary health care in 2007 (preliminary data) whereas in 2005 that concerned three thirds and in 2003 less than a half of the hospital districts (Figure 3).

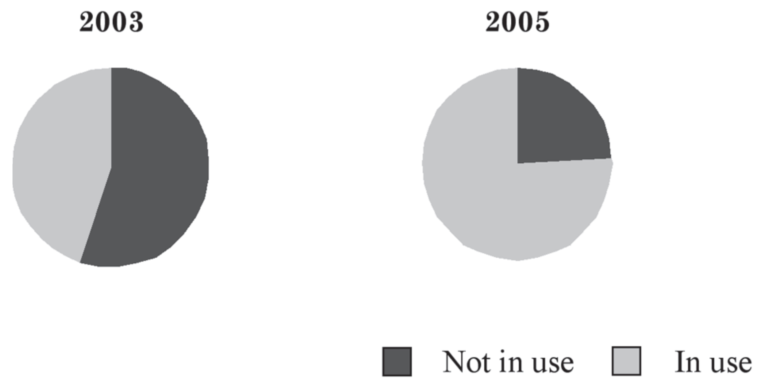


Figure 3. Progress of the coverage of accepting referral letters in hospitals. * STAKES 2008

Presently, more than three thirds of health care centres seem to use eReferrals and accept eDischarge letters, which points out a significant progress during the last four years: in 2003 the corresponding figure was 24 % and in 2005 44 % of the health care centres (Figure 4).

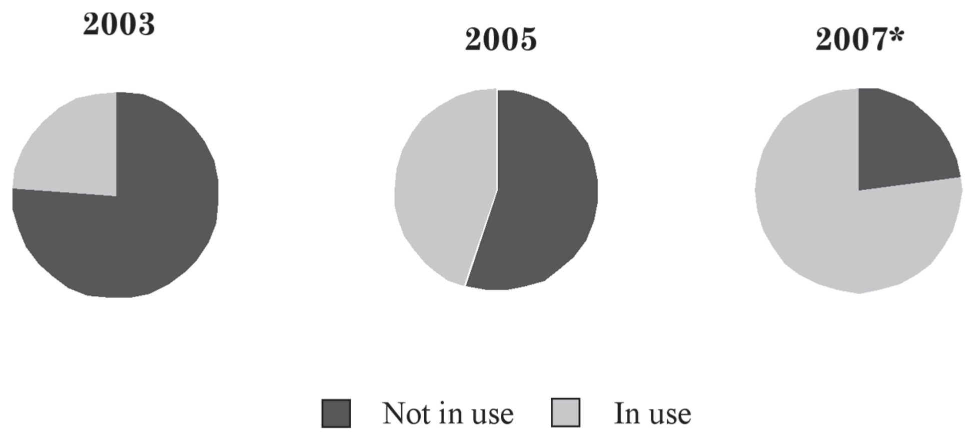


Figure 4. Progress of the coverage of the usage of referral letters in health centres. *STAKES 2008

It is worth of noting that further analyses have shown that the coverage of the use of eReferrals started to rise first at the remote sites of the country, which can be regarded as a purposeful order.
We can find that this interorganisational data exchange has increased rapidly in Finland. 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.

The *consultation letter* signifies a course 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 specialised care than the conventional referral. This is because it exploits the functionalities of electronic information exchange better e.g. flexible negotiations between the physicians before decision making.

Electronic consultation was provided by about half of the 21 hospital districts in 2005 and the proportion seems to be similar also in 2007. As far as health care centres are concerned, the mode of action is seems to become more common: presently over a half of them are using, whereas two years ago only a third.

Use of Teleradiology and Telelaboratory

Along with referral and discharge letters the exchange of imaging and laboratory results without delays is very important for a fluent collaboration between primary and specialized health care.

Teleradiology has been one of the first applications of telemedicine in Finland. The first experiments were made already in 1969 (Reponen 2006) and real implementation started at the beginning of the 1990's. In 1994 all the five university hospitals had teleradiology services (Reponen 1996). The regular service started in the sparsely populated northern areas, but has then spread all around the country.

The boarder line between teleradiology and image distribution through a regional archive is gradually vanishing with certain services. In the current surveys, 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 contains also images.
The combined results are presented here. Four fifths of the hospital districts maintained in 2007 teleradiology services whereas so did about 60 % and 70 % in 2003 and 2005, respectively (Figure 5).

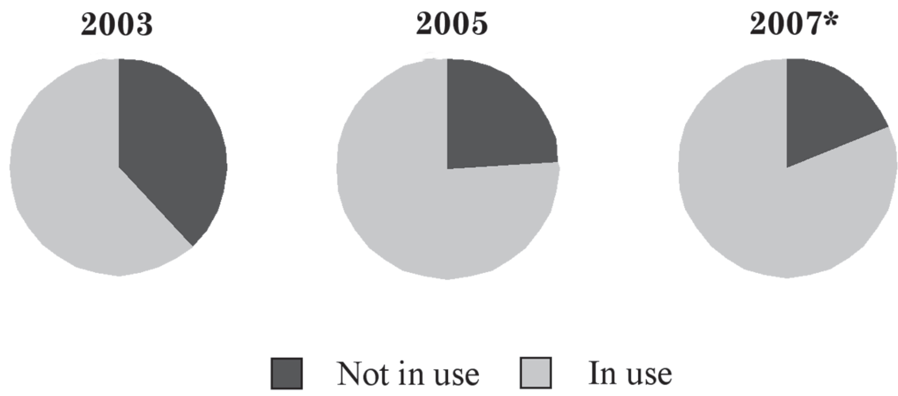


Figure 5. Progress of the coverage of the use of teleradiology in hospital districts. *STAKES 2008

In the primary health care the use of teleradiology has rapidly became more common during the recent four years: in 2003 it covered about 10 %, and in 2005 about 30 %, but in 2007 more than a half of health care centres (Figure 6).

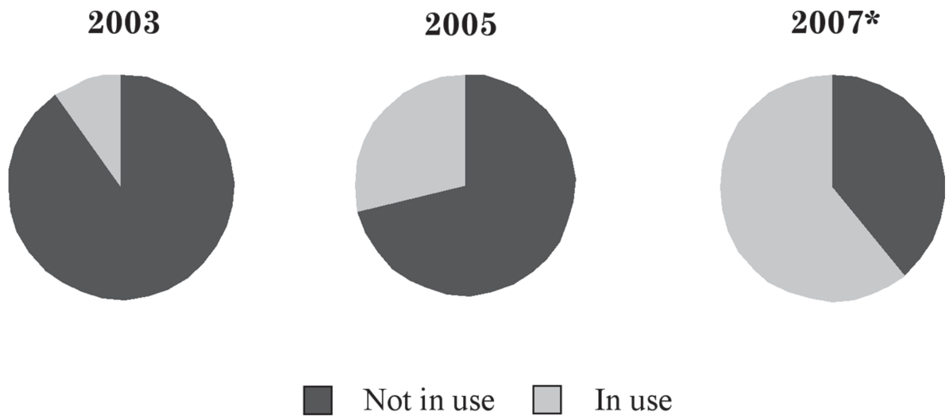


Figure 6. Progress of the coverage of the use of teleradiology in health care centres. *STAKES 2008

The results show that the use of teleradiology has increased, but at the same time new regional image archives are taking over the role of previous teleradiology applications for consultations between primary and secondary care. Only time will tell if traditional teleradiology will find new applications in e.g. the redistribution of the excess radiology workload.

For *telelaboratory* services, there are also different methods to deliver the results. Here are presented the combined results. The combined results refer that 90% of the hospital districts had some method for the electronic distribution of laboratory results in 2007 and 2005. The figures had strongly from the year 2003 (Figure xx).

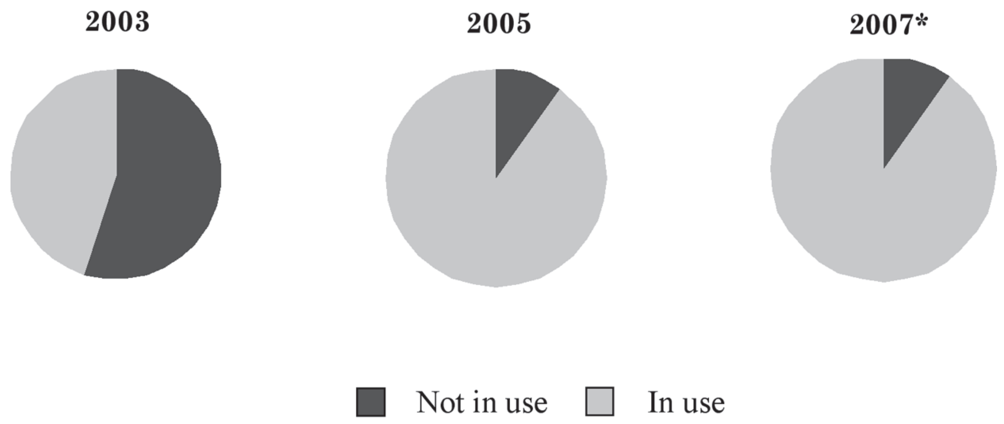


Figure 7. Progress of the coverage of the use of telelaboratory in hospital districts. *STAKES 2008

In the primary health care sector, almost three fourths of health centres used telelaboratory services in 2007 The coverage had increased since 2003 when it was 38 % and further since 2005 when it was 64 % (Figure 8). Further analysis has shown that those dealing with primary care will accept new services like receiving telelaboratory data as soon as the hospital districts can provide it.

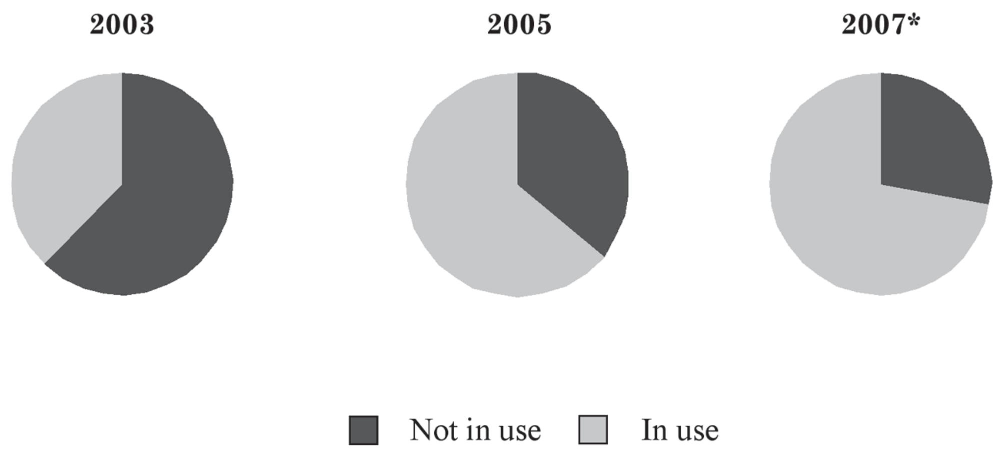


Figure 8. Progress of the coverage of the use of telelaboratory in health care centres. *STAKES 2008

5.2.3. Infrastructure on National Level: from hierarchies to seamless information flow

Acoording to the decision of the Government for the reasons dealing with the practicality and economy, the structure of information management will be at least partly organized on the national level. This has been manifested as e National IT Architecture for Health care which can be regarded as a unique solution also from an international point of view. It is based on legislation and is mandatory by/2011 for all public health care providers, and also for those private services providers who use electronic documentation of patient data.

The over all steering and coordination is under the responsibility of The Ministry of Social Affairs and Health. The national architecture consists of local EHRs using common data structure and technical standards, and a national eArchive in which all EHRs are available online with patient consent, a national ePrescription database, and an eView for citizens comprising of access to their own patient data and log data.
It includes (Figure 9):
* 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 Medicolegal Author TEO
* Nationally standardized codes and classifications are managed by Stakes and delivered via a code server
* Data between the central organisations and health care providers is transferred via VPN/SLL secured internet
* Decision support systems and management applications will be included

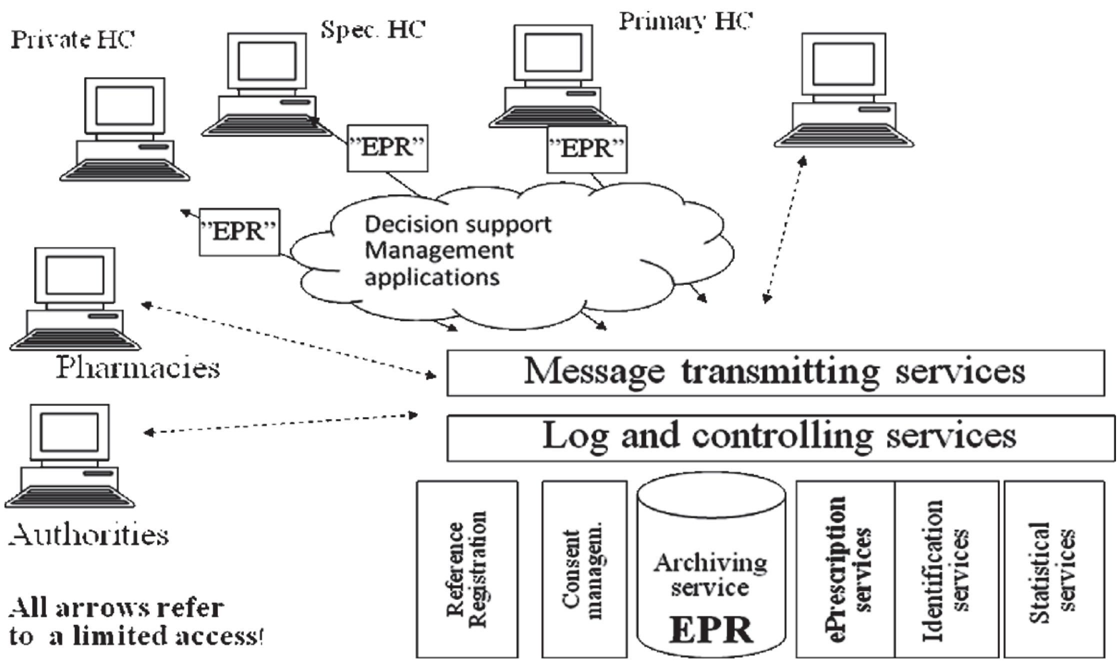


Figure 9. Functional scheme on the most important elements of the national eArchive

One prerequisite for the national solution is the standardized core data structures of EPR. It has been taken into use and it promotes continuity of care, clinical decision support, scientific research, quality assessment, and to build modern information management systems for administration and statistics. Last but not least it promotes citizens access to browse her/his own EPR everytime and everywhere

5.2.4. Direct services to Citizens

The information systems and applications presented earlier are those for the use of professionals and between professionals of health care. They form also the backbone for direct eHealth services for citizens. All service providers maintain informing web sites, but most of other direct services (as question-answer sites, direct order of an appointment on through a web site, ability of a service provider to offer of an appointment, electronic forms to be fullfilled by patients to transfer health related information to health care professionals, use of e-mail or SMS messaging for different kind of information exchange) are presently at designing, piloting or early implementing stages.

Figure 10 shows the preliminary data of the 2007 survey. Compared with the results of the earlier surveys, offering direct services are becoming more common, but the coverage among hospitals and health centres is still rather low: from only some percents to about 40 %. As far as the sampling of the private service providers are concerned, the direct services were a little bit more common than at the public sector-

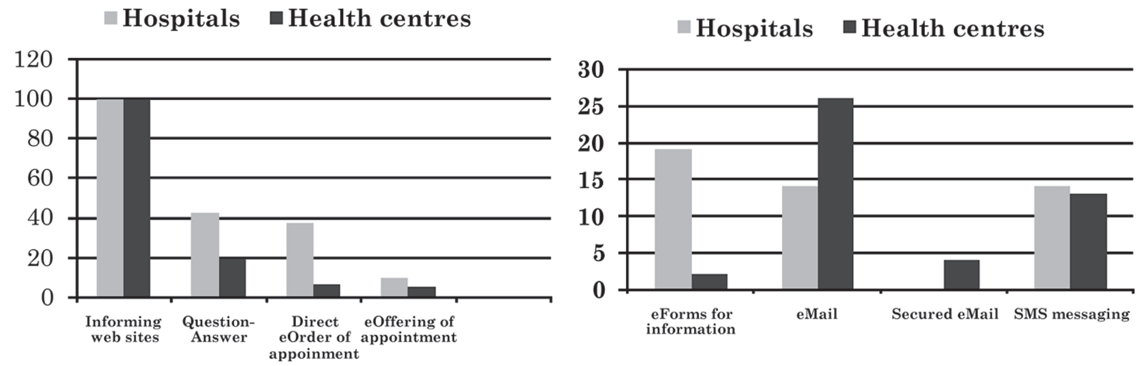


Figure 10. Proportions of hospitals and health centres providing direct eServices for citizens. Preliminary data from the 2007 survey.

In Finland, there are ongoing projects for developing and testing versatile direct eHealth services for citizens. Among them the most advanced is the Self-Care project of Oulu, which has this year started to offer services for citizens. The basics of the project have been presented briefly in the following:
For the project there has been developed a service platform which will promote customer health behaviour and provide new service processes in health care (Figure 11)

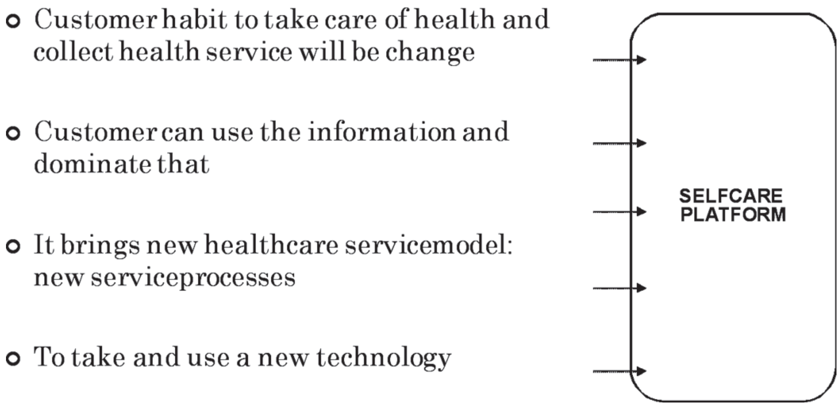


Figure 11. Basic issues of the Self-Care project of Oulu (source: Hirvasniemi 2008)

Functional scheme of the project is presented in the Figure 12. It is noteworthy that the service is available for information exchange not only for the public primary and specialized service providers but also for private providers thus combining their resources Patient initiated information is also incorporated.

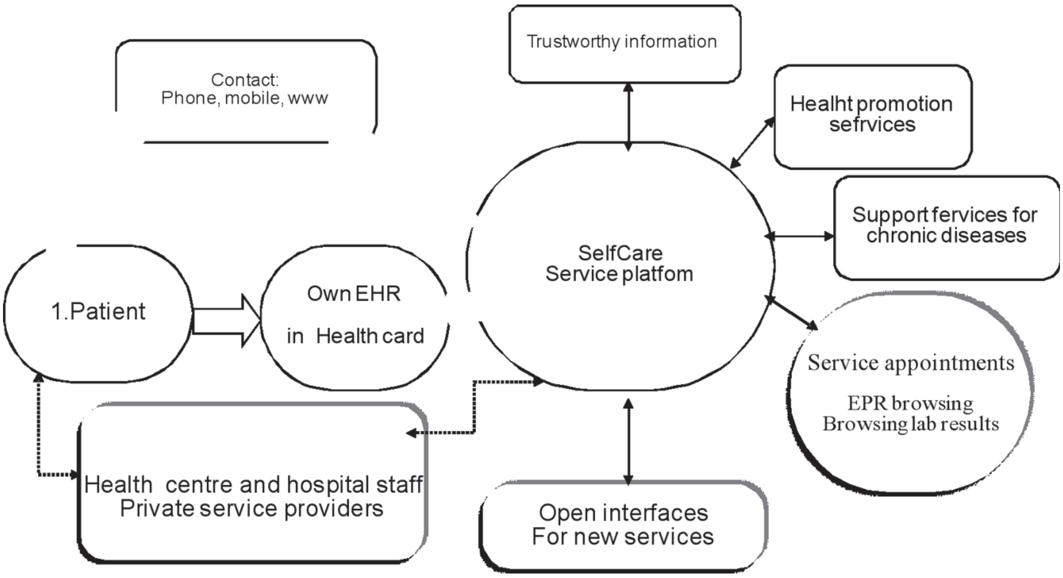


Figure 12. Functional scheme on the basic elements of the Self-Care program of Oulu (Source: Hynninen and Niska 2008)

Figure 13 shows an example of a view which the citizen sees on her/his monitor.

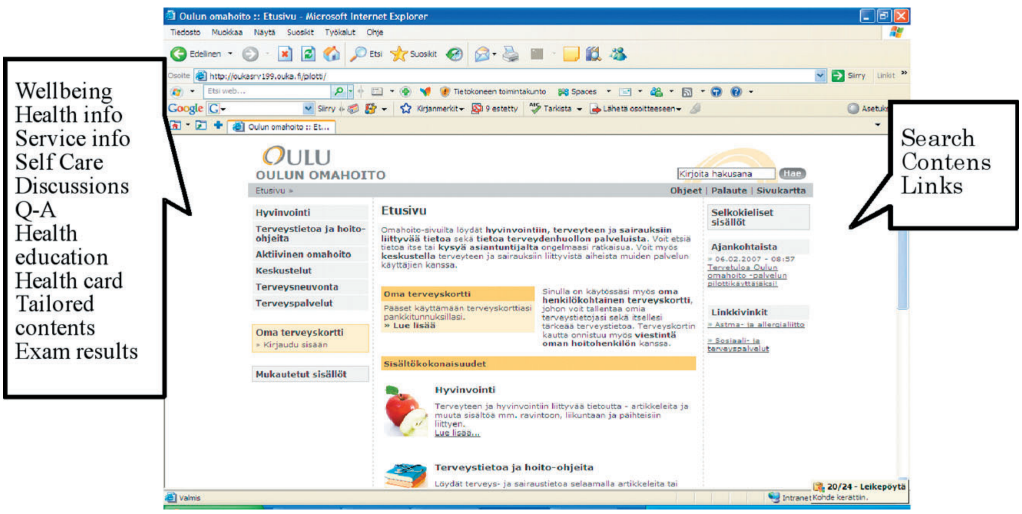


Figure 13. Example of citizen's view on the Self-Care service

In the Self-Care project there has been incorporated a controlled study covering the users and effect of the service on health behaviour, health, use of services, and work processes.

5.3. Use of Information Technology among Ambulance Service Providers

The 2005 survey included, as mentioned earlier, also ambulance service providers. The basic results have been briefly referred in the following:

The main finding was that in the ambulances there were the preparedness for patient data transmission during transportation but the preparedness among hospitals and health care centers to receive the information was low: 89 % of the ambulances can transfer digital ECGs, but a minority had preparedness for data exchange for other purposes. On the other side: only 33 % of the central hospitals and 27 % of the health centres has preparedness for receiving telemetric ECGs (Winblad et al 2006).

There was also found that only 21 % of the ambulance service providers regarded collaboration with hospitals and health centres in planning, implementing and usage of ICT as sufficient, and the corresponding figure for education and training of ICT was 14 %.

The figures call for more collaboration with ambulance service providers and hospitals and health centres on planning, implementing and using of ICT in emergency care, and in the education concerned.

5.4. CASE: Northern Ostrobothnian Hospital District

One of the early adopters of ICT in service delivery has been the Northern Ostrobothnia Hospital District (NOHD): Its main hospital is the Oulu University Hospital, which is the northernmost tertiary hospital in Finland. Its responsibility area is the largest in the country, covering nearly half of the Finnish territory, also including the arctic regions. Because of vast distances and a sparse population, Oulu has been a forerunner in developing telemedicine and eHealth services in the country. The development started in 1990 and has resulted in the establishment of teleradiology and televideoconferencing services, distance education and a multimedia medical record with remote access capabilities. Wireless technology has been a special focus area, as has the development of an efficient communication between primary care and secondary care (Reponen 2004).

Electronic patient record as an eHealth platform

Oulu University Hospital started a web-based multimedia medical record project in 1995. One purpose of this development was the creation of regional eHealth services. Currently, the system, called ESKO, is used in all of the departments with over 250000 registered patient folders. The information can be retrieved via web-browsers and even with mobile communicator devices. The patient record is a virtual record retrieved from various hospital databases according to the users‘ requests. The system is technically divided into three layers: 1) user interfaces using a standard www-browser, 2) a middleware taking care of the query/retrieval processes, and 3) modular databases.

Currently, the multimedia content of the medical record combines narrative texts, laboratory results, radiological information system (RIS) information, scanned graphics and DICOM format radiological images, such as computed tomography (CT) and computerised radiology (CR), and ultrasound (US) and magnetic resonance imaging (MRI) scans. Together with a structured nursing care record system, there are over 3000 professional users. With the system provided, users are able to use a familiar interface, the web-based electronic patient record (EPR), to display almost all of the clinical data they need in the university hospital environment. Current developments include installations in three other central hospitals in Finland and secure connections to remote primary health-care centres for teleconsultations and electronic referrals.

Electronic communication between primary and secondary care

Today, all the primary health-care centres in Northern Finland are equipped with fully operational, paperless, electronic patient records. This means that electronic referrals and discharge letters are key tools in sharing multidisciplinary patient information between primary and secondary care. In order to be effective in a major health-care service network, e-referrals should be connected to local electronic patient record systems and patient databases. In 1999, the first e-referral services between electronic patient record (EPR) systems at the university hospital and primary care centres in the region were started. This supplements the current network of e-consultation tools, such as teleradiology, videoconsultation services in surgery and psychiatry, and elearning opportunities for professionals. According to users, electronic consultation is a major modification in the patient care process and has required a careful roll-out process.

From local to mobile: teleradiology

Our first teleradiology services were started in 1990/1991 using fixed line connections between primary and secondary care institutions. By 1996 all the hospital in our responsibility area were connected to the university hospital via DICOM standard compatible links. The services include emergency coverage, secondary opinion and transfer of patient data in case of hospital transfers. In 1995, the first feasibility studies were made with a digital GSM (Global System Mobile) phone and a laptop computer system which was built into a suitcase and weighed 3 kilograms. Finally in 1997 the first smartphone application weighing only 300 grams was brought into use. In the MOMEDA project funded by EU, the first wireless terminal in a mobile phone was taken into clinical use by our neurosurgeons.

6. Product and Service Innovations of Finnish Companies within the eHealth Sector

In research and development of technology, Finland has clearly specialized in information and communication technology. The industry grew rapidly in Finland in the 1990s, but the growth rate has subsided in the beginning of the 21st century. The importance of the information and communication technology in production, however, has not dimished and has stabilized to fairly high level.

Information and communicatiosn technology is also extensively utilized elsewhere in Finland. A majority of people have mobile phones, computers and internet access and broadband coverage has increased rapidly in the 21st century (table 1). A survey concerning internet shopping was conducted in the spring of 2004 and it revealed that 70% of people between 15-74 years old had used internet in the previous 3 months (1). At home, internet is most frequently used for e-mail and finding product information and internet shopping is growing rapidly. In the spring of 2004, over 20 % of Finns between the ages of 15-74 had at some point purchased goods over the internet.

The frequency of home and work use of the Internet is linked. Active computer users at work are also active home users. 54 % of those people who use a computer at work daily or weekly also use a computer at home daily (1).

Table 1. Prevalence of ICT equipment and applications at Finnish households (Source: Statistic Finland, 2007)

Mobile phone	98 %
Personal computer	75 %
Internet	70 %
Broadband	62 %
Digital TV	78 %

The use of ICT is very high in companies. Internet is generally being used for banking and handling of finances and for obtaining information from the authorities. Homepages are used for the marketing of products and services, for conveying information and for actual eCommerce (2). In the spring of 2004, 94 % of companies employing more than 5 people had internet access, 62 % had their own home pages and 17 % were involved in eCommerce (2). The use of ICT was very high in large companies. In the spring of 2004, 90% companies employing more than 50 people had internet access, over 90% had their own home pages and over 20% was doing eCommerce (2). A comparison between EU countries, including Norway, shows that intranet and internet were more common in Finnish companies than in most of the EU countries (3). In the Danish and Swedish companies internet was as common as in the Finnish companies.

The information industry is a significant employer. In the 1990s, the demand for employees grew mostly in the product production, but service provision and content production have become the most prominent employers in recent years (4). In the beginning of the 21st century, the information sector employed around 7 % of the Finnish working force (4).

6.1. ICT in Health Care

Successful production of innovations is a success factor for companies and the society. Innovation activity in the Finnish health care in the 21st century has moved from the development of goods and products to the development of services and content. Electronic data transfer between public service organisations is commonly used in the health care sector (5) and to some extent between public and private sector organisations. Electronic patient record creates a platform for the integration of other health care services. The basic ICT skills of employees in the health care sector are good and 90-100 % of the staff who handle patient information master those skills (5). However, eHealth services for the citizens are still currently being developed.

Wellbeing technology is human centred technology. It aims to sustain or improve the quality of life, wellbeing or health through technology or technical solutions. Wellbeing technology utilizes an inter-disciplinary approach and includes medicine, nursing science, rehabilitation and several technical disciplines, such as electronics, materials technology, automation and production engineering. Wellbeing technology includes technology associated with disease prevention, diagnostics and care- and follow-up systems. In Finland, the main focus has been placed on medical devices, health care information systems, wireless technology in hospitals and care institutions, biomaterials and tissue-technology. Software and services associated with the maintenance of health enable and support active health promotion of the citizens. Technology innovations offer support for the senior citizens and facilitate independent living at home or in home-like environments for longer periods of time. (6)

6.2. Demand for Wellbeing Products

The demand for wellbeing products and services will rise in the future as the general population ages, the standard of living rises and technology develops. Wellbeing technology is a fast growing industry which creates new and challenging career opportunities demanding skills and educated people. There are around 100 healthcare technology companies in the Uudenmaa district (Southern Finland) alone and their turnover is around 3 billion euros. Most Finnish wellbeing technology companies are small and medium enterprises and their internationalisation is challenging. The world market for the health care sector is extremely large, over 200 billion euros annually, but they are very difficult to penetrate. Tailored wellbeing technology solutions for the elderly are of particular international interest. Population is aging in Asia as well as in Europe and this creates global interest for the Finnish wellbeing innovations (7).

Hannu Ahjopalo, the chairman of the steering group of FinnWell, a Wellbeing technology programme of TEKES, the Finnish Funding Agency for Technology and Innovation, announced in the 2005 annual seminar that Finland has an internationally superior operational model which allows for close cooperation between industry, research institutions and the health care service system. Resources should be allocated to research and development also in the future. In order to produce a functional prototype for commercial success, approximately 5 years and 50 million euros are needed. Therefore small and medium enterprises need public funding for R&D. This investment is returned via new jobs, growing profits and as cost-effective wellbeing services for the society.

The most significant funding sources for the R&D of national wellbeing technology are Tekes and the Academy of Finland. The FinnWell 2004-2009 programme of Tekes aims to improve the quality and productivity of health care and to promote entrepreneurship and exports. The central idea of the programme is that technology improves the quality and productivity of health and care services while new ways of working are being developed. The programme budget is 150 million euros and Tekes covers half and the other half is by the participants.

6.3. Products and Services of Finnish Health Care ICT Companies

In the summer of 2008 FinnTelemedicum mapped the provision of eHealth services among Finnish ICT companies. The survey was done using a web-based form questionnaire. The form was sent by e-mail to 91 companies and the form was re-mailed twice. Altogether 36 companies (40%) replied. One company wanted to remain anonymous, other have given their consent to publish their names. The survey produced a description of 52 products/services. Information was also included for 17 companies using the information available on their web pages. The names of all companies who replied to the questionnaire and their product/service concepts have been gathered in table 2.

Table 2. Product / Service Descriptions

	Company	Contact	Product/service description)
1	Addoz Oy	www.addoz.com	This innovation by Addoz is the first system in the world to integrate the doctor, chemist, health care services and relatives together with patient care. This will significantly improve the quality of health care and cut costs at the same time. Medication alert system When connected to a health care alarm system, Med-O-Wheel Smart can send a forgotten dose alert to the desired address, for example home care nurses or user's relatives, who can then contact or visit the patient to ensure medication. A health care alarm system is an easy and cost-effective way to complement medication management in communities and improve the patient's sense of security. Med-O-Wheel Smart is compatible with almost all health care alarm systems on the market. Initialization is arranged together with companies providing health care alarm services. Mobile phone system When connected to a mobile phone network, Med-O-Wheel Smart is capable of making a reminder call to the patient and/or sending a message to the desired address regarding a forgotten dose. As a result, Med-O-Wheel Smart is not geographically restricted and safe medication can be carried out anywhere. All dosage information and timing data will be stored in dispenser memory and relayed daily to the server. This information can then be used later when planning patient care. Doctors can depend on the medication data and make a more exact diagnosis. Unnecessary laboratory tests are eliminated, as the report indicates the exact level of medication.
2	Agfa HealthCare Finland Oy Ab	www.agfa.com	A leading provider of integrated IT solutions and state-of-the-art diagnostic imaging for hospitals and other healthcare centers
3	A-klinikkasäätiö	www.paihdelinkki.fi	AddictionLink is for all those interested or concerned about alcohol consumption, drug abuse and the various other issues connected to addiction. This site is intended for experts, substance abusers, their families and friends, and anyone who wants to learn more. The goal is to give the visitor high standard objective information and support on substances and addictions in an anonymous way. Within AddictionLink you can read up on the latest topics within the addiction scene and test your situation with self assessment tests and self-help tools. Our Info bank contains short articles divided to six different categories: general information, alcohol, drugs, nicotine, behavioral addictions and services.
4	A-klinikkasäätiö / A-Clinic Foundation, Avec-verkosto / Avec network	www.apua.info	Finnish NGO´s have established a common internet service, Apua.info (apua = help), for early intervention and crisis support. Apua.info is targeted to general public. Specificly produced versatile, reliable help and information are offered in themes of mental health, family, children, parenthood, relationships, substances and addictions, and domestic violence. Over 700 articles, tools for estimating one´s own situation, conversations of specific themes and personal councelling have realistic but at the same time positive approach. In Apua.info people are not obligated to diagnose themselves before they can find

			suitable professional service to turn to. A vague, bad feeling is enough to find support. Apua.info combines services that are related to each other, to one easy to reach source. For its members, Apua.info offers a continuum of mutual learning, beside opportunities for developing, co-ordinating, co-operating and sharing tasks in a sensible way.
5	ArctiCare Technologies Oy	www.arcticare.com	ArctiCare is easy-to-use Internet based wireless solution, which creates safety and feeling of security. It consists of easy video call connection, room specific positioning, intelligent alert functions and efficient communication tools. ArctiCare acts as platform for Health service, which can be utilised by professionals in social and health service as well as by relatives and nursing personnel.
6	Audio Riders Oy	www.audioriders.fi	Soundvitamins is a Finnish innovation for recreational and rehabilitative age care. The concept consists of software, a vast archive of music and audio programs, and hardware, i.e. a user-friendly panel and intelligent loudspeaker. The loudspeaker is connected to the LAN / Internet for the easy updating of new audio content from Audio Riders' / a local partner's server. New audio content and care processes are continuously being developed according to the feedback given by the customers, i.e. both carers and residents. The results on research projects show the Silver Bird improves the physical, mental and social abilities of the elderly. The staff needs less time for the implementation of high-quality customized care. As the residents' functional capabilities are improved due to the sessions, daily care is less resource demanding. Also the linguistic and cultural customization of the service can be achieved.
7	Avain Technologies Oy	www.avaintec.com	X-Archive is a digital archive product for long time archiving. It is based on open international software standards and it supports archive management in organizations based on Finnish archive legislation (831/1994). X-Archive can also be used as a centralized regional digital archive. Integrations to information systems can be implemented using open interfaces or integration platform.
8	Avain Technologies Oy	www.avaintec.com	X-Digital Signature Suite provides digital signature and non-repudiation technologies. The product can be installed as a centralized service to be used by several information systems and organizations. X-Digital Signature Suite provides the following non-repudiation technologies: 1. PKI signature in World Wide Web Consortium's (W3C) standard XMLDSIG format, using smart cards, soft certificates, USB tokens, or other on-workstation certificate. 2. System signing: standard PKI signatures created server-side, using a certificate issued to the server. 3. Time stamping: providing proof that the data existed in a specific form at a certain time by signing it with a system certificate. 4. Signature validation: verifying the integrity of signed data and the status of the certificate used to sign it, including checking revocation lists, time span, and certificate signature. 5. PKI signatures using certificates stored on cellular phones. 6. TUPAS Bank Signatures: ensuring the non-repudiation and integrity of data by exchanging numerical keys with a bank at the time of signature.
9	Avain Technologies Oy	www.avaintec.com	X-Web Form Manager product makes it possible to

			gather information with World Wide Web forms and process it through a customizable workflow, where each phase of the flow can be secured with digital signatures. With X-Web Form Manager you can implement information secure questionnaires between a patient and a doctor, CDA forms of patient record systems and all other electronic forms.
10	Beneway Oy	www.beneway.fi	Wellou.fi is a comprehensive teaching package that joins new technology with old tried-and-true- methods. Thanks to Wellou, teaching of proper nutrition, exercise and rest becomes easy and efficient. Wellou offers both teachers an extensive Internet based service and for children an own learning environment divided according to various age groups. In addition, there is information for the childrens' parents, too.
11	Biohit Oyj	www.biohit.com	Biohit Service Laboratory offers quality determinations of Biohit assays as well as some other determinations for patient health care diagnostics.
12	Biohit Oyj	www.biohit.com	diagnistic tests
13	Citec Information Oy Ab	www.citec.fi/	Citec Information provides services and solutions in the field of technical communication for customers representing various industries (e.g. Life Sciences and Telecom). In the Life Sciences segment our customers represent medical device and pharmaceutical industries. We produce manuals, e.g. user instructions, marketing and training materials, animations and translation services. We also provide consultation services; information analyses and development of documentation systems. See our website for further information.
14	Commit; Oy	www.commit.fi	Mammography information system
15	Commit; Oy	www.commit.fi	Radiology Information Sysytem
16	Coronaria Hoitoketju	www.hoitoketju.fi	Remote health care service with internet connection between the doctor and patient/ nurse utilising the electronic patient record of the health service provider
17	Coronaria Impact Oy	www.coronaria.fi	Web-based system for analysing and reporting the effectiveness of treatment and rehabilitation. Can be used with SMS, too.
18	eHIT Oy	www.ehit.fi	Mobile phone based system for self care Mostly indicated to patient with chronic disease, the eHealthMonitor wirelessly collects information from self care measuring devices like glucometers, blood pressure meters, PEF meters, etc., to the mobile device and forwards them to the Information System of the health care service provider. This ensures that measurement results are available, accurate and both cost and time effective. The patient can also follow his/her progress in the therapy directly from the display of the mobile device. The bidirectional connection guarantees a faster patient treatment process as the patient can receive a feedback almost immediately. The system is also capable of generating automatic alarms according to predefined algorithms. These alarms can be addressed to the health care professionals as well as to the patient or his/her relatives.
19	eHIT Oy	www.ehit.fi	Health Gateway system The Health Gateway is an effective and secure system to wirelessly transfer data from different measurement devices to the health care service provider via a mobile platform, ensuring that measurement results are available, accurate and both cost and time effective. The system consists of a

			mobile platform, which collects the information from the measuring devices, and a server platform, which receives the collected data and forwards them to the existing Information System. The mobile platform can be used on different devices such as mobile phones, smart phones and Personal Digital Assistants (PDA).
20	eHIT Oy	www.ehit.fi	Home nursing support This smart phone based system is designed to support care personnel in assisting home patients. It represents a mobile extension to care management and coordination systems. The nurse receives the daily schedule on the smart phone from the service centre. This includes a detailed list for each patient explaining all the tasks to be accomplished. The smart phone also automatically collects the data form the measurement devices. Information on the tasks performed together with the measured values are sent in real time back to the service centre. The system can handle multimedia contents such as photographs (for instance of patient's wound) and voice recordings (for instance a voice message to the doctor), which are also automatically transmitted back to the service centre.
21	eHIT Oy	www.ehit.fi	Patient monitoring eHIT's Patient Care Device (PCD) Gateway is an integration platform to be used inside hospitals to collect observation data from various patient care devices and to forward them to the hospital information system. A typical application is the operating theatre, where clinical observation devices used in monitoring anaesthesia and surgery operations collect valuable data, which need to be integrated into the clinical information system. The architecture of Health Gateway PCD connector enables both LAN and serial communication interfaces to support a broad range of clinical observation devices, other ICU equipment and POC devices and providing a complete picture of key information.
22	Entteri Professional Software Oy	www.entteri.fi	E-booking service: customers books appointments through internet. Health care professionals use the service to book appointments and to administrate internet bookings (which times can be booked through internet etc.)
23	Entteri Professional Software Oy	www.entteri.fi	E-anamnesis service: customers fills an easy-to-use form in internet before visiting a doctor. The doctor sees the input immediately in his/her own computer.
24	Etelä-Pohjanmaan Terveysteknologian Kehittämiskeskus ry (EPTEK)	www.eptek.fi	Our main area is healthcare technology. We make EU-project are develop this area. We have done several projects in Videoconferencing and elderly care area in healthcare and offer different kind of education in these area too.
25	Fudeco Oy	www.fudeco.com/mobilecalories	MobileCalories is an aid device for you to use in your mobile phone, always at hand, helping you to define and reach your ideal weight.
26	FWBC Finland Oy	www.fwbc.fi	FWBC is the Wellbeing Center Concept for the older persons. The center serves seamless and versatile services and bases on the Finnish care concept, Finnish welfare technology and architecture.
27	Goodit Oy	www.goodit.fi	Mobile information systems for healthcare.
28	Intensium Oy	www.intensium.com	Intensium CFM (Intensium® Care Flow Manager) helps the user to map and model the care processes step by step. For every step healthcare provider can define default orders and care, task and check lists,

			costs/resource utilization and criteria for quality and outcomes.
29	Intensium Oy	www.intensium.com	Care flow manager -solution
30	Kustannus Oy Duodecim	www.duodecim.fi	Publishing
31	L-Force Oy	www.lforce.fi	Radiological Information System RADU
32	LifeIT Oyj	www.lifeit.com	LifeIT is a specialist consultancy and development company that focuses on developing IT applications for use in health care and telemedicine.
33	Mawell Care Oy	www.mawellcare.com	Mobile eye screening service and consulation platform.
34	Mawell Care Oy	www.mawellcare.com	Health counselling, care need assessment, appointment scheduling, disease management support via contact center phone service and internet consultation. Service is supported by Mawell S7 self care IT platform, where people can have services via net application. They can read content, consult professionals, make appointment scheduling, download own measurement data, see lab results and advices related --> Individual health record platform.
35	Medanets Oy	www.medanets.com	Medanets Oy's product is a Medanets system with which nursing staff can record, save, and browse the results of patient measurements. Measurement data are transferred into the information system via a wireless network, either automatically or with one entry. The information is immediately available to all system users. Medanets system allows nurses to use their time more efficiently, since they no longer need to first record information on paper and then enter it into an electronic system. Time is freed for actual nursing work. As the number of recordings decreases, the possibilities of making errors also diminish. Because less time is spent doing routine tasks, the quality of nursing goes up and the nurses' work becomes more meaningful.
36	Medixine Oy	www.medixine.com	The Medixine Scheduling is an e-booking system that brings cost-efficiency and flexibility into scheduling appointments. The patients are able to book appointments via internet 24 hours/day and receive automatic SMS reminders one day before their visit. Using the system health care providers can plan their activity more efficiently and offer a uniform quality of care. The software is scalable, designed for easy operation and provided with a customized user interface. Medixine Scheduling is available in three versions: Resource booking is ideal for GP practices, Laboratory Booking has been optimized for large scale central laboratories and Regional booking integrates all service providers in a region into one efficient and scalable e-booking environment. Benefits For patients: - Booking and cancelling of appointments– anywhere and anytime on the web - No need for queuing on the phone or at the practice - Program is easy-to-use and includes clear instructions throughout - Receipt of a SMS reminder the day before the appointment For practices: - Ability to plan the activity and use of resources more effectively - Freed time for other tasks than booking administration - A uniform quality of service – larger practices can steer and use their resources more accurately according to patient demand, on e.g. rush hours - Smooth operation – patient queues can be

			shortened - Less stress and increased working satisfaction - Less 'no-shows' by patients
37	Medixine Oy	www.medixine.com	The Medixine Clinic Monitor solution enhances independent management and control of the patient's disease. Pertinent information such as diagnoses or medication can be stored in the system. Every patient is registered in a flexible care group structure that controls which professionals get access to the patient's information. A patient specific contact group can be defined for the sending of reminders and alerts. A task list is available, reminders can be set for each task. Secure communication between the patient and his doctor or nurse is easy with the inbuilt safe messaging feature. The system also enables various measurements to be made at home, such as blood sugar, blood pressure or weight. The values are sent automatically to the server / hospital for immediate analysis. Various automatic alerts and reminders can be defined; for instance, a very low blood pressure or blood sugar can trigger a text message to a care taker, and an e-mail to a physician or a nurse. A missing value could cause a reminder to be sent to the patient. Another unique feature is the ability to combine patient queries with the measurement results. A low bow blood sugar value may trigger a few questions to get more information on the patient's symptoms at that time. Both professionals and patients have access to tables and graphs of the measurement values. Benefits - Increased quality of care - Increased comfort for the patients, measurements can be made at home, safe communication 24/7 - Increased safety, thanks to pre-defined alerts and reminders - Cost savings; less travelling needed - Increased efficiency; personnel freed for other tasks
38	Medixine Oy	www.medixine.com	The Medixine RFID communication board combined with a RFID mobile phone is a cost-effective tool for communication between patients and caretakers. By simply touching the phone on a pictured RFID tag on the board the patient can send information, such as reporting of medication compliance or treatment-follow-up (e.g. pain levels), or sending orders for various services. The board and the messages can be fully customized; it can also be modified for use by blind people. The Medixine server uses the Clinic Monitor software and has easy configuration of messages and message recipients. Reminders and alerts (by SMS, e-mail, automatic voice calls) can be built into the system if messages are not received from the patient within a set time limit.
39	Medixine Oy	www.medixine.com	The COPD Health Forecasting service alerts COPD patients by automatic voice calls in advance of impending high risk periods increasing their risk of illness, and reminding them to take appropriate precautions to keep themselves well. The system reaches all patients simultaneously and fully automatically. The service significantly reduces COPD-related hospital admissions and provides people with COPD an improved quality of care.
40	Medixine Oy	www.medixine.com	The Medixine MobileNurse system brings cost-efficiency and quality into home care. With an RFID enabled mobile phone and the MobileNurse program, home care nurses can report patient details during

			their visit and send them directly to the hospital for further analysis. By placing the phone over an RFID-sticker, the nurse automatically lets the hospital know her location and reports the time and duration of her visit. The main benefits are 1) time savings, thanks to real time patient reporting during the visit, 2) safety for home care nurses (on-line follow-up of location), and 3) automatic follow-up of working hours
41	Mega Electronics Ltd	www.megaemg.com	Wireless personal ECG/HRV monitor (Wireless Bioamplifier)
42	Mylab Oy	www.mylab.fi	Weblab® LabIT platform provides comprehensive information services for clinical laboratories and their customers. Weblab® creates clinical information service environment where clinicans and laboratory experts can communicate via Internet. Weblab® also covers all productional IT-needs of a modern clinical laboratory.
43	Myontec Oy	www.myontec.com	Development, manufacturing and marketing of products and services for applications in the areas of physical activity, sports, rehabilitation, ergonomics and occupational health services. The technology is based on measurement of bio-signals and other human body related responses.
44	Newtest Oy	www.newtest.com	Bone Exercise Monitor and Cholesterol Exercise Monitor (Cholesterol Health TM) Monitors tells you how much you have to exercise to reach certain health benefits.
45	Oy Raisoft Ltd	www.raisoft.com	Oy Raisoft Ltd (www.raisoft.com) provides solutions for care planning, quality monitoring, and resource management in areas of elderly care, rehabilitation, and mental health. Our products and services take full advantage of the international interRAI assessment instruments. More information: www.interrai.org
46	Planmed Oy	www.planmed.com	Planmed Oy manufactures and markets advanced mammography equipment. Planmed's small sized and well-designed Sophie units are efficient and user-oriented.
47	Polar Electro Oy	www.polar.fi	Heart rate monitors, fitness and sports training computers, noninvasive movement sensors and softwares supporting the use of monitors and computers
48	Siperia Systems Oy	www.siperiasystems.com	Management software for elderly service providers, including customer and employee data, and service planning, control, follow-up and reporting functions.
49	Snowpolis Ltd	www.snowpolis.com	Living Lab-environment for Sport, Nutrition and Winter Technologies
50	STAKES/FINOHTA	http://finohta.stakes.fi	Ohtanen is a database that contains Finnish language summaries of health technology assessments. Ohtanen is freely available at http://www.ohtanen.fi
51	Tosfin Oy	www.tosfin.com	Medical imaging equipment.
52	anonymous	No data	Messaging, communication and security service to active elderly persons and their caretakers. The service includes three parts: a stylish wristwatch with GSM phone communication and messaging, location awareness, automated alerts in the event of a fall or immobility; a secure web site for the caretaker and required mobile talk and messaging services.

Service environment for the products was out-patient care, i.e. a health care centre, a clinic, a hospital/institutional care and home. Most services are functional in all the beforementioned environments. According to the answers, among the companies 37 reported as their products/services are meant for out-patient care, 36 for hospitals/ institutional care and 33 for home use (table 3). A total of 18 reported all three environments.

Table 3. Usage environment for eHealth products and services

	Company	Out-patient care	Hospital/institutional care	Home
1	Addoz Oy	X		X
2	Agfa HealthCare Finland Oy Ab		X	
3	A-klinikkasäätiö	X	X	X
4	A-klinikkasäätiö / A-Clinic Foundation, Avec-verkosto / Avec network			X
5	ArctiCare Technologies Oy	X	X	X
6	Audio Riders Oy		X	X
7	Avain Technologies Oy	X	X	X
8	Avain Technologies Oy	X	X	X
9	Avain Technologies Oy	X	X	
10	Beneway Oy			X
11	Biohit Oyj	X	X	
12	Biohit Oyj	X	X	
13	Citec Information Oy Ab	X	X	
14	Commit; Oy	X	X	
15	Commit; Oy	X	X	
16	Coronaria Hoitoketju	X		
17	Coronaria Impact Oy	X	X	
18	eHIT Oy	X		X
19	eHIT Oy	X	X	X
20	eHIT Oy		X	
21	eHIT Oy	X	X	X
22	Entteri Professional Software Oy	X	X	X
23	Entteri Professional Software Oy	X	X	X
24	Etelä-Pohjanmaan Terveysteknologian Kehittämiskeskus ry (EPTEK)	X	X	X
25	Fudeco Oy	X		X
26	FWBC Finland Oy			X
27	Goodit Oy	X	X	X
28	Intensium Oy		X	
29	Intensium Oy	X	X	
30	Kustannus Oy Duodecim	X	X	X
31	L-Force Oy		X	
32	LifeIT Oyj		X	
33	Mawell Care Oy	X		X
34	Mawell Care Oy	X		
35	Medanets Oy		X	X
36	Medixine Oy			X
37	Medixine Oy		X	X
38	Medixine Oy	X		X

39	Medixine Oy	X	X	X
40	Medixine Oy	X	X	X
41	Mega Electronics Ltd	X		X
42	Mylab Oy	X		
43	Myontec Oy	X		
44	Newtest Oy	X	X	X
45	Oy Raisoft Ltd	X	X	X
46	Planmed Oy	X	X	
47	Polar Electro Oy	X	X	X
48	Siperia Systems Oy		X	X
49	Snowpolis Ltd	X		X
50	STAKES/FINOHTA	X	X	X
51	Tosfin Oy		X	
52	anonymous			X

The products/services were used by both the public and private sector actors and citizens. User groups are defined in table 4.

Table 4. Target user groups for eHealth products / services

	Company	Primary care	Specialized care	Public sector	Private sector	Wellbeing	Citizen
1	Addoz Oy	X		X	X	X	
2	Agfa HealthCare Finland Oy Ab	X	X	X	X		
3	A-klinikkasäätiö	X	X	X	X	X	X
4	A-klinikkasäätiö/ A-Clinic Foundation, Avec-verkosto / Avec network						X
5	ArctiCare Technologies Oy			X	X	X	X
6	Audio Riders Oy			X	X	X	
7	Avain Technologies Oy	X	X	X	X	X	X
8	Avain Technologies Oy	X	X	X	X	X	X
9	Avain Technologies Oy	X	X	X	X		
10	Beneway Oy			X			X
11	Biohit Oyj	X	X	X	X	X	
12	Biohit Oyj	X	X	X	X	X	
13	Citec Information Oy Ab	X	X	X	X	X	
14	Commit; Oy	X	X	X	X		
15	Commit; Oy	X	X	X	X		X
16	Coronaria Hoitoketju	X		X			
17	Coronaria Impact Oy	X	X	X	X	X	
18	eHIT Oy	X		X	X	X	X
19	eHIT Oy	X		X	X	X	
20	eHIT Oy		X	X	X		
21	eHIT Oy	X	X	X	X	X	X
22	Entteri Professional Software Oy	X	X	X	X	X	X
23	Entteri Professional Software	X	X		X	X	X

	Oy						
24	Etelä-Pohjanmaan Terveysteknologian Kehittämiskeskus ry (EPTEK)	X	X	X	X	X	X
25	Fudeco Oy	X		X	X	X	X
26	FWBC Finland Oy	X		X	X	X	
27	Goodit Oy	X	X	X	X	X	X
28	Intensium Oy	X	X	X	X	X	X
29	Intensium Oy	X	X	X	X	X	X
30	Kustannus Oy Duodecim	X	X	X	X	X	X
31	L-Force Oy		X				
32	LifeIT Oyj	X	X	X	X		
33	Mawell Care Oy	X	X	X	X	X	X
34	Mawell Care Oy	X	X				
35	Medanets Oy	X	X				
36	Medixine Oy	X	X	X			
37	Medixine Oy	X		X	X		
38	Medixine Oy	X		X	X	X	X
39	Medixine Oy	X	X	X	X		X
40	Medixine Oy		X	X	X	X	X
41	Mega Electronics Ltd	X	X	X	X	X	X
42	Mylab Oy	X	X	X	X	X	
43	Myontec Oy			X	X	X	
44	Newtest Oy	X	X			X	X
45	Oy Raisoft Ltd			X	X	X	
46	Planmed Oy	X	X	X	X		
47	Polar Electro Oy	X		X	X	X	X
48	Siperia Systems Oy			X	X	X	
49	Snowpolis Ltd			X		X	X
50	STAKES/FINOHTA	X	X	X	X	X	
51	Tosfin Oy	X	X	X	X		
52	Anonymous					X	X

As Table 4 shows the companies reported private sector as their target user for 42 solutions, 40 concepts for primary health care, 34 specialized health care, 45 public sector, 35 wellbeing service providers, and 26 citizens, respectively.

Several product and service concepts were applicable for professional use and between professionals and citizens. Services were also available for activities between citizens, such as peer groups. 34 products/services were directed for use by the health care professionals and 36 for professionals and 9 for citizen to citizen use (table5).

Table 5. Information flow classified by target groups. (1. "B to B" = between health care professionals, 2. "B to C" or "C to B" = between professionals and citizens and 3. "C to C" between citizens, e.g. patient groups.

	Company	1. " B-B"	2. "B-C" or "C-B"	3. "C-C"
1	Addoz Oy	X	X	
2	Agfa HealthCare Finland Oy Ab	X		
3	A-klinikkasäätiö	X	X	X
4	A-klinikkasäätiö / A-Clinic Foundation, Avec-verkosto / Avec network		X	
5	ArctiCare Technologies Oy		X	X
6	Audio Riders Oy	X	X	
7	Avain Technologies Oy	X	X	
8	Avain Technologies Oy	X	X	X
9	Avain Technologies Oy	X		
10	Beneway Oy		X	
11	Biohit Oyj	X		
12	Biohit Oyj	X		
13	Citec Information Oy Ab	X	X	
14	Commit; Oy	X	X	
15	Commit; Oy	X	X	
16	Coronaria Hoitoketju	X		
17	Coronaria Impact Oy	X		
18	eHIT Oy		X	
19	eHIT Oy	X		
20	eHIT Oy	X		
21	eHIT Oy	X	X	X
22	Entteri Professional Software Oy		X	
23	Entteri Professional Software Oy		X	
24	Etelä-Pohjanmaan Terveysteknologian Kehittämiskeskus ry (EPTEK)	X	X	X
25	Fudeco Oy	X	X	X
26	FWBC Finland Oy	X	X	
27	Goodit Oy		X	X
28	Intensium Oy	X	X	
29	Intensium Oy	X	X	
30	Kustannus Oy Duodecim	X	X	
31	L-Force Oy	X		
32	LifeIT Oyj	X		
33	Mawell Care Oy		X	
34	Mawell Care Oy	X	X	
35	Medanets Oy	X		
36	Medixine Oy		X	

37	Medixine Oy		X	
38	Medixine Oy		X	
39	Medixine Oy		X	
40	Medixine Oy		X	
41	Mega Electronics Ltd		X	
42	Mylab Oy	X		
43	Myontec Oy	X	X	
44	Newtest Oy		X	X
45	Oy Raisoft Ltd	X		
46	Planmed Oy		X	
47	Polar Electro Oy	X	X	X
48	Siperia Systems Oy	X		
49	Snowpolis Ltd		X	
50	STAKES/FINOHTA	X		
51	Tosfin Oy	X		
52	anonymous		X	

Most of the companies were small and medium enterprises marketing either one or more product/service concept. Several companies directed their services to a special target group, the largest being the elderly (table 6). Product concepts for the management of public chronic diseases provided solutions for the monitoring of diabetes, cholesterol and blood pressure and for weight control.

The companies were asked to mention some special target groups of their products or services. Their answers are presented in Table 6. The table shows that the most common special target group was the whole population (25 answers), aged population was reported by 10 companies, families with children only one company. Among the companies there were 17 such ones, which reported some specified target group.

	Company	**Special target group**	
		in general	specified
1	Addoz Oy	aged population	patients with long-term medication
2	Agfa HealthCare Finland Oy Ab	other special group (see right)	hospitals/ health centres / private radiology
3	A-klinikkasäätiö	whole population	
4	A-klinikkasäätiö/ A-Clinic Foundation, Avec-verkosto/ Avec network	whole population	
5	ArctiCare Technologies Oy	aged population	
6	Audio Riders Oy	aged population	
7	Avain Technologies Oy	whole population	
8	Avain Technologies Oy	whole population	
9	Avain Technologies Oy	whole population	
10	Beneway Oy	families with children	
11	Biohit Oyj	whole population	
12	Biohit Oyj	whole population	
13	Citec Information Oy Ab	other special group (see right)	All manufacturers in the Life Sciences segment

14	Commit; Oy	whole population	
15	Commit; Oy	other special group (see right)	age groups to be screened
16	Coronaria Hoitoketju	other special group (see right)	health centres
17	Coronaria Impact Oy	other special group (see right)	hospitals
18	eHIT Oy	whole population	
19	eHIT Oy	aged population	
20	eHIT Oy	whole population	
21	eHIT Oy	whole population	
22	Entteri Professional Software Oy	whole population	
23	Entteri Professional Software Oy	whole population	
24	Etelä-Pohjanmaan Terveysteknologian Kehittämiskeskus ry (EPTEK)	whole population	
25	Fudeco Oy	whole population	
26	FWBC Finland Oy	aged population	
27	Goodit Oy	whole population	chronic national diseases
28	Intensium Oy	whole population	
29	Intensium Oy	whole population	
30	Kustannus Oy Duodecim	whole population	
31	L-Force Oy	other special group (see right)	radiological units
32	LifeIT Oyj	other special group (see right)	companies and public organizations
33	Mawell Care Oy	whole population	
34	Mawell Care Oy	other special group (see right)	diabetes
35	Medanets Oy	other special group (see right)	medical treatment
36	Medixine Oy	other special group (see right)	COPD patients
37	Medixine Oy	aged population	
38	Medixine Oy	whole population	
39	Medixine Oy	other special group (see right)	chronically ill patients
40	Medixine Oy	other special group (see right)	elderly, sick, handicapped, blind, deaf-blind patients
41	Mega Electronics Ltd	koko väestö	
42	Mylab Oy	koko väestö	
43	Myontec Oy	other special group (see right)	athletics, working people needing muscular rehabilitation
44	Newtest Oy	other special group (see right)	people with insufficient physical exercise
45	Oy Raisoft Ltd	aged population	
46	Planmed Oy	other special group (see right)	women visiting mammography screening
47	Polar Electro Oy	whole population	products developed for healthy persons
48	Siperia Systems Oy	aged population	

49	Snowpolis Ltd	whole population	
50	STAKES/FINOHTA	other special group (see right)	health care professionals and decision-makers
51	Tosfin Oy	other special group (see right)	health care professionals
52	anonymous	aged population	

In addition to the web survey, we also collected product or service information from the web sites of those Finnish companies, which have announced eHealth as their target area, but did not answer to our questionnaire. See Table 7.

Table 7. Additional product and service information collected from Finnish Internet sites

Company and product/service description	Contact
Nordic LAN & WAN Communication Oy is a private Finnish company, specialized in telecommunication, networks, security and video surveillance systems. The business idea behind our company is bringing new technology to our customers and keeping our customers competitive in their respective businesses by freeing resources to their own key business areas.	www.lanwan.fi
TietoEnator is among the leading architects in building a more efficient information society and is one of the largest IT services companies in Europe. TietoEnator specialises in consulting, developing and hosting its customers' business operations in the digital economy. The Group's services are based on a combination of deep industry-specific expertise and the latest information technology.	www.tietoenator.com
TELESPRO FINLAND Ltd. specializes in developing products and services for emergency care and rescue services. Telespro developes markets and distributes innovative, high-quality products and provide services. We aim at improving safety, effectiveness and efficiency in the work of rescue operations as well as providing patients with best protection and comfort. We are dedicated to working closely together with professionals from Universities, Research Centres, Hospitals as well as Rescue Service Professionals to continuously improve the performance of products and services, in order to fulfil all of our customers' needs and requirements.	www.telespro.fi
TeliaSonera is in the business of providing high quality telecommunications services, including packaging and carrying content like sound, images, data, information, transactions and entertainment. TeliaSonera offers services that help people and companies communicate in an easy, efficient and environmentally friendly way.	www.teliasonera.com
FRWD Technologies is a Finnish forerunner in sports technology. The Oulu-based company designs, develops and markets easy-to-use high quality products for outdoor and action sports enthusiasts, top athletes and professionals. FRWD Technologies pushes the limits and innovates revolutionary sports computers that take the sports experience of the adventure and action addicts	www.frwd.fi

into an entirely new dimension. FRWD products are developed together with professional athletes.	
Roche is a leading healthcare company with a broad spectrum of innovative medical solutions. For more than 100 years, we have been active in the discovery and development, manufacturing and marketing of novel healthcare solutions. Our products and services bring significant benefit to patients from early detection and prevention of diseases,to diagnosis,treatment and treatment monitoring.	www.roche.com
We provide our customers diversified IT consulting services, as well as information solutions for comprehensive development of business operations. We have directed our services and products to the manufacturing industry and to the health care sector.	www.arcusys.fi
Health and Science is an integral part of the Berner success story. Our expertise in serving several demanding specialised sectors combines the needs of customers and solutions that best meets these needs. The majority of our customers are Finnish professionals in surgery, diagnostics, imaging, infection control, laboratories, microbiology and pet nutrition and healthcare.	www.berner.fi
Siemens AG (Berlin and Munich) is a global powerhouse in electronics and electrical engineering, operating in the industry, energy and healthcare sectors.	www.siemens.com
CRF Inc. is the leading global provider of eDiaries and wireless data collection solutions for the Life Sciences industry. Our unique TrialMax® eDiary design tool enables the collection of primary and secondary efficacy data in shorter timescales and the conduct of complex clinical trials with greater flexibility than any other ePRO solution.	www.crfhealth.com
MediWare Oy is an IT corporation specializing in healthcare information systems. We provide the Finnish healthcare industry with software products, ITIL compliant maintenance and control services as well as expert services.	www.mediware.fi
BCB Medical is a service provider for the health care sector developing reliable solutions for information management and sharing. Our solutions aim at improved and cost-effective health care resulting from optimal patient management. We concentrate our development on reliable, user-friendly and flexible browser based information management systems.	www.bcbmedical.com
Pikosystems Inc. produces electronic systems solutions and services that improve quality of life, independence and security.	www.pikosystems.fi
Fujitsu Services Oy is a supplier of ICT services to enterprises and organisations in Finland and the Baltic countries. Fujitsu's mission is to facilitate the lives of its customers. The advanced ICT operating models allow them to focus on their core business, generating tangible business benefits.	www.fujitsu.com/fi
Oy ProWellness Ltd. provides its customers with solutions for the management, monitoring and preventive care of chronic diseases like diabetes, hypertension and asthma. In addition to public and private healthcare organisations, the solutions are utilised by occupational healthcare providers and private individuals.	www.prowellness.com
Founded in 2000, Ekahau is the recognized leader in location-enabling enterprise Wi-Fi networks. Ekahau's mission is to provide the easiest, most cost effective and accurate positioning solutions for locating people, assets, inventory and other objects using wireless enterprise networks. The Ekahau solution tracks wireless	www.ekahau.com

laptops, PDAs, VOIP phones, Wi-Fi tags and other 802.11 enabled devices	
Founded in 2002 in Oulu, Finland, Mediracer Ltd specialises in medical technology. The company's core business is the development, manufacture and global sales of Point of Care (POC) diagnostic testing equipment for diseases of the peripheral nervous system. POC analysis equipment makes treatment processes faster and easier, and therefore also extremely cost-efficient.	www.mediracer.com
Logica is a leading IT and business services company, employing 39,000 people across 36 countries. We enable business transformation for our customers through the innovative use of technology.Our customers want a local partner who can deliver world-class services wherever they operate. Logica is a trusted innovation partner with a 40 year track record of success. We bring the best people and technologies from around the world to deliver creative, intelligent answers to your business issues.	ww.logica.com

6.4. Summarizing eHealth Product and Service Supply of Finnish Companies

A survey done in the summer of 2008 reveals that the Finnish companies offering eHealth services are mostly small and medium enterprises. Due to the poor reply rate (40%), this survey does not offer a complete view of the Finnish eHealth services. In this mapping, user-friendliness, impact on health or cost-effectiveness was not determined and a larger study would be needed to obtain that information.

Based on the received replies, the supply of services in Finland is fairly multi-faceted. Instead of just a product, an entire service consept is offered which can often be utilized in the entire health care service chain from a citizen to a professional. The elderly form a largest customer group with special needs. In addition, solutions for the follow-up of chronic diseases for the citizens and for the professionals are also being developed. Citizen-to-citizen services are increasing. Some service consepts have established their position as part of the Finnish health care system, but also novel innovations were discovered.

For further surveys in the coming years, many companies requested a possibility to announce their segment in the eHealth domain in more detail. E.g. those providing products and services to major inter-organisational information exchange usually differ quite substancially from companies providing products either to traditional telemedicine or to personal health care. A wide but clearly segmented umbrella of eHealth should be used also for this information collection.

6.5. Referred Litterature of the Chapter

1. Tilastokeskus, Nettiostotutkimus
2. Tilastokeskus, Tietotekniikan käyttö yrityksissä 2004
3. Eurostat, Statistics on the information society in Europe
4. Tilastokeskus, Alueittainen työssäkäyntitilasto 2002
5. Hämäläinen P., Reponen J., Winblad I. eHealth of Finland. Check Point 2006, Stakes raportteja 1/2007
6. Salo S., Konttinen M. Teknologia hyvinvoinnin edistäjänä – Finnish Wellbeing Center –hanke. Suomen Hammaslääkärilehti 2006, 13; 5: 264-267.
7. Salo S., Näyttöön perustuvaa hyvinvointiteknologiaa – Finnish Wellbeing Center. Suomen Lääkärilehti 2006, 13: 1502-1503.

7. New Concepts and Alternatives of Service Delivery

A municipality can arrange for the provision of health services either by providing them through local authorities or by securing them partly or entirely from a different service provider. The municipalities therefore can exercise competitive tendering for their services. The legislation and EU directives set an obligation for tendering in public procurement. When using contracted services, one must adhere to the law on public procurement (1505/1992), which requires competetive tendering (Melin 2007).

7.1. Entrepreneurship in Health Care

When using contracted services, the municipality is left with the monitoring of the quality or quantity of the service. The service being bought must be defined in the invitation to tender and in the contract. Current legislation does not pose barriers to entrepreneurship and the utilization of new possibilities. Enterpreneurship is already being widely utilized in the provision of services in health care centres. For 3 million Finns, the out-of-hours service during the weekend is already provided by the private sector. Day-time services have also been out-sourced and are increasingly out-sourced. The industry has witnessed the development of businesses which provide services and this has formed the basis for competitive tendering of services. Also temporary hiring of staff for shorter and longer periods of time is here to stay (STM 2004:9).

Out-sourced services cannot nevertheless be used for duties which necessitate the use of public authority. Instances such as this are listed in legislative Acts dealing with the prevention and treatment of some infectious diseases, involuntary psychiatric care and executive assistance.
Practitioner entrepreneurship is not a potential possibility in health care centres according to the current employment legistlation (STM 2004:9). Interpretation of the Health Insurance Act has also posed a barrier for this type of activity as it denies health insurance coverage for the patient if using private medical services.

A municipal enterprise is between entrepreneurship and local operations. It is utilized when there is a need to offer a service as a business and yet to retain it as part of local operations (STM 2004:9).It is becoming increasingly common in the provision of information systems and diagnostic services.

A municipal enterprise is a business which is owned by the local authorities alone or with other actor(s). It aims at flexibility in provision, transparency and efficiency through an organisation where guiding and management of operations is structurally easier than in a municipal organisation (Melin 2007). One of the best known examples in Finland is Coxa Oy in Pirkanmaa, which is owned by both the public and the private sector. It produces

orthopaedic services and also participates in the tendering procedures.
An example of a limited company entirely owned by municipalities in primary care is provided by the Kiljava hospital, which is owned by the HUS municipal federation and 5 Uusimaa municipalities. It provides specialized medical care services and extended care and rehabilitation for its owner municipalities.

City of Karjaa and Samfundet Folkhälsan provide an example of contract services and the purchaser-provider model. They made a contract in 1998 concerning for the provision of health services and elderly care. As an outcome of this model, only 1 1,6 % increase in costs inthose sectors has been reported between 1999 and 2005, whereas in other municipalities costs have risen by over 25%.

7.2. Special State Subsidy

Special state subsidy (EVO) provides a special financial funding instrument for health care and is aimed at compensating for research expenses. Researchers and research groups compete for this funding and it is targetd to clinical research, research on national health and health economics. Part of the funding is aimed at the development of infrastructure and research (STM 2006:34). The system has been critisized for not offering funding to research on service structures (STM 2006:24).

8. Actions Supporting Innovations in Finnish Health Care

8.1. Renewal of Public Service System

Renewal and development in health care cannot be achieved without altering structures and processes. In the central hospital of North Karelia it has been estimated that 40% of doctor's time is associated with technology and 10% is spent on solving technological problems. In the Hospital District of Helsinki and Uusimaa, HUS, 20% of nurse's time is spent on other duties than nursing (Terveysteknologian…2007).

The renewal of the public sector is one of the biggest challenges of innovation politics, especially in a country such as Finland where the public sector is large (Hautamäki 2008). Despite the fact that municipalities use a large proportion of tax revenues on social and health care, innovation activity is low in those sectors. As social and health care services in the public sector are increasingly out-sourced, an opportunity for the implementation of innovative products and services arises. It remains to be a challenge to develop business- and innovation systems in such a way that they can discover potential service concepts for further development and productification (Wallenius ja Hjelt 2004).

Increasing the productivity of the public sector requires the development of larger systems, new practises and and the dissemination of good practises. The health care system is composed of smaller individual units and has a fragmented structure which has resulted in the development of service innovations in a too narrow sector. This has resulted in sub-optimisation at the expense of the whole and since the businesses in wellbeing sector are small and poorly networked, the end results have been small improvements in the processes which have not been disseminated elsewhere.

Good practises are not discovered if cost efficiency and effectiveness studies are not carried out (Wallenius and Hjelt 2004, Saranummi ym. 2005). Third sector and the potential of voluntary work as a productivity increasing innovation activity platform have not been utilized to their full extent. Innovations which increase productivity are often combinations of technology and process innovations and their development requires a multi-disciplinary approach and open-minded pilot projects. Associations are also an avenue that could be utilized for service production together with the citizens. A closely related approach is *Peer production*, where citizens support one another and might provide services through on-line communities.

A trend in the area of innovation activity is to move from an availability centred approach to a demand driven, service centered approach (Hautamäki 2008).

Finland is a country of high technology where product or service innovations are being offered without the utilization of user analysis or sufficient involvement of users in the development (Wallenius and Hjelt 2004).

A timely example of this is provided by the electronic patient record systems, which have been critically evealuated by the medical and nursing staff (Winblad 2007).

8.2. Different Ways to Arrange Services

A *purchaser-provider* model is one method of guidance. It is based on demand- and customer-centeredness, instead of a production-centered approach commonly used in the health care sector. The model distinguishes between the purchases of services and their providers and thereby aims at improving efficiency, quality and cost efficiency.

The purchaser can be a municipal organisation or an outside organisation. Its functionality depends on the success of productification. The purchaser must know what they want. The success of the provider is dependent on know-how and the ability to produce innovative service products (Melin 2007).

The model has been experimented with in Oulu, where according to the preliminary information productivity and economic efficiency has been improved by 10-30 %. On the other hand, there has been uncertainty with regards to the different roles and opposition to the organisation of duties. This has resulted in resignations among the middle management.

A municipal service voucher is a certificate which is given to a citizen who is entitled to a service. The service voucher has been stipulated in The Act on Social- and Health Care Fees (734/1992) and in The Act on Planning and State Subsidies for Welfare and Health Care (733/1992). The service voucher is seen as an effective way of promoting customer's right to choose. The customer can not, however, demand a voucher but instead it is up to the local authorities to decide who to give it to and to what purpose (Melin 2007). The use of a service voucher has been minimal in health care, at least until recently.

The traditional model of public health care, i.e. the care unit being determined on the basis of residence, poses a restriction to the patient's freedom of choice. Furthermore, it does not generate incentives for the service providers for developing their own service provision. In some hospital districts, new experimental contracts are in progress which allows the customer to choose their care setting among public hospitals.

Regional models are already being implemented in the Joint Authority of Kainuu region, where health centre hospitals are open to patients. In Kainuu, the main task of the system most likely is the levelling of the usage peaks and the appropriate use of basic services in bedwards instead of using a central hospital.

Service networks have been built in the interphase between social and health care and these include elderly care, substance abuse care, child welfare and youth work. Their significance lies in the pooling of resources from several actors as well as NGOs in order to provide services.

In recent years call centers or contact centers have become more common in out-sourcing and they refer to a centralized phone service which is focused on customer or patient advice and further referral to other medical services. It may also include a booking service. Introduction of this type of service was expedited with the Act on the Status and Rights of Patients, which stipulates that the health care centres must be immediately available during office hours and that care assessment must be given within 3 days if situation is unhurried (Act 855/2004). Call centres have been reported to be able to forward around 20-60% of out-of-hours patients to active self-care by giving professional advice and guidance. In 2005, call centres were operating in six health centres and in 1 hospital district (Winblad et al. 2006).

8.3. Innovation Democracy and the Living Lab

In the working life, a principle of innovation democracy is exceedingly emphasized when developing new operating models. This principle emphasizes employee's and citizen's right to express their creativity in the development of the working community and its functions. The central message is that every employee is innovative and every employee has the right to get rewarded for it.

The aging population presents a challenge for service provision, but also an opportunity: it produces a demand for new service innovations, a challenge Finland is thought to be well equipped to deal with.

Technology skills of the employees are often associated with human capital generated through tacit knowledge. This human capital is generated with the help of a close face-to-face interaction or it migrates with the employees as they move from one organisation to another.

Living Lab presents a novel open innovation environment (www.openlivinglabs.eu).
It encompasses real-life settings in which academia, firms, emerging technology, public sector, NGOs and end-users form a platform for co-creation of new services and products. The idea is to give to users and user communities the role of contributors and co-creators instead of a mere object or consumer. In Europe European Network of Living Lab (ENoLL) consists of 50 qualified Living Labs, seven of them from Finland. The membership of ENoLL means a strong recommendation to an applicant for EU funding.
This model also supports public-private partnership principle. Due to its customer centeredness and a structure which emphasizes cooperation, this model is a real possibility in the development of public service innovations

8.4. Incentives in Service Production

One of the biggest challenges in the public sector is the creation of an effective incentive system for the service providers and customers. Competition is absent in the public sector. Public sector funding based on customer's freedom of choice and customer satisfaction would create a very effective incentive scheme (Hautamäki 2008).

8.5. Towards Patient-centered Services

The role of the customer and the consumer is gaining more importance. The public sector has been critisized for not taking on board customer needs and wishes. For example, citizens want more eServices, but the public sector is slow to respond to this need. In a global UN e-Government survey on internet-based administration, Finland scored below other Nordic countries, particularly in citizens e-Participation index (E-government survey 2008).

The main focus of the electronic health care activities has been the development of data management system inside organisations and between organisations (business to business). In this sector Finland has been in the forefront of development along with other Nordic countries, if looking at the scope of applications in the entire health service system (TemaNord 2005). However, development of eHealth services directly for the citizens, the business to consumer services, has been slow until now. The extensive infrastructure which has been built does, nevertheless, enable the addition and intergration of services which are directly aimed at the citizens (Winblad et al. 2006).

9. Developmental Actions

This review has highlighted some structural problems and hindrances which are linked to innovation activity in the health care sector. These problems have nevertheless been acknowledged and several important development projects are in progress.

9.1. Recent National Health Project

The most prominent development project was the before-mentioned National Project on Safeguarding the Future of Health Care Services between 2003-2007. It set six priorities 1) functional primary health care and prevention programmes 2) guaranteed access to treatment 3) guaranteed availability of trained personnel 4) a reformation of functions and structures 5) strengthening the resources of health care and 6) the implementation of the project proposals (VNp 2002).

In their closing report, the rapporteurs of the national project concluded that many projects were initiated in municipalities and municipal federations which were in alignment with the goals, i.e. regional out-of-hours services, telephone and health advice services. The out-of-hours services of health centres were transferred to larger primary care units or to facilities shared with specialized medical services.

In the joint projects of social and health care, psycho-social services for different age groups and home services were developed as well as regional services for mental health care and substance abuse care.

The national project aimed at facilitating collaboration and organisation of work in the units of specialized medical care and the elimination of redundancy. These aims were boosted by a legislative act which guarantees access to treatment and sets the framework for regional collaboration. Functional collaboration between the different units in the specialized medical care did increase to a certain extent. Also joint acquisition of drugs and materials and joint production of laboratory and imaging services have progressed well (STM 2008:5). The rapporteurs estimated that progress made with the service structure reforms in the health care project has been slow.

9.2. New Development Programme "KASTE"

KASTE-programme is a statutory novel strategic guidance tool for the management of social welfare and health care politics set by the Ministry of Social Affairs and Health. It defines the objectives of Finnish social welfare and health care for 2008-2011 and the focus for development and monitoring. It also identifies reformation projects and legislative initiatives which support their implementation and gives guidance and recommendations.

The programme aims is to reduce social exclusion and to improve the involvement, well-being and health of the municipal inhabitants, and to diminish inequalities in wellbeing and health and regional inequalities. The aim is to form a service which operates as an integral whole through a reform of the service structure. Health care centres, Stakes (National Research and Development Centre for Welfare and Health), National Public Health Institute, Finnish Institute of Occupational Health and universities and networked to carry out development of primary health care. The collaboration between specialized medical care and primary care is developed and the cooperation and division of duties between hospitals is intensified through defined areas of special responsibility. Patients will have more freedom to choose a setting for their medical care (STM 2008, STM:n esitteitä 2008:5).

9.3. ”PARAS” plan

In 2005 the Cabinet Finance Committee has instigated a ”PARAS” project for the re-structuring of municipalities and services. The corresponding framework act is valid from 2007-2011 (Laki 169/2007). Its objective is to create a sound structural basis for the development of the methods of municipal service production, to control the increase of costs, and to develop the steering and development systems for the production of municipal services. By strengthening the structural and financial basis these objectives will be achievable.
PARAS-project has initiated the planning of municipal mergers to a larger extent than expected and by October 2007 46 municipalities had decided on a merger. As a result, the number of municipalities will be decreased by 32 in the beginning of 2009 and almost 90 municipalities are in a process of arranging a merger. Altogether 290 municipalities are also organising primary health care and at least parts of social welfare in co-operation.

9.4. Strengthening Primary Care

Primary health care is grappling with a shortage of medical doctors although Finland has more doctors now than ever and the number of doctors per inhabitant is equivalent to a European average.

Primary care will be strengthened by the New Health Act, which unites Primary Health Care Act and the Act on Specialized Medical Care. A new development unit for primary care will be founded in Stakes (National Research and Development Centre for Welfare and Health), which will develop primary care, produce information on care processes, practises and developmental tools together with health care centres, universities and other departments (STM 2008:5).

Primary care is also strengthened through an extensive development of regional functions and reformation of structures, which is implemented through health districts or via other regional models. The Joint Authority of Kainuu region was formed swiftly.

Health districts have been planned and implemented according to the PARAS-framework legislation and they are formed as co-operation areas in populations of at least 20 000 inhabitants (STM 2008:5).

The Ministry of Social Affairs and Health states in their working group report concerning the future of health care centres (STM 2006:56) that public specialised medical care has formed successful networks through their areas of special responsibility, which has created a sound functional and financial basis for the development of service innovations. Health care centres as small units have been left out of similar resources.

The working group has suggested the establishment of a solid primary care network within the national development centre for primary care. This network would include regional health care centre development units and development funds, which would be responsible for the allocation of research funds from specified government transfers and also for the compilation of development projects (STM 2006:56).

In their report the working group has suggested that a database of good solutions and development projects will be established to support and to promote service innovations in primary care. The above mentioned network would be responsible for the assessment of development plans, for the development of evaluation methods and for establishing international contacts. A database of research topics and on-going research projects would be created to support the work. FinGPWeb could be utilized as a data collection tool. Once implemented, this constitutes a totally new type of structure for the development of primary care.

The working group has also noted that the introduction of new technology strengthens the patient's position and this could be further supported by increasing service users' freedom of choice beyond municipal borders.

A service innovation project which is based on a national development plan, increases the transparency of services and ensures the utilisation of best practises. It is implemented in a web site called Palvelupuntari, which enables the comparison of services between individual service providers and also between municipalities and larger areas. Another outcome is a Good practise-network, which creates an open innovation environment and supports the implementation, productification and dissemination of good practises (STM 2008:5).

9.5. New Comprehensive Legislation for Health Care

The New Health Care Act, which includes now both primary care and specialised medical care, has been given as a proposal to the Ministry of Social Affairs and Health. Some of the objectives of the law include supporting primary care and the facilitation of the availability, productification and development of health services. The proposal also contains a recommendation to increase patient's freedom of choice. Within the special responsibility area, the patient has the right to choose a health care unit where he/she wants to be treated.

9.6. Implementation of Good Medical Practices

A noteworthy development project of health care practises is the Finnish Current Practice guideline, which is managed and organised by the Finnish Medical Society Duodecim (www.kaypahoito.fi). It contains guidelines and recommendations for the most common diseases and public health problems. It also draws guidelines for the division of duties between specialized medical care and primary care in order to develop optimal cooperation.

9.7. National Architecture for Health Care Information System

As a result of the national project the utilization and spreading of ICT was markedly increased. Electronic patient record is in use practically everywhere in the public health care system and with all major private health providers. Of special importance is the increase in the transfer of knowledge between organisations, such as referrals, post-treatment surveys and laboratory and imaging results. The end result is the establishment of ICT infrastructure which covers the entire health care service system in Finland. This provides excellent grounds for the development and introduction of novel service innovations (Winblad et al. 2006).

Electronic patient record has become the core around which all other electronic services are built on. The national electronic archives, KANTA, will form the national architecture around the electronic patient record and it is managed by the Social Insurance Institution of Finland, KELA. Health service providers must join KANTA as stipulated by law by the year 2011. Similar architecture has not been experimented with before anywhere in the world. Building of the national eArchives and the integration of systems, and the ePrescription project will necessitate considerable effort from KELA, system providers and health care organisations. It remains to be seen how much financial and human resources are left for other development projects in this transition period.

9.8. Services for Elderly People

National Framework for High-Quality Services for Older People is a renewed framework which incorporates current national strategies in old-age policy, assessments of the earlier framework, the latest research findings and recent changes in the operating environment (STM 2008:5, Ministry of Social Affairs and Health publications; 2008:5). The framework is designed to help municipalities and cooperation districts to develop their services for older people on a basis of local needs and resources, jointly with the third sector, private-sector service providers, and clients, their relations and other local residents. Municipalities are required to draw up their own strategy for old-age and to prepare for the demographic change, and integrate it into their municipal budget. Implementation of the strategy will be monitored regularly.

The new framework defines the values and ethical principles guiding the provision of services for older people. It also outlines strategies for boosting quality and effectiveness in three dimensions: (1) promoting health and welfare and developing the service structure, (2) staffing levels and staff skills and management, and (3) old-age living and care environments.

The framework sets national quantitative targets for services for older people that municipalities and cooperation districts can use as a basis for fixing their own targets. It underlines the primacy of promoting health and welfare, of giving priority to prevention and support for home living, and of comprehensive assessment of individual needs.

10. Selected Highlight Findings for Future Consideration

10.1. Public Health Care System

In Finland e-Health was developed in three steps, on a local, regional then national scale. The first step saw a change from paper to electronic documentation.

Electronic patient record (EPR) coverage is close to 100% today in Finnish primary and secondary healthcare, including hospitals and ambulatory care.

Development on a regional level meant a change from printed letters to electronic data exchange between primary and secondary health service providers. Inter-organisational data exchange has increased rapidly in the past few years. Digital data depositories in individual healthcare institutions are in active clinical use, and secure data connections enable sharing of electronic patient information.

10.2. Products and Services from Commercial Sector

The lack of an extensive product and service register has, until now, been an important problem to solve. Presently we can boldly declare that companies do not know what health care needs, and health care doesn't know what companies have to offer.

The product and service innovations of ICT companies have often come into existence accidentally and spontaneously driven by technology or business. Innovated and needs driven design has been too scanty. Due to the present situation there may be holes in the coverage of technological solutions in the health care processes.

We do need systematic analyses from the needs of health care and technology which would have to meet the needs. Other important research topics are feasibility, effectiveness and cost-effectiveness analyses of technology applications and technology supported working processes. For sociodemographic reasons the importance of these issues is emphasized in the northern parts of the country.

We have, however, several promising product and service innovations at a design, testing or implementing stage or even in use. Examples worth mentioning are a personal health record, systems for diabetes care, virtual consultations (teleradiology, tele-EKG, tele-EEG and –EMNG) and teleneurology (telestroke). Some of those have been proven to be effective and cost-effective.

11. Literature and Background Material

1. Act 159/2007 (in Finnish, concerns management of electronic patient data)

2. Act on Experiments with Seamless Service Chains in Social Welfare and Health Care Services and with a Social Security Card (811/2000)

3. E-government survey 2008) http://unpan1.un.org/intradoc/groups/public/documents/UN/UNPAN028607.pdf

4. Eurostat, Statistics on the information society in Europe

5. Finnish Government. Government of Paavo Lipponen. Government Programme 13.4.1995. (www.valtioneuvosto.fi)

6. Finnish Government. The second Government of Paavo Lipponen. Government Programme 15.4.1999. (Valtioneuvosto. Pääministeri Paavo Lipposen II hallituksen ohjelma 15.4.1999.) (www.valtioneuvosto.fi, 9.1.2005)

7. Finnish Government Decision-in-Principle. 26.5.2000. Valtioneuvoston periaatepäätös valtion omaisuuden myynnistä vuosina 2000–2003 saatavien tulojen käytöstä. 26.5.2000. (Government.) Available from http://www.ktm.fi/index.phtml?page_id=206&menu_id=206&topmenu_id=8&lang=1&Chapter_id=5909#5909

8. Finnish Government. (2003 A). Hallituksen esitys 96/2003. (Government Proposal 96/2003). Hallituksen esitys Eduskunnalle laiksi sosiaali- ja terveydenhuollon saumattoman palveluketjun ja sosiaaliturvakortin kokeilusta annetun lain muuttamisesta.

9. Finnish Government (2003 B). Prime Minister Matti Vanhanen's Government. Government Programme 24.6.2003. (Pääministeri Matti Vanhasen hallitusohjelma 24.6.2003) (www.valtioneuvosto.fi)

10. Finnish Government. 2002 A. Government Resolution on the Health 2015 Public healthProgramme. Available from: http://pre20031103.stm.fi/english/eho/publicat/ehocontents17.htm

11. Finnish Government. 2002 B.Government Decision in principle by the council of state on securing the future health care. Available from: http://pre20031103.stm.fi/english/eho/publicat/ehocontents68.htm

12. Hautamäki A. Innovaatiopolitiikka uusien haasteiden edessä. Sitran raportteja 76, Sitra 2008

13. Hämäläinen P, Reponen J, Winblad I. eHealth of Finland. Check point 2006. Report 1/2007. National Research and Development Centre for Welfare and Health, Helsinki 2007

14. Hämäläinen P, Tenhunen E, Hyppönen H, Pajukoski M. Experiences on Implementation of the Act on Experiments with Seamless Service Chains in Social Welfare and Health Care Service. Discussion Papers 5/2005. Stakes. Helsinki, 2005

15. Järvelin J et. al. Health Care Systems in Transition (HiT) Profiles: Finland. European Observatory on Health Care Systems, 2002

16. Kiviaho, K., Winblad, I., Reponen, J. [in Finnish] Terveydenhuollon toimintaprosesseja ja asiointia tukevat atk-sovellukset Suomessa—Kartoitus ja käyttöanalyysi. FinnTelemedicum. Osaavien keskusten verkoston julkaisuja 8/2004. STAKES, Helsinki, 2004

17. Ministry of Social Affairs and Health. Health Services in Finland. Available from: http://www.stm.fi/Resource.phx/eng/subjt/healt/hserv/index.htx,

18. Komission vihreä kirja innovaatiosta KOM(95) 688-tiedote 12-1995).

19. Kujansuu E. Pääkirjoitus, Yleislääkäri 6/2007

20. Lillrank P ja Parvinen P. Omistaja, prosessi, potilas. Suom Lääkäril 2004;59:1052-1055

21. Linden T. Hoidon porrastus ja terveyskeskuksissa järjestetyt erikoislääkäripalvelut Oulun yliopisto. Suomen Kuntaliitto, Helsinki: Kuntaliiton painatuskeskus 1998

22. Lääveri T, Lääkäripäivien 2008 luento kurssilla Neuvova potilaskertomus

23. Ministry of Social Affairs and Health (Sosiaali- ja terveysministeriö) [in Finnish]. Sosiaali- ja terveydenhuollon tietoteknologian hyödyntämisstrategia. Sosiaali- ja terveysministeriön työryhmämuistioita 1995:27

24. Ministry of Social Affairs and Health (Sosiaali- ja terveysministeriö) [in Finnish]. Terveydenhuolto 2000-luvulle-hankkeen päätösseminaari 4.–5.2. 2002. Ohjelma ja luentomateriaali. Monisteita

25. Ministry of Social Affairs and Health (Sosiaali- ja terveysministeriö). [Abstract in English]. Sähköisten potilasasiakirjajärjestelmien toteuttamista ohjaavan työryhmän loppuraportti. STM Työryhmämuistioita 2004:18. Sosiaali- ja terveysministeriö, Helsinki, 2004

26. Ministry of Social Affairs and Health 2006A. Available from: http://www.stm.fi/Resource.phx/eng/index.htx

27. Ministry of Social Affairs and Health.2006B. Strategies for Social Protection 2015 (Publication 2006:16)

28. Melin T: Innovaatiot ja hyvät käytännöt kunnallisessa palvelutuotannossa, Sitra, Helsinki 2007

29. OECD. Proposed guidelines for collecting and interpreting technological innovation data – the Oslo manual, OECD, Paris 1997.

30. Ohtonen, J. [in Finnish]. Satakunnan Makropilotti: Tulosten arviointi. FinOHTAn raportti 21/2002. STAKES/FinOHTA, Helsinki, 2002

31. Osborne SP. Naming the beast; Defining and classifying service innovations in Public Services. Human relations 1998;51(9):1133-1153

32. Parkkinen P. Riittääkö työvoima terveydenhuolto- ja sosiaalipalveluihin? (Abstract in English). VATT-keskustelualoitteita No 433. Government Institute for Economic Research, Helsinki 2007

33. Population Register Finland Centre, available from: http://www.vrk.fi/vrk/home.nsf/pages/index_eng

34. Päätalo M, Suorsa S, Hämäläinen P. .[in Finnish] Sosiaali- ja terveyspalvelujen vuoden 2002 valtakunnallinen peruspalvelujen arviointi. Sosiaali- ja terveysministeriön monisteita 2003:14.

35. Reponen J. Teleradiologia Suomessa.[in Finnish] Suom Lääkäril 1996; 51:1875-1878

36. Reponen J. Radiology as a part of a comprehensive telemedicine and eHealth network in Northern Finland. International Journal of Circumpolar Health. 63(4):429-35, 2004.

37. Reponen J, Niinimäki J. [in Finnish] Digitaalinen radiologia – modaliteeteista tietoverkkoihin. In: Radiologia Suomessa.[Radiology in Finland] . Radiological Society of Finland, WSOY. 2006, p. 76 - 81

38. Sahala H. (2005). Tietoteknologian käytön edistäminen sosiaalihuollossa - hankesuunnitelma. [Abstract in English]. [Project plan for promoting the use of information technology in social services. Stencils of the Ministry of Social Affairs and Health 2005:1] Sosiaali- ja terveysministeriön monisteita 2005:1

39. Salo S., Näyttöön perustuvaa hyvinvointiteknologiaa – Finnish Wellbeing Center. Suomen Lääkärilehti 2006, 13: 1502-1503.

40. Salo S., Konttinen M. Teknologia hyvinvoinnin edistäjänä – Finnish Wellbeing Center –hanke. Suomen Hammaslääkärilehti 2006, 13; 5: 264-267.

41. Saranummi N, Kivisaari S, Väyrynen E, Hyppönen H, Perälä M-L, Saalasti –Koskinen U. Terveydenhuollon uudistaminen. Systeemiset innovaatiot ja asiantuntijapalvelut muutoksen ajureina. Tekes, Helsinki 2005

42. Simonen J. The effects of R&D Cooperation and labor mobility on innovation. Doctoral Dissertation, G Oeconomica 27, University of Oulu 2007 http://herkules.oulu.fi/isbn9789514284083/isbn9789514284083.pdf).

43. STAKES; National Research and Development Centre for Welfare and Health - STAKES. Available from: http://www.stakes.fi/english/index.html

44. STAKES. Available form: http://www.stakes.fi/EN/Ajankohtaista/Tiedotteet/2006/39en_2006.htm

45. Statistics Finland 2006. Available from: http://www.stat.fi/til/index_en.html

46. STM. Sosiaali- ja terveysministeriö. Selvityksiä 2004:9

47. STM. Sosiaali- ja terveysministeriö. Selvityksiä 2006:34, Helsinki 2006.
48. STM Sosiaali- ja terveysministeriö. Selvityksiä 2006:24, Helsinki 2006

49. STM. Sosiaali- ja terveysministeriö. Selvityksiä 2006:56, Helsinki 2006.

50. STM. Terveyskeskus 2015 – terveyskeskustyön tulevaisuus. Sosiaali- ja terveysministeriön selvityksiä 2006:56, Helsinki 2006.

51. STM. Sosiaali- ja terveysministriö. Esitteitä 2008:5 (In Finnish, concerns: national devepomental program of national social welfare and health 2008 – 2011)

52. Taipale V, Hämäläinen H. Kertomuksia sosiaalisista innovaatioista. Stakes M247, Helsinki 2007.

53. Tekes (National Technology Agency of Finland). FinnWell-ohjelma. Innovaatioista hyvinvointia—Painopisteet tulevaisuuden rakentamiseksi Available from: www.tekes.fi

54. Teknologiakatsaus 180/2005, Tekes, Helsinki 2005

55. Tema Nord. Health and Social Sectors with an "e". A study of the Nordic countries. TemaNord 2005:531

56. Terveysteknologian toimialaraportti. Terveen teknologian tekijät, Teknologiateollisuus, terveysteknologia 2007

57. Tilastokeskus.Toimialaluokitus TOL 2002. Tilastokeskus, käsikirjoja 4, Helsinki 2002)

58. Tilastokeskus. www.stat.fi , 2007

59. Tilastokeskus, Alueittainen työssäkäyntitilasto 2002

60. Tilastokeskus, Nettiostotutkimus

61. Tilastokeskus, Tietotekniikan käyttö yrityksissä 2004

62. VNp. Valtioneuvoston päätös. Kansallinen terveysprojekti: www.stm.fi/Resource.phx/hankk/hankt/terveysprojekti.htx, 2002

63. Wallenius T, Hjelt M. Uhasta mahdollisuudeksi? – Väestön ikärakenteen muutokset

64. Suomen elikeino-, teknologia- ja innovaatiopolitiikalle. Gaia, Helsinki 2004.

65. Winblad I, Nykänen P, Reponen J, Hartikainen K toim): Sähköinen potilaskertomus – pomosta piiaksi, ss 8-13. Raportti seminaarista 26.10.2005. Suomen Kuntaliitto, Sosiaali- ja terveydenhuollon tietojenkäsittely-yhdistys, Suomen telelääketieteen seura, Kuntatalon paino, Helsinki 2006

66. Winblad I, Ruotsalainen P, Hartikainen K, Reponen J, Saranto K (toim). Kuka katsoo tietojani? Raportti potilasta koskevan tiedon hallintaa käsitelevästä seminaarista 27.3.2007, ss 7-12. Suomen Kuntaliitto, Helsinki 2007

67. Winblad I, Reponen J, Hämäläinen P. Informaatio- ja kommunikaatioteknologian käyttö Suomen terveydenhuollossa vuonna 2005. Stakesin raportteja, Helsinki 2006.

68. Winblad I, Reponen J, Hämäläinen P, Kangas M. [Abstract in English]. Informaatio- ja kommunikaatioteknologian käyttö Suomen terveydenhuollossa vuonna 2005. Tilanne ja kehityksen suunta. Raportteja 7/2006, Stakes, Helsinki 2006

69. www.terveysportti.fi

11. Appendix, Glossary of Terms and Abbreviations

CDA	Clinical document architecture
DICOM	digital imaging and communication in medicine
EBM	evidence based medicine
EDI	electronic data exchange
EHR	electronic health record
ENoLL	European Network of Living Labs
EPR	electronic patient record
eHealth	use of information and communication technology in health care and health related issues
Finn Tele-medicum	Centre of Excellence for Telehealth at the University of Oulu
HL7	a set of standards related to medical documents
ICD-10	international classification of diseases
ICT	information and communication technology
ISO	international standard organisation
NGO	non governmental organisation
OID	object identifier code
PACS	picture archiving and communication systems
PHR	personal health record
PKI	public key infrastructure
RIS	radiology information system
STAKES	National Research and Development Centre for Welfare and Health
STM	Ministry of Social affairs and Health of Finlans
XML	extendible markup language

The context and development of eHealth innovations in Scotland with particular reference to the Highland region

David Heaney
Mary Wakeling
Anne Roberts
Lee Dowie

January 2009

1495
UNIVERSITY OF ABERDEEN

Centre for Rural Health
Research and Policy
The University of Aberdeen and UHI Millennium Institute working in partnership

Report produced by:

Centre for Rural Health
University of Aberdeen
The Centre for Health Science
Old Perth Road
Inverness
IV2 3JH
Scotland
m.wakeling@abdn.ac.uk
d.heaney@abdn.ac.uk
Tel: +44 (0) 1463 255889

Lead Partner Organisation

The Northern Ostrobothnia Hospital District
Oulu University Hospital
P.O.Box 10
FI-90029 OYS
Finland

Partners

FINLAND

Northern Ostrobothnia Hospital District and Oulu University Hospital
Project Leader: Pasi Parkkila
pasi.parkkila@ppshp.fi
Project Coordinator: Minna Mäkiniemi
minna.makiniemi@ppshp.fi

SWEDEN

County Council of Västerbotten
Karl-Erik Renhorn
karl-erik.renhorn@vll.se
Umeå University
Eva Lindh Waterworth
eva@informatik.umu.se

NORWAY

Norwegian Centre for Telemedicine and University Hospital of North Norway
Frank Larsen
frank.larsen@telemed.no

IRELAND

Department of General Practice, National University of Ireland
Anne MacFarlane
anne.macfarlane@nuigalway.ie

Project part financed by the European Union

1 Demographic structure of Scotland

1.1 Current situation

The population of Scotland is currently at its highest level since 1983. The estimated population in mid-2007 was 5,144,200, a rise of 27,300 on the previous year. In the twelve months up to mid-2007, the number of births in Scotland exceeded the number of deaths by 1,100, whereas during 2005-06 there were around 300 more deaths than births.

Over the same period Scotland experienced a net migration gain of 26,800 from other regions of the UK and from overseas.

The average population density was 66 persons per square kilometre for Scotland as a whole, ranging from 8 persons per square kilometre in Highland Council area to 3,316 persons per square kilometre in Glasgow City Council area.

Data from the Mid-2007 Population Estimates Scotland (July 2008)
- www.gro-scotland.gov.uk

1.2 Future demographic trends

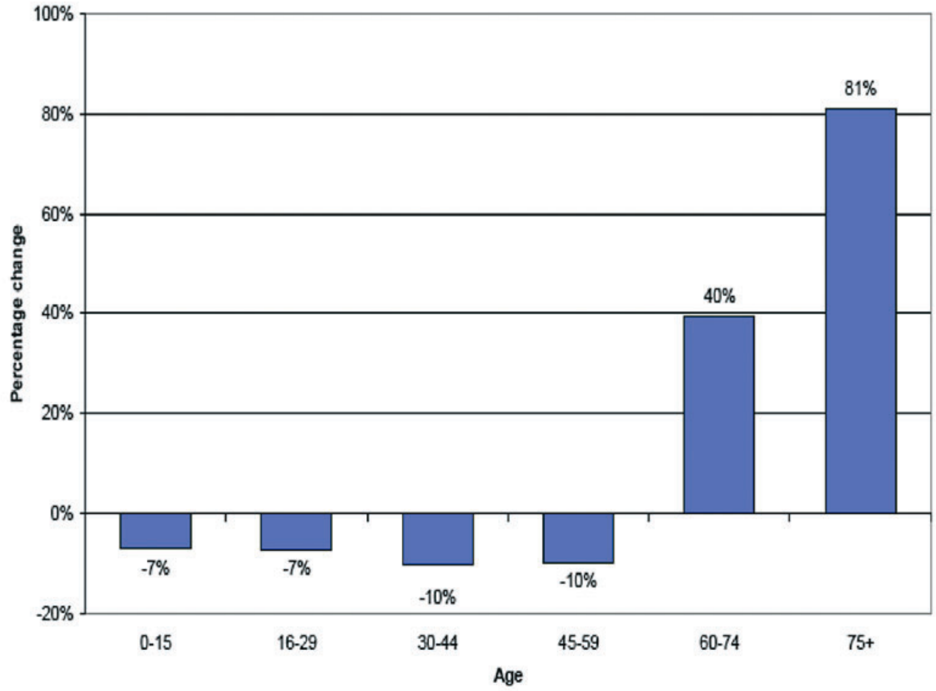
Scotland's population is projected to grow from 5.12 million in 2006 to around 5.37 million by 2031, followed by a slow decline. In 2006 there were 0.92 million children under 16 – this figure is expected to decrease by approximately 7% over the 25 year period up to 2031. The highest projected increase is in the category of persons over 60 years of age, and particularly those over 75 years. These ageing demographic trends will have implications for the future provision of health services across Scotland.

Table 1. Projected population of Scotland by age group: 2006-2031

						('000s)
	2006 (base)	**2011**	**2016**	**2021**	**2026**	**2031**
All Ages	**5,117**	**5,206**	**5,270**	**5,326**	**5,363**	**5,374**
0-15	922	897	896	905	887	858
16-29	912	955	922	864	842	848
30-44	1,107	1,019	978	1,011	1,032	994
45-59	1,058	1,104	1,144	1,081	992	955
60-74	735	812	866	939	988	1,026
75+	382	417	464	526	622	692
Children	922	897	896	905	887	858
Working ages	3,213	3,260	3,303	3,309	3,313	3,227
Pensionable ages	983	1,048	1,072	1,112	1,163	1,289

1 Pensionable age is 65 for men, 60 for women until 2010; between 2010 and 2020 pensionable age for women increases to 65. Between 2024 and 2046, state pension age will increase in three stages from 65 years to 68 years for both sexes.

Table 2. **The projected percentage change in Scotland's population by age group, 2006-2031**



Data from the Mid-2007 Population Estimates Scotland (July 2008)
- www.gro-scotland.gov.uk

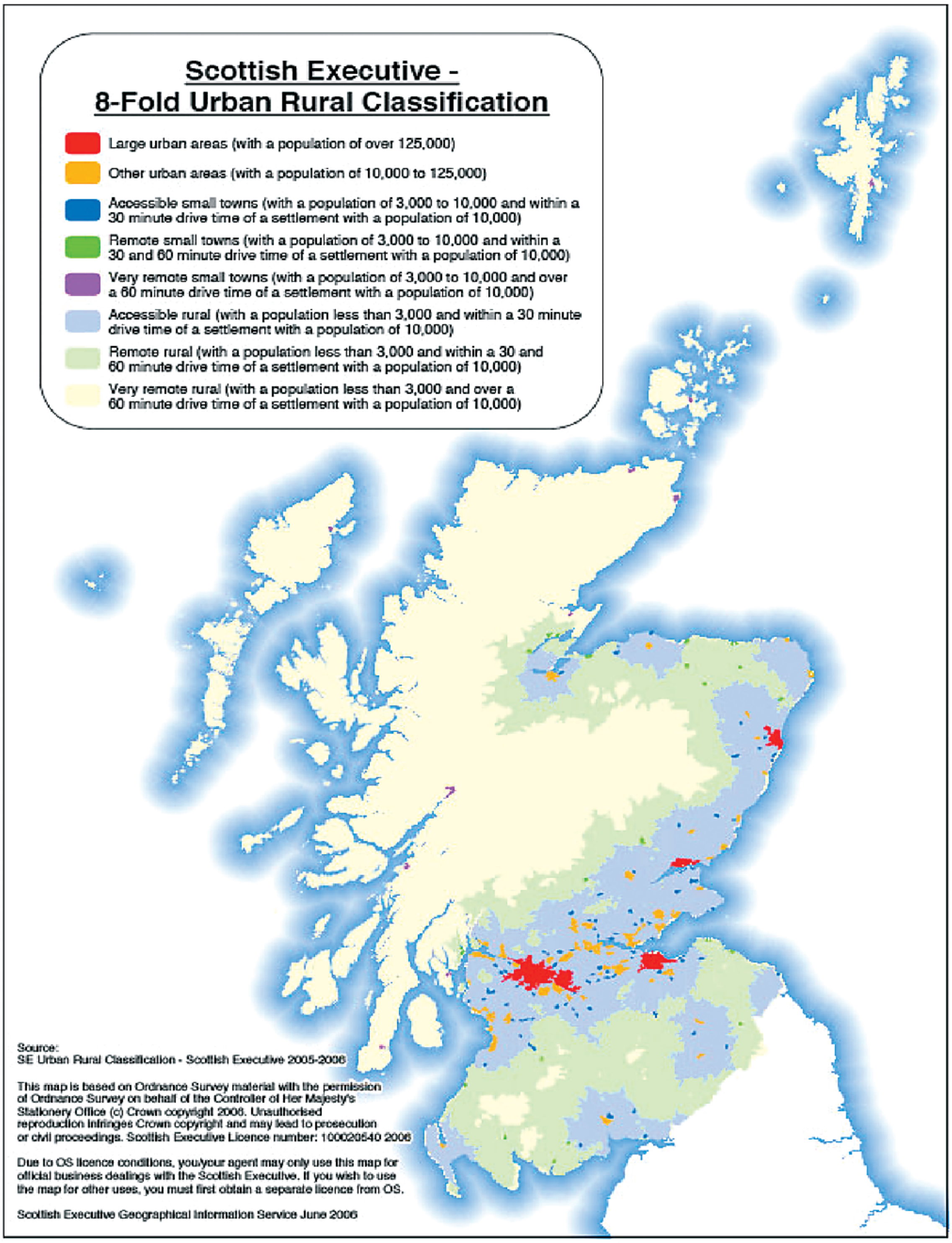
1.3 Remote and Rural Scotland

Of the 5 million plus people that live in Scotland, almost 1 million of them live in rural areas. Rural Scotland accounts for almost 20% of its population. The Scottish Governments (formerly the Scottish Executive) Urban Rural 8 fold classification is the most widely used measure of rurality in Scotland. The key determinants of rurality are the size of the settlement and the distance (in drive time) to an urban centre. Its classifications range from large urban area (with population over 125,000) to very remote, rural area (with population less than 3000 and over 60 minute drive time to a larger settlement of 10,000 or more).
www.scotland.gov.uk/Publications/2005/09/08115837/58393

Settlements of 3000 people or less are defined as rural and populations greater than 3000 are defined as urban. If a settlement is within 30 minutes travelling time of a larger settlement it is defined as "accessible". Settlements further away in travel time than 30 minutes are described as "remote".

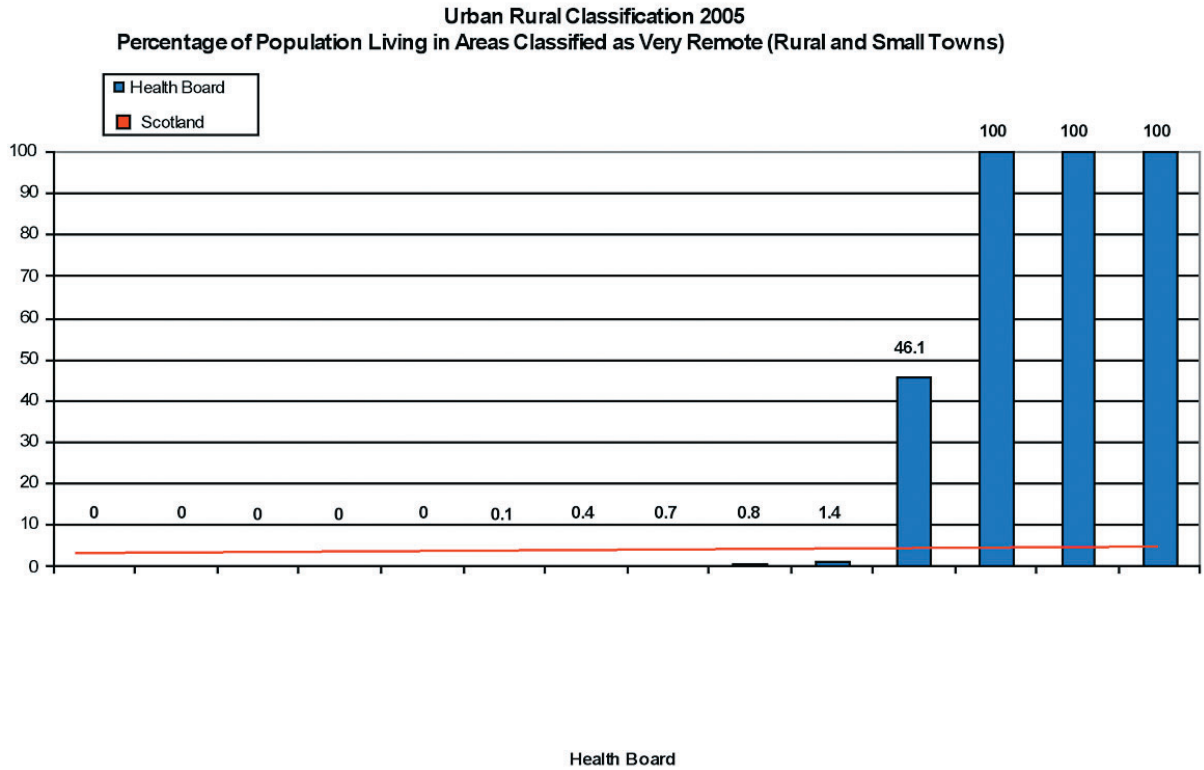
The geographical map below shows the spread of Scotland's population from large urban centres to very remote rural localities:

Figure 1. **Scottish Executive 8-Fold Urban Rural Classification (2005-2006)**



Only a small proportion of the population in Scotland is classified as very remote, however as the table below demonstrates 46.1% of Highland Health Board residents are classified as residing in "very remote" (rural and small towns).

Table 3. Percentage of Population Classified as Very Remote (Rural and Small Towns) by Health Board



2 Scottish Health Care System

The vast majority of healthcare in the United Kingdom is provided by the National Health Service (NHS), funded from public taxation and free at the point of delivery, with the exception of some charges for dental and optical treatment and prescriptions. Exemptions apply for children, people over 60 years of age and those on benefits related to low income.

Healthcare in Scotland is a matter devolved to the Scottish Government. The directorate of Health & Community Care administers and funds NHS Scotland, whose structure and organisation differs from that of the NHS in England, Wales and Northern Ireland.

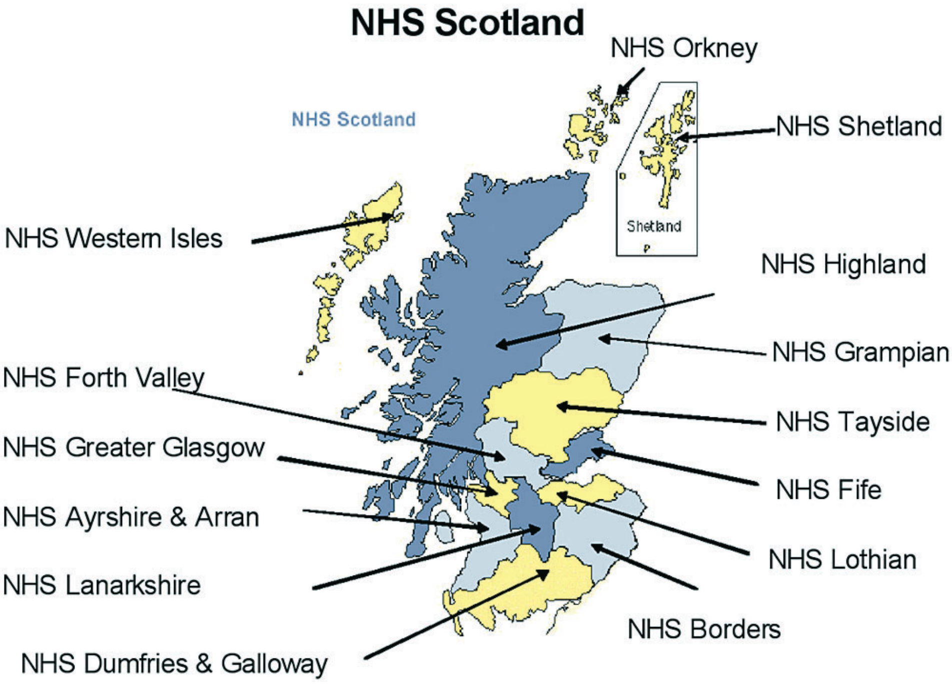
2.1 Structure of NHS Scotland

2.1.1 Health Boards

Scotland is divided into 14 territorial NHS Boards, responsible for the planning and delivery of all health services in their own areas. Some Health Boards cover small geographical areas with relatively dense, primarily urban populations (e.g. NHS Greater Glasgow & Clyde and NHS Lothian); several cover scattered island groups to the west and north of the mainland (Western Isles, Orkney and Shetland).

NHS Highland covers the largest area (32 518 sq km – 41% of the Scottish land surface) and has the lowest population density (approximately 299,000 residents in the combined council districts of Highland and Argyll & Bute). These figures are swollen by tourists visiting the Highlands, which at certain times of the year can double or even triple the local population (NHS Highland website).
Due to the geographical complexities in NHS Highland - mountainous terrain, a long indented coastline with inhabited islands, a high proportion of rural and remote communities and difficult weather conditions in winter, the provision of effective and economic health services is a constant challenge.

Figure 2. Map of NHS Scotland Boards



In addition, there are eight Special Health Boards in Scotland, responsible for providing national services. These are:

- NHS Health Scotland
- NHS Quality Improvement Scotland
- The Scottish Ambulance Service
- NHS National Waiting Times Centre
- The State Hospital Board for Scotland
- NHS 24
- NHS Education for Scotland
- NHS National Services Scotland

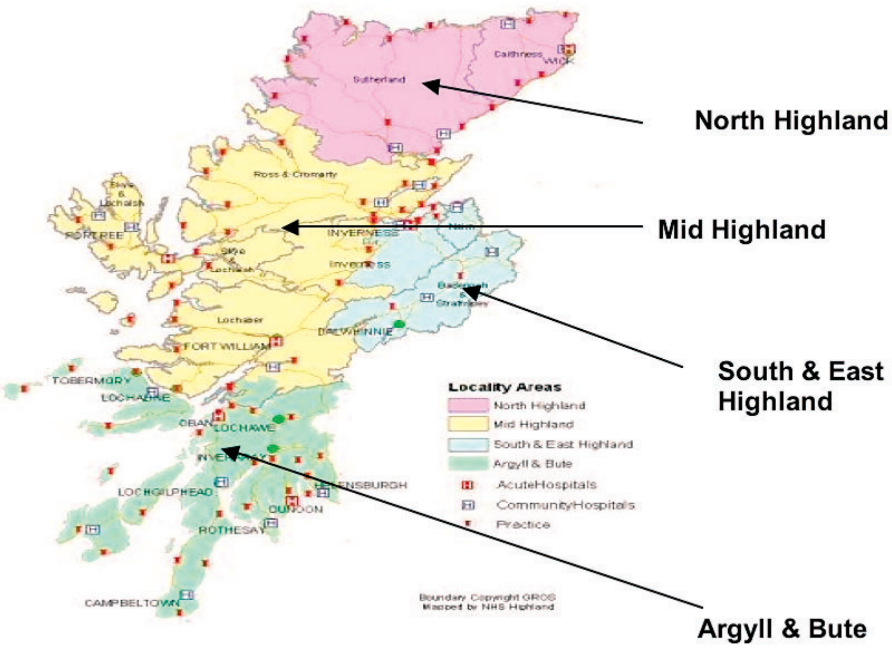
(SHOW website)

2.1.2 Community Health Partnerships

Community Health Partnerships (CHPs) have been established within all Health Boards, as a result of the NHS Reform (Scotland) Act of 2004. CHPs aim to integrate primary care, specialist services and social care in their areas, working in partnership with local authorities, the voluntary sector and other stakeholders, including patients and carers (Scottish Government Health Directorates website).
There are four Community Health Partnerships covering the NHS Highland area:

- North Highland
- Mid Highland
- South East Highland
- Argyll & Bute

Figure 3. Map of Community Health Partnerships in NHS Highland region



(NHS Highland website)

2.1.3 Secondary/tertiary care structure

NHS Scotland operates four categories of hospital:

- District General hospitals
- Rural General hospitals
- Community hospitals
- Specialist hospitals (e.g. Yorkhill Children's Hospital in Glasgow)

In NHS Highland there is one District General hospital (Raigmore, situated in the Highland's only city of Inverness), offering a wide range of acute services. Patients are referred to Raigmore Hospital from across the region.

Rural General hospitals are located at Wick in the north of the region, at Oban and Fort William in the west, as well as in the three main island groups of Orkney, Shetland and the Western Isles. The hospital at Stornoway in the Western Isles is linked to Raigmore for specialist services. The Shetland and Orkney hospitals have links with Aberdeen.

There are 21 Community hospitals in NHS Highland which serve smaller, mostly rural, communities scattered throughout the Highland region.

2.2 Finance

The overall budget for NHS Scotland in 2007-8 amounted to £10.26 billion. 79% was allocated to the 14 territorial Health Boards, according to the Arbuthnot Formula. This is based on population numbers, adjusted to allow for the additional costs associated with a higher than average incidence of elderly patients, areas of deprivation, and a remote and rural population.

The proportion of older people in the NHS Highland area (37% aged 65 or older) is above the Scottish average of 19.3% (Henderson and Steer, 2007). However, levels of morbidity and levels of deprivation are well below the Scottish average (NHS Highland website).

In 2006/07, 60% of Board expenditure nationwide was spent on hospital care, 13% on community health services and the remaining 27% on family healthcare (i.e. GP practices, community prescribing, dental and ophthalmic services)

(Data from the High Level Summary of Statistics Trend Last update: Monday, May 19, 2008 www.scotland.gov.uk/Topics/Statistics/Browse/Health/TrendHealthWorkforce)

2.3 Staffing

The following data is based on figures obtained from the Information Services Division Scotland (dated 30/09/07):

In 2007 NHS Scotland employed just over 162,000 staff across all categories. The largest staff group consists of nurses and midwives, comprising 41% of the total workforce - 57,050 (WTE – Whole Time Equivalent), an increase of 266 on the previous year. This number includes a small category of clinical nurse specialists (1,344 WTE).

15,349 medical and dental staff were employed throughout the service, an increase of 750 on the previous year. This figure includes GPs, hospital, community and public health services, excluding locums.

There were 8,951 Allied Health Professionals (AHPs) (WTE) in post, representing a small increase on 2006 figures. The biggest group was physiotherapists (28.2% of the total), followed by occupational therapists (24.1%) and radiographers (20.5%). AHPs comprise 6.7% of the total NHS Scotland workforce.

The majority of NHS Scotland staff have now been assimilated onto the new Agenda for Change pay bands, terms and conditions (a new system applicable across the UK). It is a key reform element of the Pay Modernisation Agenda which focuses on providing more effective, patient-centred care, better value for money and redesign of services.

Table 4. NHS Scotland workforce statistics

All NHS Scotland staff (including GPs & GDs)	Total	NHS Highland
	162,139.0	**9,010.0**
Medical (Hospital, community and public health services)	11,128.0	447.0
General medical services	4,721.0	402.0
Dental (Hospital, community and public health services)	695.0	69.0
General dental services	2,546.0	166.0
Medical and dental support	1,264.0	168.0
Nursing and midwifery	67,345.0	4,024.0
Allied health professions	10,981.0	610.0
Other therapeutic services	3,265.0	136.0
Personal and social care	704.0	36.0
Healthcare science	5,760.0	292.0
Emergency services	3,655.0	-
Administrative services	29,366.0	1,610.0
Support services	19,645.0	1,123.0

(Adapted from ISD (Information Services Division) website - www.isdscotland.org)

2.3.1 New approaches to staffing

Several changes have been made in recent times to traditional staffing roles, some being particularly relevant in the remote and rural context.

GPs with Special Interests (GPwiSI) – a concept developed since the late 1990s, to encourage GPs with additional training and experience to deliver more specialised care within the community. Special interests can, for example, encompass care for older people, palliative care and chronic conditions such as coronary heart disease or diabetes.

Extended Community Care Teams (ECCT) – integrated working between a range of health and social care practitioners, ideally co-located in a Community Resource Hub (GP practice or community hospital). This is a recommendation put forward in Delivering for remote and rural healthcare (Scottish Government 2008a).

Community Health Nurses – merging the traditionally distinct roles of district nurse, health visitor, school nurse and family health nurse into one generic role. This proposal stems from the Scottish Executive's Review of nursing in the community in Scotland (2006). NHS Highland was selected as one of the early development sites for this new model.

Generic Support Workers – trained to work across the health and social care spectrum, supporting individuals with self-care, rehabilitation at home, after early discharge from hospital, undertaking basic observations and screening processes, short term home-based nursing etc. This role is being piloted in Shetland (Scottish Government 2008a).

3 Health policy framework in Scotland

Scotland's eHealth strategy is set within the context of national legislation and policy on healthcare, published by the Scottish Government.
Key policy documents since 2005 are:

- Building a health service fit for the future (Kerr Report) – 2005
- Delivering for health – 2005
- Better health, better care: action plan – 2007
- Coordinated, integrated and fit for purpose –
- a delivery framework for adult rehabilitation in Scotland - 2007
- Delivering for remote and rural healthcare – 2008
- NHS Scotland – eHealth strategy 2008-2011 (Consultation draft April 2008)
- Review of nursing in the community in Scotland - 2006
- Seizing the opportunity: Scottish telecare strategy 2008-2010 – 2008

3.1 Challenges for healthcare in Scotland

The Kerr Report (2005) identifies the following challenges for healthcare in Scotland:
- an ageing population (within 25 years one in four of the population is expected to be over 65, and one in twelve over 80)
- a growth in long term conditions (27% of people aged 75-84 have two or more long term conditions co-existing)
- a growth in emergency hospital admissions among older people
- the growing divergence in life expectancy, despite the general improvement for Scotland as a whole.

3.2 Service redesign

To meet these challenges a major shift of emphasis and practice is required:

From:
- Episodic, reactive, acute care of illness, emergency hospital admission

To:
- Focus on preventive medicine
- Support for self-care
- Anticipatory care for those most at risk
- Intensive case management of long-term conditions
- More capacity for local diagnosis and treatment
- More continuous care in the community

"90% of patients' interaction with the NHS starts and ends in primary care;…hospitals should be our last resort for most health care needs, not our first port of call" (Scottish Government 2005b).

The aim is to offer patients an integrated 'journey of care' regardless of where they access the health service, with emphasis on partnership and multi-disciplinary working across organisational boundaries. Learning from innovative evidence-based best practice from elsewhere is strongly encouraged (Scottish Government 2005b).

3.3 National priorities & targets

Scotland has designated four priority clinical areas; the Scottish population has a high incidence of these conditions compared to the rest of western Europe;

- Coronary heart disease
- Stroke
- Cancer
- Mental health (including dementia from 2008)

Scotland is committed to the 18 week 'referral to treatment' target, which sets this as the maximum time a patient should wait between seeing a GP, being referred to a consultant and commencing treatment, if appropriate. Reducing the length of time taken to obtain diagnostic test results is a key factor in this – telemedicine can enable patients to be assessed remotely from a community setting, thus speeding up the chain of events. December 2011 is the target date for full implementation of this 18 week standard.

3.4 IT infrastructure issues

Work is continuing at national level to develop a robust high specification network that can handle image and data transfer and video conferencing – this is not expected to be in place for about two years. However, the principle is accepted that infrastructure, level and quality of connectivity should be equal across Scotland, though the level of investment will be disproportionate in remoter areas. Mobile phone network coverage and broadband access is not universal in the rural areas of Scotland at present, hindering the adoption of eHealth solutions (Scottish Government 2008a).

There are problems with some existing local IT systems at Health Board level – some are ageing, designed to support administration rather than clinical patient care, and incompatible with systems across Board boundaries. IT development is patchy, with some areas more advanced than others. There is a need for greater investment both locally and nationally, and the introduction of common data standards between systems (Scottish Government 2008b).

Ensuring that patient data is stored and transmitted securely is a high priority, in order to maintain patient confidentiality and comply with the UK Data Protection Act (1998).

4 e Health in Scotland

The Scottish national eHealth budget is projected to grow from under £40 million in 2005-2006 to around £140 million in 2010-2011 (Scottish Government 2008b).

4.1 Aims of eHealth

The aims of eHealth in Scotland are to:
- focus on benefits, rather than technology
- make patient care safer and more effective by having the right information in the right place at the right time
- ensure secure handling of confidential patient data
- involve patients in the management of their own healthcare
- enable more efficient use of healthcare resources (less paper processing, separate record keeping)

4.2 Role of eHealth in remote & rural areas

eHealth is seen as integral to health service delivery in the remote rural regions of Scotland, predominantly the Highlands and Islands, despite practical difficulties with IT infrastructure.

"The concept of utilising eHealth in the remote and rural situation is not an addition or an add-on, it is more of a developing philosophy which should permeate thinking around every aspect of the remote and rural agenda…and every aspect of service planning and delivery to maximise local access and reduce the need for patient travel" (Scottish Government 2008a).

In the context of adult rehabilitation services, for whom two key client groups are older people and those with long-term conditions, the NHS is expected to:

"maximise developments in eHealth, telehealth and new technologies to ensure equitable access and service provision, especially for those in remote and rural areas" (Scottish Executive 2007).

eHealth can play a role by:
- providing specialist advice remotely by video conference, phone or e-mail
- transmitting digital data, including images, to aid diagnosis and monitoring
- reducing travel for patients by channelling eHealth services through Rural General and Community hospitals, GP surgeries or directly into homes.

4.3 The electronic health record

The creation of an electronic health record is seen as a key mechanism for achieving this radical shift of priorities and practice, based on international evidence. The challenges posed by a fragmented patient record system are quantified as:

- one in seven hospital admissions occurs because care providers do not have access to previous hospital records
- 20% of laboratory tests are requested because the results of previous investigations are not accessible
- 15% of hospitalisations are complicated by medication error

(Scottish Executive 2005b)

In principle, authorised healthcare professionals should be able to access patients' electronic health records regardless of where they are being treated, whether in a primary or secondary care setting (this is particularly important when unscheduled care is required while away from home). The plan is to link existing records through a 'clinical portal' with a single online entry point, rather than creating a unified single record stored centrally. This fits with Scotland's declared policy of developing eHealth in an incremental and pragmatic way, building on what already exists, filling gaps and building bridges between systems (Scottish Government 2008b).

4.4. Scottish Centre for Telehealth

The Scottish Centre for Telehealth came into being in 2006, with the aim of supporting and guiding the development of telehealth for clinical, managerial and educational purposes across Scotland. This involves working across boundaries with industry, Local Authorities and NHS Boards to develop recognised models for redesigning care. The core functions of the Scottish Centre for Telehealth are to:

- provide a centre of expertise to define and disseminate best practice and develop inter-operable standards, protocols and processes to support telehealth solutions
- provide practical and informed support to telehealth projects in their development phase and to NHS Boards implementing National Telehealth Reference Solutions
- co-ordinate the evaluation of projects capable of evolving into National Telehealth Reference Solutions and support the process of awarding funds to projects
- evaluate the impact of telehealth solutions on service redesign

The Centre has initiated projects relating to long term conditions (e.g. COPD, epilepsy), paediatrics, unscheduled care and remote/rural care and is responsible for managing a number of the local eHealth applications (detailed below).

4.5 National, regional and local eHealth initiatives

eHealth provision operates on three levels in Scotland:

- **National core programme** - mandatory, centrally funded applications

Examples: Emergency Care Summary, clinical portal (SCI Store/Gateway), Patient Management System (secondary care)

- **Regional applications** - organised where clinical or business needs make it sensible to do this at regional, rather than national level. Common data standards should apply across regions.

Examples: Managed Clinical Networks (MCNs) for specific conditions such as cancer and epilepsy

- **Local applications** - where no national options exist (funded mostly by Boards, maybe with some central funding)

Examples: Clinical telehealth projects between rural areas and urban hospitals

4.6 Future developments

In the longer term, there are plans to move towards a single medication record, available to authorised prescribers, and towards integrated information-sharing across health and social care, especially for nurses, midwives and Allied Health Professionals. Current progress towards the eCare framework and Single Shared Assessments is incremental and patchy.

5 e Health in NHS Highland

5.1 Strategic planning

The NHS Highland area is a challenging environment in which to provide effective and economic health services, given the combination of mountainous terrain, a long indented coastline with inhabited islands, limited transport infrastructure, a high proportion of rural and remote communities, difficult weather conditions in winter and demographic factors.

The contribution that eHealth can potentially make to the delivery of healthcare in Highland is spelled out in the document **NHS Highland e-health strategy 2005-2007**, issued in March 2005. It remains in force (September 2008), but is due to be superseded by a new strategy covering the period 2008-2011 in December 2008.
Information derived from the 2005-2007 strategy document is supplemented by updates issued in the interim period:

- **The development of a telehealth strategy for NHS Highland** (report presented by William McKerrow to NHS Highland Board, 5 June 2007)
- **E-health/Tele-Health update as at 31 May 2008** (issued 3 June 2008 by NHS Highland Board)

Telecare is viewed as being in a slightly different category from other eHealth applications because of its focus on multi-agency provision of support for independent living. A separate strategy has therefore been produced:

- **Highland Telecare Service: service development strategy 2007-2009** (2007)

5.1.1 Vision

"The vision for eHealth Services in NHS Highland is to pursue excellence in terms of supporting direct patient care, education and learning, and management processes by deploying and exploiting modern, robust and secure infrastructure"(NHS Highland 2005)

In specific terms this means:

Direct patient care

- Planned applications to address the national clinical priority areas of cancer and coronary heart disease
- Other areas to address include; diabetes, renal & genito-urinary medicine services, children's services, endoscopy, community dentistry & pharmacy, maternity and mental health services
- Use of SCI Store to offer seamless integration of patient information (current and historic) from GP systems, archived case notes, departmental systems, lab and imaging systems.

- Upgrade of GP equipment, systems, especially with a view to improving connectivity.
- Involvement in national initiatives, such as PACS, Emergency Care Summary, use of CHI (Community Health Index) numbers as the primary patient identifier.

Education & learning

Staff of all disciplines should be able to share in learning regardless of location – with access to training courses, reference and research material, e.g.:

- eHealth training centre in Inverness
- ECDL training
- NHS Scotland e-library
- GP IT mentoring scheme
- Commitment to training out in remote/rural areas (tele-education)

Management processes

Senior management, clinical and non-clinical staff to access information and technology to reduce back office functions, e.g:

- Use of SCI Gateway for referral and discharge letters
- Expansion of Patient-Focused Booking
- Monitoring of waiting information
- Activity, financial and staffing data
- Document management system
- Use of national eProcurement system

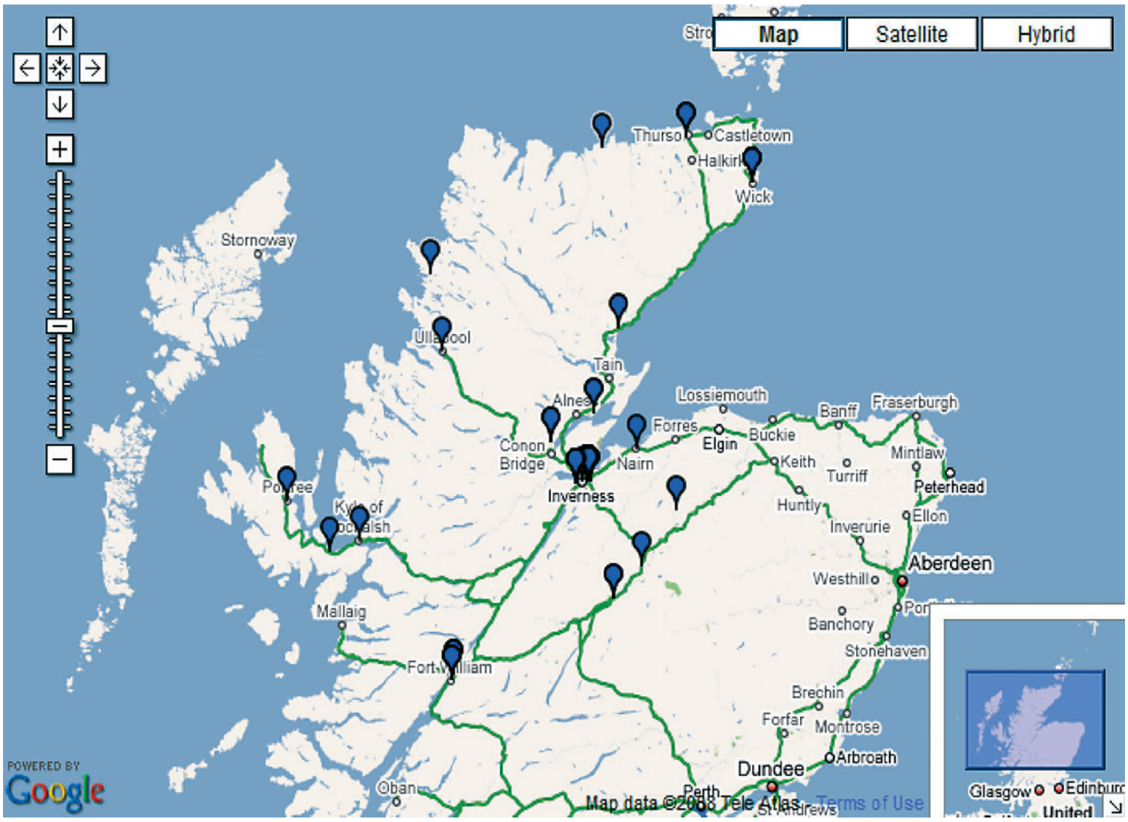
Infrastructure

- Move to conform to national standards where these exist.
- Enhance and upgrade IT networks, to enable transmission of images, PACS, telemedicine applications, video conferencing
- Development of security policies

In general, it is acknowledged that NHS Highland needs to address its legacy of underfunding of eHealth (below the national average), which has resulted in ageing systems and deferred development. Robustness and reliability of equipment is improving, after initial technical challenges.

NHS Highland has invested considerably in video conferencing from 2007, with the appointment of two dedicated staff to manage a network which has grown from eight to approximately 100 video conferencing units distributed around the Highland region (some 20 units in Argyll & Bute are currently managed separately). The units range in size from small desktop units, potentially capable of being used over a broadband connection from a patient's home, to large screen mobile units. The eventual aim is that patients in Highland should not have to travel for more than an hour or so to reach a medical facility with a video conferencing link.

Figure 4. Map showing the location of video conferencing units in NHS Highland region (excluding Argyll & Bute) at September 2008



Factors which are driving the development of eHealth in Highland:

- overall framework of national-level policy Delivering for health (2005) – encouraging the integration of IT into all areas of provision, including clinical
- Scottish Government investment (e.g in IT infrastructure for community hospitals, GPs etc)
- critical service pressures (resulting in the need to provide remote clinical support to one community hospital)
- vision, commitment, energy of a few individual 'champions'

(McKerrow 2007)

5.2 Current eHealth applications

5.2.1 National core programme

NHS Highland participates in several national eHealth initiatives which operate across the whole of Scotland:

- Emergency Care Summary - patient records
- SCI Store & Gateway - patient records
- NHS 24 - telephone helpline and website
- E-library - online health information library
- PACS (Picture Archiving & Communication System) – digital transmission of images
- Telecare Development Programme – home monitoring of elderly and other vulnerable users
- Diabetes Retinal Screening Programme – digital images stored in national diabetes database

5.2.1.1 Emergency Care Summary (ECS)

A summary is compiled for all patients, based on current GP records, containing the name, date of birth, GP surgery, CHI (Community Health Index) number, medication and known allergic reactions. This summary is stored electronically for access by out of hours staff, NHS 24 and Accident & Emergency departments, in emergency situations. Access to the full record is restricted to authorised clinicians with individual usernames and passwords; access is audited to preserve patient confidentiality. If conscious, the patient must give consent before the ECS is accessed, on each occasion.

The system has been in operation from 2006, with over 25,000 recorded instances of use per week (2007 figures taken from Better health, better care action plan - Scottish Government 2007).

Use of the ECS in Scotland informs clinical decision making, minimises the risk of adverse drug interactions in unscheduled care, and enables existing medical conditions to be taken into account in diagnosis and treatment. It is especially useful out of hours, when it is not possible to phone a GP surgery to check full medical records.

Individual patients may choose to opt out of having an ECS, or not consent to its use on a specific occasion.

5.2.1.2 SCI Store and SCI Gateway

SCI is an abbreviation for Scottish Care Information and forms the basis of services used by clinicians working in primary and secondary care settings.

SCI Store is the repository for patient data (such as lab test results) within each Health Board; it is increasingly seen as the basis for the cross sector electronic patient record.

SCI Store-to-Store is a proposed system for sharing data between individual Health Board Stores. It has been under development for around two years. There is strong clinical interest in this becoming operational.

SCI Gateway is a national system for communication between primary & secondary care systems, e.g. for referral and discharge letters (not currently funded).

The chief advantage lies in giving clinicians immediate access to test results and other patient data, avoiding postal delays. The standard is, however, uneven across the country. Some Boards are more advanced in implementing it effectively.

5.2.1.3 NHS 24

NHS 24 is Scotland's first point of contact during the out of hours period, in the form of a nurse led telephone helpline and additional website (www.nhs24.com). It thus offers convenient access to health care, information and advice out of hours to anyone with a phone and/or Internet connection.

NHS 24 handled 1.5 million calls in 2006/7; over 5.5 million calls since its inception in 2002. There were 93,000 calls over the Christmas/New Year period 2006/7, a 15% increase on the previous year. Call handlers from NHS 24 refer patients on to nurses, pharmacists or mental health counsellors as appropriate, or may call an ambulance for emergency situations.

The NHS 24 website offers a self-help guide, A-Z of symptoms, an interactive body diagram to locate symptoms, general health information, the facility to find GPs, dentists and pharmacies in the enquirer's local area. Information is provided in several languages besides English. 193,000 visits to the website were recorded between November 2006 and April 2007.

5.2.1.4 NHS Scotland e-library

The e-library went live in 2003 and is continually evolving. It is open to all NHS Scotland staff, students, academics involved in health education and the general public. It provides online access around the clock to evaluated, evidence-based health information resources – bibliographic databases, full text electronic journals, e-books, policy documents, clinical guidelines, systematic reviews, patient information (on all topics, with additional sections on diabetes, stroke and Polish language information), evaluated websites, news features and alerts. Information is arranged in portals by specialities and user groups, for example remote and rural, stroke, diabetes, community pharmacy, speech and language therapists.

Much of the content is open access, although clinical databases are restricted to NHS staff and students via an authenticated username and password. New resources are added to portals by Knowledge Services Group staff, based at NES in Glasgow.

As well as information resources, there are interactive online ‘communities of practice’ for special interests, which provide networking opportunities for dispersed health professionals.

NHS staff can access online training through a Virtual Learning Centre (Learn Direct).

5.2.1.5 PACS (Picture Archiving & Communication System)

PACS is a tele-radiology system, providing digital transmission of X-ray, CT scans and other images between remote locations and main hospitals, as well as within individual hospitals. PACS allows digital images to be accessed and displayed on desktop monitors, where they can be viewed by GPs, hospital doctors and patients during consultations. New diagnostic images are uploaded to the database automatically within minutes of being recorded; archived images can be recalled for comparison with the current images on screen.

PACS can be used in conjunction with SCI Store to access written reports which relate to particular images, using the same patient CHI identifying number.

The system has been in use in NHS Highland (Raigmore Hospital, Inverness) from May 2008, with plans to extend it to outlying hospitals. Images produced on film ceasing from September 2008

Scottish Government policy is to prioritise rural areas in the roll out of PACS across the country (Scottish Government 2008a).

5.2.1.6 Telecare Development Programme

The National Telecare Development Programme was inaugurated by the Scottish Government in August 2006 to address the growing needs of frail elderly and other vulnerable people (such as those with learning and other disabilities), who require support to remain living independently at home. The aim is for telecare to become embedded in mainstream community care services, forming an integral part of the assessment, care management and review process.

Telecare is defined by the Scottish Government as:
“the remote or enhanced delivery of health and social services to people in their own home by means of telecommunications and computerised systems. Telecare usually refers to equipment and detectors that provide continuous, automatic and remote monitoring of care needs, emergencies and lifestyle changes, using information and com-

munication technology (ICT) to trigger human responses, or shut down equipment to prevent hazards."
(http://www.jitscotland.org.uk/downloads/1208770184-telecare-glossary-of-terms-and-definitions.doc)

An £8 million development fund was made available to health and social care partnerships across Scotland, to fund local telecare initiatives. In 2008 a further £8 million was allocated for use over the period 2008-2010 (Scottish Government 2008c), with the aim of extending telecare to 7,500 more people.

Evaluation to date confirms that approximately 6000 clients have been provided with telecare during the first phase of the programme (figures from December 2007). It is estimated that around £7 million has been saved through a reduction in delayed hospital discharges, unplanned hospital admissions, sleepover care and home check visits. (Joint Improvement Team website - *Telecare Development Programme News*, *July 2008 newsletter*)

Within the context of the National Telecare Development Programme NHS Highland has produced a Telecare Service Strategy to complement its general eHealth strategy. (Henderson & Steer 2007). Highland Community Care Partnership is a joint venture between Highland Council (social care) and NHS Highland (health care), working together with other agencies, service users and their carers. Potential user groups within Highland comprise the frail elderly, those living with chronic disease, physical or learning disabilities, domestic abuse victims and those requiring palliative care. The Partnership has so far received a grant of £330,000 from the national development fund; the plan is to upgrade the existing community alarm system in Phase 1 and move on to incorporate a broader range of sensors and monitors (enhanced telecare) in a second pilot phase.

5.2.1.7 Diabetes Retinal Screening Programme
This programme makes provision for annual screening of patients with diabetes over the age of 12 nationwide who are at risk of retinal damage. There are approximately 11,000 known diabetes patients in the Highland area. The service is organised locally with a choice of location being offered to patients (GP surgeries, community centres, high street optometrists, diabetes centre, mobile units). Digital photos are taken and transmitted electronically, for storage on the national database SCI-DC in Dundee, where they can be accessed by GPs and diabetes specialists.

All NHS Boards populate SCI-DC with the patients they have on their own diabetic registers. Grading of images is done regionally.

5.2.2 Regional applications

5.2.2.1 Managed Clinical Networks (MCN)

Managed Clinical Networks are defined as: "linked groups of health professionals and organisations from primary, secondary and tertiary care, working in a co-ordinated manner, unconstrained by existing professional and Health Board boundaries, to ensure equitable provision of high quality clinically effective services throughout Scotland". (www.epilepsymcn.scot.nhs.uk/aboutUs.htm)

Most MCNs function within single Board areas, although there are a few regional networks which transcend these organisational boundaries. The North of Scotland Cancer Network (www.noscan.scot.nhs.uk) acts as an over-arching body for MCNs for specific types of cancer in the region covered by the three island Health Boards (Western Isles, Orkney and Shetland) and three mainland Boards (Highland, Grampian and Tayside). The aim is to co-ordinate consistent, high quality care across the region. Similarly the North of Scotland MCN for Epilepsy links organisations and professionals across the North of Scotland working with epilepsy, in the primary, secondary and tertiary sectors.

5.2.3 Local eHealth applications in the NHS Highland region

Table 5. Summary of Highland eHealth applications

Location	Medical field
Western Isles/Raigmore (Inverness)	ENT tele-endoscopy
Western Isles/Raigmore (Inverness)	Paediatric diabetes clinic
Raigmore/Glasgow	Various paediatric applications + wider use for clinical education
Argyll & Bute/Glasgow	Cardiology - Home monitoring of heart failure patients
Argyll & Bute/Glasgow	Cardiology outpatient clinic

Inverness/Quarriers (Renfrewshire)	Neurology - epilepsy
Portree (Skye)/Raigmore (Inverness) Inverness/Aberdeen	Neurology – 2 links set up for individual patients with epilepsy and motor neurone disease
Portree (Skye)/Raigmore (Inverness)	Cardiology – capture and secure transmission of ECG readings
Across the region – GRIP (Grid Reference Identification Project)	Asthma and other long term conditions
Raigmore (Inverness) / Rural General Hospitals	MDT cancer and pathology team meetings

5.2.3.1 Tele-endoscopy link between Raigmore Hospital and Western Isles Hospital

This is a service for remotely-based patients with voice, throat disorders, swallowing difficulties,. The service enables early diagnosis of serious conditions, enabling savings in time and consultant / patient travel costs. It also provides specialist ENT education for local healthcare staff (doctors and the Speech and Language therapist).

A consultant at Raigmore Hospital in Inverness is able to talk to the patient over the video conferencing link and view images of the patient's airway. A Speech and Language therapist in the remote site of the Western Isles Hospital in Stornoway carries out the endoscopy procedure and is also involved in therapeutic intervention with most of the patients scoped. The first live examination took place in June 2008 and the tele endoscopy clinics are scheduled to run every 6-8 weeks.

For around 50 per cent of people with benign voice disorders, voice therapy is the main form of treatment and this can commence on the day of the examination.
A similar tele-endoscopy service was previously successfully trialled outwith NHS Highland, between Shetland and Aberdeen and is now considered sustainable. Both this and the Western Isles link have been established by the Scottish Centre for Telehealth.

5.2.3.2 Paediatric tele-health links

One mobile wireless video conferencing unit at Raigmore Hospital is used for a variety of purposes, both clinical and educational. At the main site, the unit allows wireless linking between out-patients, the ward and the Special Care Baby Unit. Staff use the equipment regularly to link in to lectures for education and professional development.

Outpatient diabetes clinics link Raigmore with Stornoway and Benbecula in the Western Isles, utilising the video conferencing facility. These virtual clinics alternate with consultant visits, which now take place every four months, instead of at three month intervals. A consultant at Raigmore uses the link to obtain updates on the progress of child patients with diabetes on the island, once an initial diagnosis has been made in a face-to-face consultation.

A link to Yorkhill Children's Hospital in Glasgow is used as needed, mostly for cardiac cases. It is used less now, as more expertise is locally available in Inverness itself.

5.2.3.3 Tele-cardiology – home monitoring of heart failure

The service is targeted at patients with heart failure who have been discharged from hospital to their homes in Argyll & Bute. This is a remote, widespread area, which presents difficulties for follow-up by a heart failure nurse on the ground.

Monitoring equipment in patients' homes is linked to an urban heart failure service in Glasgow. A variety of plug-in peripherals allows the system to be customised for an individual patient's needs. A heart failure nurse trains patients and carers in use of equipment, and agrees tests to be carried out, e.g daily weight. Alerts are set up to warn of deviation from identified limits, and notify health professionals, who will then contact the patient.

The project encourages patient self-management of their condition at home; support is time-limited, and can be phased out as appropriate. Professionals are alerted to early deterioration in a patient's condition – this measure is expected to reduce crisis hospital admissions.

Set-up problems in the preparatory phase in 2007- 8 included various IT issues, such as data transfer, security of patient data, procurement and the practicalities of working across two Health Boards. (NHS Highland, where the patients live, and NHS Greater Glasgow & Clyde, which hosts the heart failure service).

The service went live in July/August 2008, following rigorous testing in a safe hospital environment. Three patients have been monitored to date, and have given very positive feedback.

5.2.3.4 Tele-cardiology outpatient clinic

The target group is outpatients with cardiac conditions living in Argyll & Bute CHP (Community Health Partnership). Echo, ECG and ETT tests can be carried out locally in real time at Mid Argyll Hospital and transmitted to the cardiology service in Glasgow.

The service is to be led by a nurse and cardiac physiotherapist, based on criteria agreed between the Glasgow-based cardiologist and local staff. It is expected to go live in early 2009, following equipment purchase and testing. Benefits include reducing the need for patients to travel to Glasgow from the rural area, while allowing more appropriate referral of cases which are found to require intervention.

The model is seen as having potential for expansion to other hospitals and other medical conditions.

5.2.3.5 Tele-neurology links
A link is being established between New Craigs hospital in Inverness (specialising in learning disabilities) and Quarriers in Renfrewshire for patients with complex epilepsy. Quarriers hosts the National Epilepsy Assessment Centre. Attending this tertiary centre in Paisley currently entails a round trip of some 350 miles for patients and carers. The service is due to commence in October 2008.

The Scottish Centre for Telehealth has previously piloted a tele-neurology service between Orkney and Aberdeen in 2005-6. This is now part of regular service delivery, with clinics running at bi-monthly intervals. Experience gained from this project is being applied to the new link in Highland.

Two video conferencing links have been put in place to support individual patients with long-term conditions, who are unable to travel to consultant appointments. One patient living in Inverness with terminal stage motor neurone disease has had a small desktop video conferencing unit installed in the home, connected to Aberdeen via domestic broadband. The consultant pays weekly virtual ‘visits’ – otherwise a home visit would be possible only once in three months. Similar technology in the community hospital in Portree, Isle of Skye, will enable contact between a patient with epilepsy and the consultant neurologist at Raigmore Hospital, Inverness.

Both these projects are managed by the Scottish Centre for Telehealth.

5.2.3.6 ECG transmission
D-MAS (Dan Medical Analysis System) is an innovation developed by an Inverness-based company, comprising a medical grade PC with an integrated system for recording 12 lead ECG, blood pressure and spirometry data in a primary care setting. These results can then be transmitted to specialists as encrypted files attached to e-mail or in real time. This method produces a much higher quality ECG reading than the conventional alternative of printing out and faxing the readings between GPs and the hospital, while also protecting patient confidentiality, and speeding up the communication process.

The system has been trialled between a GP surgery at Portree, Skye and cardiology consultants at Raigmore Hospital, Inverness, as well as within the Inverness area, with positive evaluation results. It potentially allows patients with long-term conditions, such as coronary heart disease, COPD and asthma to be managed more effectively in primary care.

5.2.3.7 Other initiatives
Research is continuing into a number of other eHealth initiatives known to be functioning in the NHS Highland area, or projected to start soon.

Multi Disciplinary Team meetings are conducted regularly in the fields of cancer and pathology, using video conferencing facilities to link Raigmore Hospital in Inverness with outlying remote hospitals. Pathology meetings incorporate use of a microscope and visualiser (platform used to display specimen slides).

The charity Asirus (Asthma Support in Rural Scotland) operates the GRIP (Grid Reference Identification Project) in Highland. Patients with severe asthma and other conditions which place them at high risk for calling out an ambulance are identified by rural GPs; a precise grid reference for their home is established and stored on the Scottish Ambulance Service Emergency Medical Dispatch Centre database, so that they can be reached without delay by ambulance staff who have been alerted to their medical condition.

Work is continuing on the theme of 'virtual hospice' in the Highland area, following on from a study which tested the feasibility of using mobile phone-based technology to monitor and manage symptoms of patients receiving palliative care at home.

A home monitoring scheme for cardiac patients in the Mid Highland CHP area is expected to be funded by the British Heart Foundation as a pilot project; other tele-health applications for patients with respiratory disease are also under investigation.

The Scottish Telestroke Network (ScoT Network) for hyper acute stroke care uses video conferencing together with the PACS system to procure a specialist opinion within three hours of a provisional thrombolysis diagnosis at an outlying location. NHS Highland is to be linked with this at a future date (Scottish Centre for Telehealth website).

6 Conclusions

Northern Scotland's ageing demographic profile, in conjunction with its widely dispersed population, means that pressure on existing health services is certain to increase in future. Greater public and professional awareness of advances in technology (both infrastructure and equipment) is also likely to generate increased use of eHealth innovations, as their potential becomes more apparent.

eHealth applications in Scotland operate on two levels: large scale systems to underpin healthcare delivery nationwide (e.g. electronic patient records, telephone helplines, imaging systems), and clinical telehealth solutions, tailored to the needs of particular patient groups or individuals (e.g. diagnostic, monitoring or palliative care for those living in remote locations, delivered via community hospitals, GP surgeries or into patient's own homes).

The Scottish Government sees eHealth as playing a significant part in the drive to 'shift the balance of care' from hospitals to the local community, in line with the policy outlined in successive strategy documents.

This report demonstrates that Scotland possesses a solid base of existing eHealth initiatives, both at national level and locally in the Highland region, with plans to expand this into the future. The time is ripe to build on this foundation, while remaining open to adopting innovations from elsewhere, notably the sparsely populated regions of the northern periphery of Europe, which face comparable challenges. There is great potential for fruitful collaboration with NPP partners in Finland, Norway, Sweden and Ireland.

7 References

Official publications of the Scottish Government
(Formerly the Scottish Executive)

Scottish Executive (2005a) *Building a health service fit for the future: a report on the future of the NHS in Scotland*. Edinburgh, Scottish Executive.

Scottish Executive (2005b) *Delivering for health*. Edinburgh, Scottish Executive.
Scottish Executive (2006) *Review of nursing in the community in Scotland*. Edinburgh, Scottish Executive
Scottish Government (2007) *Better health, better care: action plan*. Edinburgh, Scottish Government.

Scottish Government (2008a) *Delivering for remote and rural healthcare: the final report of the remote and rural workstream*. Edinburgh, Scottish Government.

Scottish Government (2008b). *E Health Strategy for Scotland 2008-2011*. Edinburgh, Scottish Government.

Scottish Government (2008c) *Seizing the opportunity: telecare strategy 2008-2010*. Edinburgh, Scottish Government.

NHS Highland and Highland Council publications

Henderson, D. and Steer, S. (2007) *Highland Telecare Service: service development strategy 2007-2009*. Inverness, Highland Council.

McKerrow, W. (2007) *The development of a telehealth strategy for NHS Highland* [report presented to NHS Highland Board, 5 June 2007]. Inverness, NHS Highland.

NHS Highland (2005) *E-health strategy 2005-2007*. Inverness, NHS Highland
NHS Highland (2008) *E-health/Tele-Health update as at 31 May 2008* [issued 3 June 2008]. Inverness, NHS Highland.

8 Websites

General Register Office for Scotland – www.gro-scotland.gov.uk

Managed Clinical Network for Epilepsy – www.epilepsymcn.scot.nhs.uk

NHS 24 – www.nhs24.com

NHS Highland – www.nhshighland.nhs.uk

NHS National Services Scotland. Information Services Division – www.isdscotland.org

NHS Scotland e-library – www.elib.scot.nhs.uk

North of Scotland Cancer Network - www.noscan.scot.nhs.uk

Scotland's Health on the Web (SHOW) – www.show.scot.nhs.uk

Scottish Centre for Telehealth – www.sct.scot.nhs.uk

Scottish Government – www.scotland.gov.uk

Scottish Government Health Directorates – www.sehd.gov.uk

Scottish Government Health Directorates. Joint Improvement Team - www.jitscotland.org.uk

9 Abbreviations

AHP	Allied Health Professionals
CHI	Community Health Index
CHP	Community Health Partnership
COPD	Chronic Obstructive Pulmonary Disease
ECCT	Extended Community Care Team
ECDL	European Computer Driving Licence
ECS	Emergency Care Summary
GPwiSI	General Practitioner with a Special Interest
MCN	Managed Clinical Network
NES	NHS Education for Scotland
NHS	National Health Service
PACS	Picture Archiving & Communication System
SCI	Scottish Care Information
SHOW	Scotland's Health on the Web
WTE	Whole Time Equivalent

The context and development of eHealth innovations in Sweden

Eva Lindh Waterworth
Ulla-Maija Pesola
P-O Söderström
Karl-Erik Renhorn

September 2008

1 Introduction to Swedish healthcare system

The current population of Sweden is 9,182,927 (Dec 2007). The total number of the aged population registered in Sweden is 1,608,413 persons (December 2007). The old and very old aged population (aged from 65 years) accounts for 17,5 % of the Swedish population. The prognosis is that in 2025 the aged population will be 2 171 813 person and in 2050 the prognosis is that the aged population will be 2 477 406

The elderly population is increasing in many societies, and in developed countries such as Sweden women live on average 6-8 years longer than men. This implies the presence of gender-specific factors in health. Despite greater life-expectancy, older women are more likely to experience functional impairment in mobility and self care than older men. Moreover, women experience greater morbidity and utilise health care resources more than men. Older women have a lower health related quality of life and reduced functional capacity compared with men, despite living longer. These differences are mainly due to a higher prevalence of disability and chronic conditions among women.

By international standards, the level of health and health care in Sweden are good. Infant mortality is low, at 3.4 deaths per 1,000 in the first year of life. Cardiovascular conditions account for half of all deaths, but the rates fell substantially during the 1980s, which has contributed to a higher average life expectancy of 77.1 years for men and 81.9 years for women.

1.1 Public Health Care

All Swedish citizens are covered by the public Health System, which is stated in four Swedish laws:

- Hälso- och sjukvårdslagen (1982:763)
- Lagen (1991:1128) om psykiatrisk tvångsvård (LPT)
- Lag (1991:1129) om rättspsykiatrisk vård (LRV)
- Lagen (1998:531) om yrkesverksamhet på hälso- och sjukvårdens område (LYHS)

In Sweden the responsibility for healthcare is split between the state, county council and the municipality. The state is responsible for the overall policies of health and medical service. The main responsibility of the county counsel is public health and medical care. It is their responsibility to see that all citizens have access to good care. The municipality's main responsibility is the care of the elderly and giving support and services to those who have finished their treatment at the hospital. . It is also the responsibility of the municipality of living, occupation and support for those who have psychological functional impairment. Swedish health care is split into 3 levels:

• Regional medical and health care
• County medical and health care
• Primary care

1.2 Public Health Services

The primary level is the level of the health care system to which people should be able to turn with any health problem. The aim of the primary care sector is to improve the general health of the population, and it treats diseases and injuries that do not require hospitalisation. This sector employs a wide variety of health professionals-physicians, nurses, auxiliary nurses, midwives and physiotherapists. Their work is organised in health centres, which facilitates teamwork. Everyone has the right to choose their own family doctor, a general practitioner.

In addition to local health centres and family doctor surgeries, primary care is also provided by private doctors, physiotherapists, at district nurse surgeries, and at clinics for child and maternity health. The child clinics provide vaccinations, health checks and consultations as well as certain types of treatment free of charge to all children under school age. Maternity clinics, staffed by midwives and doctors, are attended by expectant mothers for regular check-ups, which are free of charge during the entire pregnancy. District nurses give medical treatment as well as advice and support, both at their own surgeries and on home visits. Occupational health services and school health services are also available.

By adapting housing, using technical aids, and providing medical services and nursing in the homes of patients, it has become easier for elderly and disabled people to remain in their own homes. People in nursing homes and those living in service apartments have access to nursing services 24 hours a day.

Medical services are provided at county level and regional level for conditions that require hospital treatment. Some 65 central county hospitals and district county hospitals provide somatic care in a number of specialist fields, partly inpatient and partly at outpatient clinics. The county medical services also offer psychiatric care, increasingly in outpatient forms.

The regional medical system comprises nine regional hospitals, which have a wider range of specialist and sub-specialist fields than at county level, for example neurosurgery, thoracic surgery, plastic surgery and highly specialised laboratories.

In Sweden, hospitals have traditionally received a relatively high proportion of total medical resources. This can be seen, for example, in the low number of visits per person and year to doctors in the primary care services. The number of general practitioners is also low in relation to the total number of doctors (approximately 20%).

The number of days of short-term in-patient care per person and year has fallen over the last few years for all age groups. Extensive changes have been made in the area of psychiatric care during the last ten years. People with mental handicaps have largely left institutional care and now tend to live in the community.

The changes that have taken place in inpatient care must be seen in relation to the deliberate emphasis given to outpatient care. More and more medical visits are now made outside the hospitals and the nature of these visits has changed. An increasing amount of treatment and operations no longer requires the patient to be taken into hospital. The introduction of day surgery and the expansion of home medical care are examples of the changes that are taking place. The deliberate emphasis on outpatient forms of care also encourages people to consult medical staff other than doctors.

1.3 Finance

Sweden's costs for its health services amounted to SEK 178 billion in 2000, a figure which includes pharmaceutical preparations and dental care. This corresponded to 8.5% of GNP. Services provided or financed by the county councils accounted for some 80% of this figure.

The health services account for some 89% of the operations of the county councils. 71% (2001) of these operations are financed from tax revenues. The county councils are entitled to levy a proportional tax on the incomes of their residents, the average tax rate being 10%. Other important revenue sources are grants and payments for certain services received from central government, in total 19%. Patient fees amount to 4% of county council revenue.

County council revenues, and thus the funding of the health services, have diminished in recent years due to reductions in the tax base. To counteract this, the county councils reduced their expenditure in real terms by 1.5% per year during the 1990s. Patients spend less time in hospital and receive more outpatient care. The number of beds in short term somatic care fell from 4.4 per 1,000 inhabitants in 1985 to 2.4 per 1,000 inhabitants in 2002. The corresponding figures for psychiatric care were 2.5 in 1985 and 0.6 in 2001. It is possible that patients will become more aware of the reductions in the future, when the potential for further streamlining of the health services has been exhausted.

In the early 1990s, most county councils introduced some form of purchaser-provider model, whereby the traditional system of fixed annual allocations to hospitals and primary care services was to some extent abandoned. Instead, payment is made according to results or performance. Special purchasing units, normally headed by an elected committee of local politicians, have been formed with the task of formulating the requirements which should be made of the hospitals by the county councils and of evaluating quality and prices. The hospitals, for their part, have become more independent in relation to political bodies and have in some cases been made into county council owned limited companies. In the late 1990s it became increasingly common for county councils to put care services out to tender. The amount of care supplied by private providers rose from a very small percentage in 1990 to 9% of total county council expenditure in 2000. The fact that 29% of all visits to a doctor take place at private medical establishments is a reflection of this development. People of 65 years and older account for 70% of the cost of social welfare.

1.4 Patient fees

Those entitled to use the Swedish health services at subsidised prices are: all residents of Sweden regardless of nationality, as well as patients seeking emergency attention from EU/EEA countries and some other countries with which Sweden has a special agreement. The fee charged for a stay in hospital is SEK 80 per day (SEK 10 is about 1 Euro).

Each county council sets its own fees for outpatient care. The fee for consulting a doctor in the primary health services varies from SEK 100 to SEK 150. The fee for consulting a hospital consultant or a doctor in private practice ranges from SEK 180 to SEK 300. The county councils also set patient fees for medical treatment provided by other health professionals such as physiotherapists, occupational therapists and nurses, both in the public health services and, where appropriate, in private care. The fees vary from SEK 50 to SEK 100 per visit, depending on the county council.

To limit personal expense there is a high-cost ceiling. A patient who has paid a total of SEK 900 in patient fees is entitled to free medical care for the rest of the twelve-month period, calculated from the date of the first consultation. All medical treatment for children and young people under 20 is free of charge.

Sweden has an extensive system of benefits for the sick. The main component of this system is sickness benefit, but it also includes compensation for participation in labour market rehabilitation schemes and other benefits payable.

1.5 Private health care

Despite a strongly state-welfare general attitude to health care, in Sweden it is also possible to buy health care from private practitioners and private hospitals. It is also possible to take out private health insurance, both life insurance policy and non-life insurance in order not to lose any salary during illness. The tendency is for private health insurance for accident and health to increase. Between 2004 and 2005 it increased by 11.5%.

2 Description of e-health services and projects mapped in Sweden

During the mapping phase we recorded 45 e-health services according to the check-up list. In our mapping we also found 24 other e-health services. From these 45 services, 10 e-health services were selected for the semi-structured interviews, and three were chosen as most suitable to transfer.

As noted during the study, approximately half of these services use video conference as a main part of the services. Several services are based on expensive equipment, which is a disadvantage in general when most county councils have limited resources.

In Sweden today many projects deal with care planning, in view of the fact that there are problems with collaboration between different care givers especially with those that have different owners. This is an indication that the chain of nursing care is not completely clear, or as one professional expressed it “it is like running in a relay race and handling over the baton”, but there are problems with the handing over. In addition, within the different nursing care organizations and within different profession there is a different understanding of the meaning of concepts.

Below is a short presentation of the mapped services according to the check list.

2.1 Action

Action service is an IT based support system aimed at people taking care of their elderly sick relatives at home. The Action service consists of a multimedia program, a videoconference system and of the Action call centre. The care providers can contact other people living in the same situation through video calls as well as the Action call centre if they want to discuss something with a professional caregiver.
Access to practical information and guidance through multimedia program and Action centre. Action Caring AB. www.actioncaring.se

2.2 Bodykom

Bodykom provides an alternative to the traditional 24 hour ECG recording. ECG sensors are placed on the patient’s body and connect to their communicators through a radio link. The first data-analysis is done by the communicators, if the measured values are not within reference norms they are forwarded to health care professionals who are able to locate the patient and act accordingly. BodyKom enables the patient to freely conduct his normal daily life while being constantly connected to a real-time, ECG monitoring system. Can be used in all locations worldwide, as long as there is mobile phone service coverage. Product provided by Kiwok. www.kiwok.com

2.3 CareIT

CareIT is a company that provides online self help for patients who suffer from stress, panic attacks, headaches or different types of sleeping disorders. All of the online self help programs are based on cognitive behaviour therapy and can be combined with personal support given by an authorized psychologist. Service has been commercialized and is provided by CareIT Selfhelponline Solutions AB. www.careit.com

2.4 Care@Distance

This ongoing project targets patients who suffer from heart insufficiency, live at home and need their physiological parameters to be monitored. IT-based home monitoring and daily treatment follow ups by measuring the patient's weight, blood pressure and pulse. The patient is given a form about health status that needs to be filled in daily. The system is created so that it is capable of handling acute situations though its main purpose is to improve the standard of long term care patients suffering from heart insufficiency receive.

2.5 Care Planning Through Video Conference

Health care staff working on an island receives access to specialist services. Care planning with videoconference. Healthcare staff working on an island can contact staff working on mainland if they need consultation and when care planning is done.
City of Styrsö, city of Gothenburg.

2.6 Checkup-remote Monitoring of Physiological Parameters

Remote monitoring of physiological parameters. The target group are patients whose physiological parameters are frequently controlled, patients living at special units e.g. nursing homes. The service consists of portable health monitoring equipment that measures physiological parameters such as ECG, pulse oximetry, glucose, blood pressure. The measurement results can be viewed and evaluated immediately by a doctor at the hospital. The service package is easy to use and since it is portable the patient can take it home and take the measurements himself.
Product available at Explizit. http://www.argentum.se/sv/explizit/

2.7 Children with Heart Murmurs

Cardiac specialists at Norrlands university hospital provide consultation services to Skellefteå hospital. When a child has a suspected heart problem a cardiologist can listen to heartbeat of the child via electronic stethoscope and many times make a diagnosis based on the auscultation.
Västerbotten county council.

2.8 Cogmed Working Memory Training

Cogmed Working Memory Training is a proven software-based program designed for sustainably improved attention. 80% of participants significantly improve their ability to concentrate and use problem solving skills after training. Age-appropriate training programs are available for preschoolers through older adults. The program helps people improve attention by training and increasing their working memory capacity. Clinically-proven results demonstrate that after training, people improve their ability to concentrate, control impulsive behaviour and better utilize problem solving skills. The program is used at patients home under the supervision of a Cogmed-qualified coach.
Cogmed Sverige AB. www.cogmed.com

2.9 Curictus

Videogames developed for stroke rehabilitation. The system gives the user instant force feedback and tracks movements of the user's hand. The data from the user is saved in a database that is accessible for healthcare workers. The staff is able to see the progress a patient is making and adjust the training program accordingly. The service provides an integrative system which incorporates a semi-immersive workbench with 3D stereographic display using shutter glasses, haptic virtual games, the game station, and the back-end support for tele-rehabilitation.
Service provided by Curictus. www.curictus.com

2.10 Decision Support within Geriatrics

Consultations within geriatric wards between Norrlands university hospice and Sofieborgs nursing home. Patient's physiological parameters can be measured at the nursing home and results are accessible by a specialist staying at the university hospital. Patients' health status can be discussed and an experienced specialist provides decision making support for the staff working at the nursing home.
Västerbotten county council and the city of Umeå.

2.11 Dementia Management Support System

Dementia management support system is software designed to make it easier to make correct diagnosis when investigating the different types of dementia. The system is designed to be used by general practitioners who do not meet patients with dementia frequently. The system supports decision making regarding diagnosis and treatment plans and it can be used to introduce new healthcare staff to diagnosing and treating patients with dementia which generates added educational value.

2.12 Diasend

Diasend transfers glucose values from an insulin pump or from a glucose-measurement device. Used for remote monitoring patients with diabetes. Equipment is meant to be

used at home; results are automatically sent to healthcare workers and shown as graphs and statistics. Healthcare workers help the patient to adjust insulin dosage based on the values they have received via Diasend.
Product provided by Aidera. www.aidera.se

2.13 Digital Pen for Pain Evaluation

Patients keep an electronic journal of the pain they experience by using a digital pen and an electronic form. Healthcare workers have direct access to the pain journal. Medication can be adjusted in real-time and patients condition can be monitored more efficiently.
Equipment used in the project available at Anoto. www.anoto.com

2.14 Electronic Referral with Photograph

General practitioners attach photographs of the skin condition to the electronic referral. Dermatologists analyze the photograph and diagnose patient based on it and the information included in the referral. Co-operation between healthcare centres, hospitals and dermatologists at the university hospital.
Västerbotten county council.

2.15 E-Radiology

Telemedical offshore clinic. Västerbotten county council can request remote radiological consultations from Barcelona. Cuts down response time within radiology.
Commercial service.

2.16 e-Ultrasound, Decision Making Support Within Obstetric Ultrasound.

Decision making support between Lund, Uppsala and Trondheim hospitals regarding obstetric ultrasound. Specialist at Trondheim can be contacted if an obstetric ultrasound consultation is needed.

2.17 EyeNetEast Virtual Eye Institute

In this project videoconference and digital photographs were used in diagnosing and planning treatments to take care of patients' eye problems. Eye conditions are photographed and documented and referral is made to appropriate specialist. Telemedicine solutions are used in order to shorten response time and increase access to specialist care.
Southeast hospital region in Sweden

2.18 Guidelines for IT Based Communication Between Healthcare Personnel

Remedy is a training tool for learning how to use information technology for communication between healthcare personnel. The training program emphasizes ethics, communication with patients during admission and release from the hospital and how to communicate during care planning via videoconference. The training tool provides practical support for healthcare staff and helps them to understand policies and legislations surrounding care planning and admission to and release from the hospital

2.19 Health Care Channel Sister Gudrun

With the help of a TV connected to broadband in the home, a two-way communications channel is set up with an image connection between the patient and health care provider. Patient is able to contact healthcare staff and staff members are able to contact the patient. Patient can call the health care centre by using the TV remote control. Health care channel provides access to information material e.g. videos, education programs.
Blekinge county council, Affärsverk in Karlskrona, Blekinge School of technology, Karlskrona stadsnät. http://systergudrun.dreampark.se/50.html

2.20 HuGo Co-operation and Consultation; Children with Cardiac Problems

Visby hospital is able to perform cardiac ultrasound examinations on children. Examination is sent digitally to Huddinge university hospital where the diagnosis is done. A biomedical analyst received special training and obtained permission to do the ultrasounds at Visby hospital. The biomedical analyst is medically responsible for the examination.
Huddinge university hospital, Visby hospital

2.21 HuGo co-operation and Consultation; Children with Kidney Problems and Children in Need of Dialysis

Consultation service between hospitals, videoconference providing a possibility to consult a specialist. Paediatricians and patients families can have videoconferences with a doctor specialized in kidney related problems and discuss the patient's situation, diagnosis and treatment plan.
Huddinge university hospital, Visby hospital

2.22 IT Supported Early Release from Maternity Ward after Childbirth

Within this project families with a newborn baby were released from maternity ward earlier than usually. Videoconference equipment is set up at their home and they have access to the expertise of maternity wards staff 24 hours a day. Criteria for receiving the service is that the child is born healthy and without complications. 10 families have participated in this study that shows good results. This means economical savings, less

travel, and families experiencing increased feelings of safety and having been satisfied with the service. Families experienced that technology was easy to use and was not a threat to their integrity. A more extensive study with more participants is planned. If the service is implemented, there would be an estimated 25% reduction on midwife house calls.
Sunderby hospital-maternity ward

2.23 Leg Ulcer Information Program with Remote Consultation

Information about leg ulcers is available via internet to patients and health care workers. Support and instructions for taking care of leg ulcers and an interactive learning tool is available through internet. Leg ulcer patients can contact health care professionals through videoconference from their home. Staff can contact each other through videoconference if a consultation is needed.
Skåne region. http://www.skane.se/default.aspx?id=43184

2.24 Long Distance Speech Therapy by Video

Service is targeted for patients who have problems with speech formulation. Diagnostic groups include e.g. people who suffer from aphasia, Parkinson disease or dyslexia. Every healthcare centre in Västebotten county council provides to videoconference equipment that patient uses to have a videoconference with the speech therapist. The speech therapist provides online speech training. Some patients are able to have the videoconference equipment set up at their home.
Västerbotten county council.

2.25 Lötsjögården- Electronically Adjusted Nursing Home

Elderly patients living at the Lötsjögården- nursing home receive safety bracelets that have built in sensors for measuring patient's temperature, movement and pulse. When measurements have been taken they are compared to normal parametrical values patients have, if an abnormality occurs an alarm is sent to the staff. If the patient has been inactive for a long time or falls an alarm goes off and alerts healthcare staff. The patient can remotely control the electronic equipment in the apartment, for example lights can be switched on and off remotely and there is a possibility to set the apartment on different modes such as night or day mode.

2.26 Project Cardista and Medirob

Medirob is an ultrasound scanning support designed to be used by sonographers. Instead of the sonographer holding the transducer that is used in examining the patient Medirob holds the transducer. The sonographer steers Medirob by using a joystick or a trackball. No need for the patient and the sonographer to be at the same place at the same time. Medirob is compatible with most ultrasound scanning systems on the market.
Product available at Mobile Robotics AB. www.medirob.com

2.27 Digital Ear Mirror and Medical Camera for Diagnosing Children with Repetitive Ear Infections

Digital ear mirror and a medical camera designed for children who suffer from repetitive ear infections. Photos of the ear drum are sent digitally to the doctor who can assess the grade of infection and decide if the child needs medical attention or not.
Centre for Distance Spanning Healthcare (CDH) at Luleå University of technology.

2.28 MedIT- Care at Home and Remote Access to Electronic Patient Records

Healthcare workers visiting patients at their homes have remote access to the electronic patient record system. Communication between different specialist groups within home health care managed with digital writing pads. Access to remote consultant and digital image transmission if help is needed with treating wounds.
City of Gothenburg.

2.29 Mobile Safety Alarm with Fall Detector

The service enables people to remain at home despite functional disability or chronic illness. The aim of the service is to increase feelings of safety, independence, mobility and to improve care and rehabilitation. The client can carry the safety alarm with her and move freely indoors and outdoors. When client presses the alarm, a signal is send to the care staff member's phones. The care staff member can also be mobile, as they are using mobile handheld computers. Personnel and client can speak with each other about what kind of help is required by the client. When the call is finished a sms is sent with the client's position, which is displayed on a map on the personnel handheld computer/telephone. The phone can be augmented with a drop sensor, which reacts if the client falls and cannot use the alarm.
Centre for Distance Spanning Healthcare (CDH) at Luleå University of technology. ht-tps://cdh.project.ltu.se/projectweb/portalproject/Projects.html

2.30 Modesty- Personal Health Information Folder Accessible through Internet

The service is aimed for patients receiving home care and to people who are being cared for by their family members. Patients have a personal folder on the internet where they can keep a list of their medication, write down their life stories, keep a journal of their health. Physiological parameters can be saved and presented as graphs.
Service provided by Rivermen.

2.31 Old@Home

The Old@Home project deals with the development and evaluation of information and communication technology to support the homecare of elderly patients living in their own homes. Health care staff has access to virtual patient records at any location. Care plans, medication lists and health information is accessible anytime and anywhere by authorized personnel. Staff can also document on the virtual patient records as well as contact other healthcare professionals when needed.

2.32 Physiotherapy for Chronically Ill Kidney-patients

In this project a physiotherapist provided guided training through videoconference for chronically ill kidney patients. The patient is able to participate in physiotherapy lead by a trained physiotherapist. The patient can do the training at home, access to services given by physiotherapist increases and there is no need to travel. According to the pilot study done within the project patients become more motivated to participate in training when it is held frequently by a physiotherapist. Patients can also initiate training sessions with physiotherapist between appointments. A more extensive study is planned.
Sunderby hospital – kidney unit.

2.33 Physiotherapy for Patients Who Have Received an Artificial Shoulder Joint

In this project patients who have undergone shoulder-operation where they have received an artificial joint were provided physiotherapy through videoconference. The Physiotherapist contacts the patient and leads a physiotherapy session; the patient can participate in the training from home. Preliminary studies show that patients who receive physiotherapy through video conference experience less pain and have gained increased mobility in their shoulder, achieving better results than with traditional methods. The patients also experienced improved quality of life and better access to physiotherapy. A more extensive study with more participants is planned.
Sunderby hospital.

2.34 Providing Homecare for Patients with Neurodegenerative Problems

The service is aimed for patients who suffer from mild to moderate dementia, to their family members and healthcare staff. In this project patients with neurogenerative illnesses are provided diagnosis, supervision and assistance services at home. A home environment that enables safe living at home is created with built in support mechanisms based on information technology. The patients received notifications, supervision and instructions at home when needed.
Västerbotten county council.

2.35 Regional Communication within Neurology

Results from EMG and EEG examinations done by local laboratories are electronically sent to the Uppsala university hospital. Neurophysiologists have access to the data that has been gathered and they can analyze and diagnose the examinations remotely. The service also includes a possibility to have a videoconference where the diagnosis can be discussed. EMG and EEG monitoring done at children's clinic and intensive care units can be accessed by neurophysiologists online making it possible for them to comment on registrations anytime.

2.36 Rehabilitation for Patients with Cochlea Implantation

Hearing related rehabilitation is provided for patients with a cochlea-implant. Videoconference technology is used in providing rehabilitation to patients by a cochlea implant-specialist team located in Norrlands university hospital. Evaluation shows that the audio aspects of videoconference technology are not adequate enough to provide remote rehabilitation to cochlea implant patients. Technology must be improved in order to cochlea implant patients to be able to participate in remote rehabilitation.
Västerbotten county council.

2.37 Remote Consultation in Mountain Area

The service is aimed for patients visiting a smaller Tärnäby hospital in the countryside. The hospital staff has a possibility to consult with the staff at the county councils main hospital. Digital x-rays, digital images of skin, nose, ears and throat can be digitally sent to the main hospital where they can be analyzed and patient referrals to the main hospital can be avoided. Since the project started referrals to the main hospital have declined with 40%, and each referral to the main hospital equals 700km journey for the patient.
Västerbotten county council.

2.38 Remote Pathology

The traditional way of analyzing cells by looking into microscope and physically storing the glass plates containing the cells can be replaced by a computer that has a built in microscope. Samples are shown on computer screen and can be saved in the patient record system. When consultation is needed digital images can be sent electronically instead of having to send the original sample. Umeå university hospital's pathology unit provides real-time consultations to two other hospitals, in Skellefteå and Lycksele. The pathologist located in Umeå is able to steer the microscopes located in the two partner hospitals and diagnose samples in real-time.
Västerbotten county council.

2.39 Retinet

Retinet is software that includes a model for treating patients who suffer from diabetes related eye problems. Digital images and patient data are combined in the software making it easier to maintain result orientated care and assure high quality in diagnosis, treatment, measuring treatment progress and communication.
Sahlgrenska hospital, Göteborg.

2.40 SABH- Advanced Home Care of Children

Advanced home care of children provides the opportunity for severely ill children to receive round the clock care at home. Modern information technology combined with a team of nurses, paediatricians and counsellors make it possible for the child to stay at home instead of the hospital. Patient target group includes children with deformations waiting for an operation, children with severe chronical diseases and children with burns, terminally ill children and premature babies. In order to receive advanced home care the patient needs to live within 30-minutes reach from the hospital.
Astrid Lindgren children's hospital. http://www.sabh.nu/

2.41 Safemed

SafeMed Pocket is a program developed for the health sector where there is an immediate need of mobility and pharmaceutical decision support. Health care staff has instant access to information about interactions between pharmaceuticals, therapeutic duplication, counter indications, guidelines for e.g. elderly care and it is possible to download patients' medicine list and check it in order to make sure that there are no counter indications and therapeutic duplication. Also includes information about overdosing medication and guidelines for handling overdoses.
Available at Pharmtech. http://www.pharmtech.se/

2.42 Sarah- project

The development of an open and flexible service platform that effectively supports treatment and care work at home in co-operation with treatment and care organisations and companies. The service platform includes several services that work together and complement each other. This project provides a field service bag for district nurses. They have access to the city council patient record system VAS directly from the patients' home, remote consultation between the health care centre and the elderly patients' home, as well as a template for planning home care visits and co-operation with the county council and cities. The field service bag and the mobile connection to the VAS. The field service bag is essential for the service platform and includes a PC to get the mobile connection to the patient record system VAS, medical diagnosis equipment as well as visual and voice connection. The measurement results such as EKG reports, auscultation results and photographs from a digital camera can be stored directly in the patient record system.

2.43 Simple Simon

Service created for people using anticoagulation medication. Instead of weekly controls of the thickness of blood done by healthcare workers at laboratories patients can use Simple Simon and test the blood themselves.
Product provided by Zafena. www.zafena.se

2.44 *Telematic Services for the Elderly*

Co-ordinated care planning via video conference. Norrlands university hospital and city of Vännäs. The staff at the Vännäs health care centre have access to videoconference equipment that is used when they need to discuss patient's care plan with specialists at the Norrlands university hospital. Staff have become more actively involved in care planning since they received access to the videoconferencing equipment.
Västerbotten county council.

2.45 *Zenicor ECG*

Portable ECG machine used for diagnosing heart arrhythmia that does not occur when patient is at the doctor. Patient lends the ECG machine for 2-4 weeks and when symptoms occur patient records an ECG by placing his thumbs on the machine and sends the ECG via telephone service to an ECG database that the doctor can access through internet. These is no need for any software installation.
Product provided by Zenicor Medical Systems AB. www.zenicor.se

3 Introducing three e-health solutions

Sweden has chosen the four e-health services as the services most suitable to transfer:

- **Long distance speech therapy by video**
- **Cardista - Cardiac echo consultation at a distance**
- **Check-up - physiological monitoring at a distance.**
- **Medirob - Mobile remote controlled sonographer scanning support**

These four services are described in more detail below.

3.1 Long distance speech therapy by video

During the past years it has been difficult to recruit speech therapists, especially to the smaller hospitals and health care centres within the County of Västerbotten in northern Sweden. The speech therapists from North Sweden's university hospital have been travelling to the other hospitals to meet patients with speech problems. One of the problems with this was that 25% of the speech therapists' working day was spent travelling. In 2004 a patient mapping was done which revealed that the amount of people suffering from aphasia and dysarthria was twice as high in sparsely populated areas; still they received only half as many therapy sessions as people living in the urban areas. The average journey for the patient to reach the local service centre is two hours, often making it impossible to meet with the speech pathologist twice a week.

The patients usually meet with the speech therapist in person. Now speech training is provided also through video conference making it unnecessary for the speech therapist and the patient to be at the same location. All the health care centres in Västerbotten county council have access to video conference equipment that patients use to have a video conference with the speech therapist. For some patients the video conference equipment can even be set up in their home. Remote speech therapy is a service provided by North Sweden University hospital to the county councils health care centres. The service is now part of the standard service provided to the patients.

This service is aimed for patients who have problems with speech formulation. The diagnostic groups in this project include e.g. people who suffer from aphasia, dysphasia, Parkinson disease or dyslexia. Also included are children between 3 and 4 years of age who have been referred to child health care units for speech evaluation and adults who suffer from voice problems that have an impact on their professional life and are often on sick leave.

3.1.1 Evaluation and studies

During the first 17 months of the project 524 sessions led by a speech therapist were held, 144 patients participated. 19 patients had the video conference equipment in their home and the rest of the patients had access to the system in either one of the 25 health care centres or 7 other facilities in the county council of Västerbotten that received the equipment. Patients were very satisfied with the remote speech therapy, the technology is considered to be stable. Before the project was initiated all of the participating health care centres were visited and the surroundings where the speech therapy sessions were to be held were checked so that the criteria that were set on availability, acoustics, lighting and furniture were fulfilled.

The speech therapy sessions have been documented following the hospital and unit policies. 19 speech therapists have given sessions via video conference. Three speech therapists were employed within the project and they conducted 68% of the visits. Speech therapists have reported good contact with the patients in 93% of the sessions. Most of the video conference training sessions have the same content as would a face to face session. Patients were given an evaluation form after receiving speech therapy. 64 out of 66 = 94% experienced that they had good contact to the speech therapist and would recommend remote speech therapy via video conference to others. After the project period the service has been fully implemented. 15 months after project start 80% of the remote speech therapy sessions were considered to be a success.

The speech therapists have documented every session in order to adjust and improve their communication strategies and to create optimal surroundings for communication.

Benefits: There is less disparity between patients in sparsely populated areas vs. patients living close to hospital in terms of having access to speech training than prior to implementing the service, especially patients over 70 who suffer from aphasia/dysphasia, for whom the amount of speech therapy sessions has doubled after the implementation of the project. For all the patients in the project there has been less travel, fewer missed appointments, more satisfied users and improved access to specialist care. Speech therapy sessions are held more frequently than before. Patients in poor health are more likely to have the energy to complete their therapy. Productivity has increased among speech therapist since implementation of remote speech therapy. The project has saved the county council 173 691 e through reduced public expenditure on transportation to and from the hospital and the speech therapy unit has saved 25% of each speech therapists working hours since it has not been necessary to dispatch them to another hospital. The speech therapists experience that patients were more alert. The total amount of visits to the speech therapists have increased since the project started. Both patients and speech therapists have stated that it is easy to get used to working with remote speech therapy and the technology involved.

At the moment approximately 15 patients a week receive remote speech therapy via video conference. The service is currently available at 25 health care centers/34 facilities. Guidelines for new speech therapists as well as instructions on how to work in the studio have been developed within the project.

3.1.2 Technical information

All videoconferencing equipment used in the project has been provided by Tandberg. The speech therapists at North Sweden University hospital use the Tandberg 990 MXP videoconferencing system, a camera for documentation in order to show pictures and text for language training, a PC and a tape recorder for audio feedback. Patients who use the system at home have specially designed video conference equipment Tandberg 550 MXP. They also have access to a computer for storing training material etc which is easy to install and to transport. Health care centres use mainly Tandberg MXP 990. according to the patients' and health care workers' experience the technology has been easy to use and video conferences have high quality. Faint sounds and subtle movements of the lips, tongue and larynx have been clearly perceptible which is essential to successful speech therapy.

The studio at the speech therapist's reception

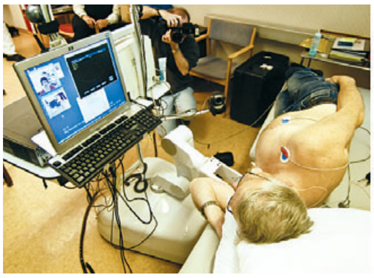
The Tandberg 990 MXP gives the therapist full control of the equipment at both ends. Patient and therapist are able to see each other simultaneously by splitting the screen. In order to provide a successful therapy session it is important that the technology enables the therapist to zoom the camera in on the patient to get a close-up on lips, tongue and larynx when needed.

To be able to use the video conference equipment the patient needs to have an ADSL connection with minimum 512 kbit upload and download, or fibre connection with 768 kbit. Support for ciphering is required when sessions take place in the patient's home, otherwise the sessions take place within the secure hospital network.
(http://www.cwhonors.org/viewCaseStudy2008.asp?NominationID=745)

Home equipment

3.2 Cardista - Cardiac echo consultation at a distance

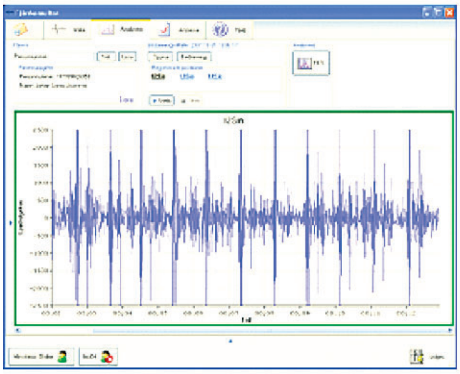
The project concept includes an ultrasound robot, an ultrasound computer and a communication platform (videoconferencing), which makes it possible to offer cardiological diagnostics competence to sparsely populated areas by using a distance spanning technology. The greatest beneficiaries are the patients, who no longer have to travel long-distance to get their hearts examined by specialists, and the hospitals could also save money. The aim of the project has been to create a ”one stop shop” for cardiac patients, once the general practitioner meets a patient and determines that a cardiac ultrasound is necessary it can be performed right away at the healthcare centre. The whole process from the initial meeting with the general practitioner to diagnosis and treatment planning by the specialist takes 90 minutes.

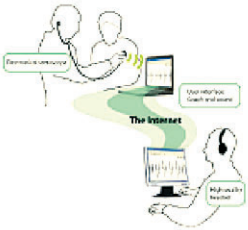


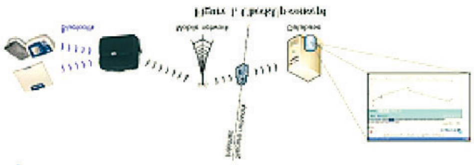
Once the general practitioner has decided that the patient needs an ultrasound examination a nurse or an assistant nurse sets up the ultrasound equipment and prepares the examination room and the patient. While the patient and the general practitioner are located at the healthcare centre the cardiologist and the sonographer are located at the research site and perform and document the examination. Diagnosis and treatment plan is set immediately and discussed with the patient. (www.medirob.com)

3.3 *Checkup - remote monitoring of physiological parameters*

The service aims at improved monitoring of patients' physiological parameters (such as ECG, pulse, pulse oximetry, spirometry, and blood pressure). The service consists of portable health monitoring equipment that measures physiological parameters. The measurement results can be viewed and evaluated immediately by a doctor at the hospital. The service package is easy to use and since it is portable the patient can take it home and take the measurements himself or the service package can be located at a health care centre where patients can come in to and take the measurements independently.







Check-up – the Bag

Each patient is given a personal identification card that uses RFID – technology; the card has a number that can be connected to the patient's social security number once the data gathered on the card reaches the secure hospital network. When the physiological parameters are measured the patient places the personal identification card in the portable health monitoring equipment. By doing this no further identification or gathering of personal information is necessary, measurements are automatically saved under right code which is not matched with patient's identity until a secure network is reached. The portable health monitoring equipment is very easy to use, most patients are capable of taking the measurements themselves saving a lot of time for the health care workers.

The platform for remote monitoring: the system consists of PC software, computers, sensors and headphones.

An SQL-database is needed for storing the measurements. A web page for accessing the measurement results, created for healthcare workers. Individual patient cards for identification, based on RFID-technology. Measurement data remains unidentified until it reaches the secure hospital network. For data transmission a mobile phone is used. If no mobile network is available, the results are stored by the computer until access to mobile network is available.

1.Patient home/healthcare centre	2. Internet	3. Secure network
-Physiological parameters are measured -Wireless access point -RFID -Bluetooth -GPRS -SCP	Temporary storage of measurement results	-Communicator -SQL database -IIS Web server -Web page -Patient code matched with identity once within secure network

Physiological parameters that can be measured with the service: **blood pressure, glucose, medication** (to check if the patient has taken his medication or not), **pulse oximetry, warafarin, ECG, haemoglobin, pulse, spirometry, and weight**. The service also includes a possibility for auscultation, this requires an electronic stethoscope and patient isolation. Auscultation by using an electronic stethoscope is usually performed by a healthcare professional.

Standard medical equipment is used in measuring the physiological parameters ensuring the same diagnostic accuracy as by using a traditional method of measuring parameters. All equipment included in the service are wireless.

At the moment the portable equipment weighs 5-10 kg depending on included measurement equipment. The system developers aim to make it lighter so that it will be easier to transport. Users have been satisfied with the kit and find it easy to use. Not much training is required in order to learn how to use it or to teach patients to use it. 1-2 hours of training for the staff is usually enough, for the patients a few minutes of introduction is enough. All the patient has to do is to put on an inflatable rubber cuff around his arm and stand on a device that resembles a scale. All the measurements will be automatically taken and stored on the RFID card.

Improved patient monitoring and increased volume in taking measurements are few of the benefits created by Check-up. It also saves travel costs, helps to eliminate human errors regarding documentation of measurement results. Early and accurate diagnoses and close follow-ups can also help prevent costly hospitalizations. Patients feel more secure since measurements can be taken more often and can be accessed by a doctor any time if needed. Workload decreases since healthcare workers perform fewer measurements and less documentation needs to be created manually. (Socialkontoret, 2007)

3.4 Medirob - Mobile remote controlled sonographer scanning support

Medirob is a mobile remote controlled sonographer scanning support that holds the ultrasound transducer during cardiac ultrasound examination of a patient. Instead of the sonographer holding the transducer that is used in examining the patient Medirob holds the transducer. The sonographer steers Medirob by using a joystick or a trackball. Since Medirob is compatible with most of the ultrasound scanning systems on the market, there is no need to get new ultrasound scanning equipment if a decision to get Medirob is made. Medirob is mainly designed to perform cardiac ultrasound examinations. It can be combined with videoconferencing technology, making it possible to perform remote ultrasound examinations.

Data Ductus provides the platform solution for audio and video communications (between patients, hospital staff and heart specialists) and the integration of the system as a whole so that it can be used for remote examinations.

Work related injuries are very common among sonographers, these injuries can be eliminated by using Medirob in controlling the transducer. The cost of traditional methods in performing ultrasound examination of the heart is approximately the same as performing remote ultrasound. The possibility to perform remote cardiac ultrasound examinations benefits mainly the patient eliminating the need for travel and shortening the response time from months to one day. (www.medirob.com)

4 Identification of gaps in Sweden

In the county of Västerbotten we identify the biggest gaps and the areas where there is less research as Cognitive Behavioural Therapy, Physiotherapy, Dieticians, and General group therapy and treatment.

4.1 Cognitive Behavioural Therapy (CBT)

Today there exist several self help books and a few computerised applications as an aid to treatment of different kinds of psychological problems, for example depression, stress. Although these are only for self help but an application or a book cannot replace face-to-face therapy. What is missing in the area is an application that can be used both as self training with interactive real time feedback and also as a communication tool between the therapist and the patient.

4.2 Physiotherapy

For a person in need of physiotherapy as part of rehabilitation it demands several physical meetings with the therapists. This costs a lot of resources in the form of money, time and the available staff especially for a person that lives in the rural areas. In this area as well as in CBT what is missing is an application that can be used both as self training with interactive real time feedback and also as a communication tool between the therapist and the patient

4.3 Dieticians

A person that is put on a prescribed diet by a medical doctor or a dietician needs regular check-ups and feedback about the progress of their treatment. As with the other described gaps, there is a need for an application that can be used both for self training with interactive real time feedback and also as a communication tool between medical staff and the patient

4.4 General group therapy and treatment

At present there are not many computerised applications that support general group therapy and treatment and that also include medical staff. There is a need for computerised support that patients and medical staff can use anytime and anywhere that could be used as a complement to ordinary sessions.

4.5 *Other general areas*

There is a need for new kinds of e-health services providing help and social contact for the elderly population. Today the elderly population grows due to the increased longevity and lowered fertility rates. In the near future in Sweden we will be unable to afford the care as it is carried out today. Improving life quality is a key factor in prolonging independent living for this group.

References

Sources and other relevant links

Försäkringsförbundet: Swedish insurance in figures 2005 http://www.forsakringsforbundet.com/documents/eng2005_2006-03-16144333.pdf

Healthcare System in Sweden
http://www.sweden.se/templates/cs/Print_BasicFactsheet.aspx?id=6856

Ministry of Health and Social Affairs Häslo- och sjukvård på lika villkor
http://www.regeringen.se/sb/d/2717;jsessionid=aBphApFUj8l4

Ministry of Health and Social Affairs
http://www.regeringen.se/sb/d/2717;jsessionid=aBphApFUj8l4

Ministry of Health and Social Affaris Hälso- och sjuvårdens organisation och resurser
http://www.regeringen.se/sb/d/2717/a/15105;jsessionid=aloGfhweJSoh

Socialkontoret, Skellefteå kommun. MONITORE- mobil televård med stöd av Check up – rapport från ett EU finansierat projekt mobil konsultation på distans/telemedicinsk monitorering, Skellefteå 2007

Socialstyrelsen: Häslo-och sjukvårdsrapport 2005
http://www.socialstyrelsen.se/NR/rdonlyres/274D32B8-45FE-4180-8E59-E2F71AC36763/4556/20051114.pdf

Socialstyrelsen: Statistik om hälso- och sjukvårdspersonal 2005-12-31
http://www.socialstyrelsen.se/NR/rdonlyres/FF84703D-8174-4110-8CE8-961E7BDA2172/6262/20061259.pdf

Statistics Sweden
http://www.scb.se/default____2154.asp

Swedish Policy for the Elderly
http://www.sweden.gov.se/content/1/c6/04/49/83/34a6f5bd.pdf

Swedish Television De populäraste alternative behandlingsmetoderna
http://svt.se/svt/jsp/Crosslink.jsp?d=32256&a=690061&lid=puff_696053&lpos=lasMer

eHealth and telemedicine in Norway

Bente Christensen
Frank Larsen

2008

NST | Norwegian Centre for Telemedicine
UNIVERSITY HOSPITAL OF NORTH NORWAY
WHO Collaborating Centre for Telemedicine

eHealth and telemedicine services in Norway

Overview of the Norwegian health care system, challenges, national ICT strategies, use of ICT in health care, telemedicine services, effects and legislation.

The report has been compiled by Bente Christensen and Frank Larsen (Norwegian Centre for Telemedicine).

Chapter 2 The Norwegian health sevices is based Johsen J R Health Systems in Transition.

Chapter 3 is based on reports concerning gaps and challenges in the Norewegian health care system.

Chapter 4 is based on national plan for ICT in the health care sector ("More health for each bIT", "Say @h!" and "Teamwork 2007").

Chapter 5 is based on documents and reports concerning the use of ICT in the Norwegian health care sector.

6.1 is based on an ongoing mapping of telemedicine services in Norway. 6.2 is based on Johnsen E, Breivik E, Myrvang, R Olsen F. Benefits from telemedicine in Norway. An examination of available documentation.

Chapter 7 "Legal issues in Telemedicine and eHealth" is based on Nohr L et al. Croatian Island Telemedicine System Project: Public Health and Technical Evaluation.

1 Geography

Norway is located in northern Europe, bordering the North Sea and the North Atlantic Ocean, sharing physical borders with Sweden, Finland and Russia. Its 4.6 million inhabitants live in a total land area of 386 958 km2, which averages 15 persons per km2. This makes Norway one of the most sparsely populated countries in Europe.

The terrain is mostly barren, with high plateaux and rugged mountains broken by fertile valleys, small, scattered plains, a coastline that is deeply indented by fjords, and arctic tundra to the north. When calculated against the proportion of arable land, Norway has 22 persons per km2 of land available for cultivation, compared with eight in both France and Denmark. The climate is temperate along the coast, modified by the North Atlantic current; it is colder towards the interior.

2 The Norwegian health service [1]

2.1 Organisation

The organisational structure of the Norwegian health care system is built on the principle of equal access to services, independent of social status, location and income. While the role of the state is to provide national health policy, to prepare and oversee legislation and to allocate funds, the main responsibility for the provision of health care services lies with the four health regions and the 431 municipalities.

2.2 Specialized health care – the Regional health

Following hospital reform in 2001, the system in Norway changed from a decentralized to semi-centralized NHS model. Before 2001, hospitals were owned by the counties. In 2001 the state took over the hospitals, but established the regional health authorities as enterprises that deliver specialized health services. The organization of the regional health authorities and the health enterprises is unique to Norway. The regions have two roles, the authority role and the enterprise role. In their principal role regions have a "care role" ("sørge for rollen") in providing the population with specialized health care services; the other is as a supplier and producer of specialized health care, since regions own the health enterprises. During the last three decades Norway has developed enterprises that enjoy an element of freedom similar to that seen in the private sector, although the state has built-in directing/steering and control mechanisms in the organization, in other words an "in between solution" .

Consequently, the responsibility for primary care and secondary care has been divided between different governmental levels. The regional health authorities are responsible

[1] Johnsen J R. Health Systems in Transition. European Observatory on Health Systems and Polcies. Vol. 8 No. 1 2006.

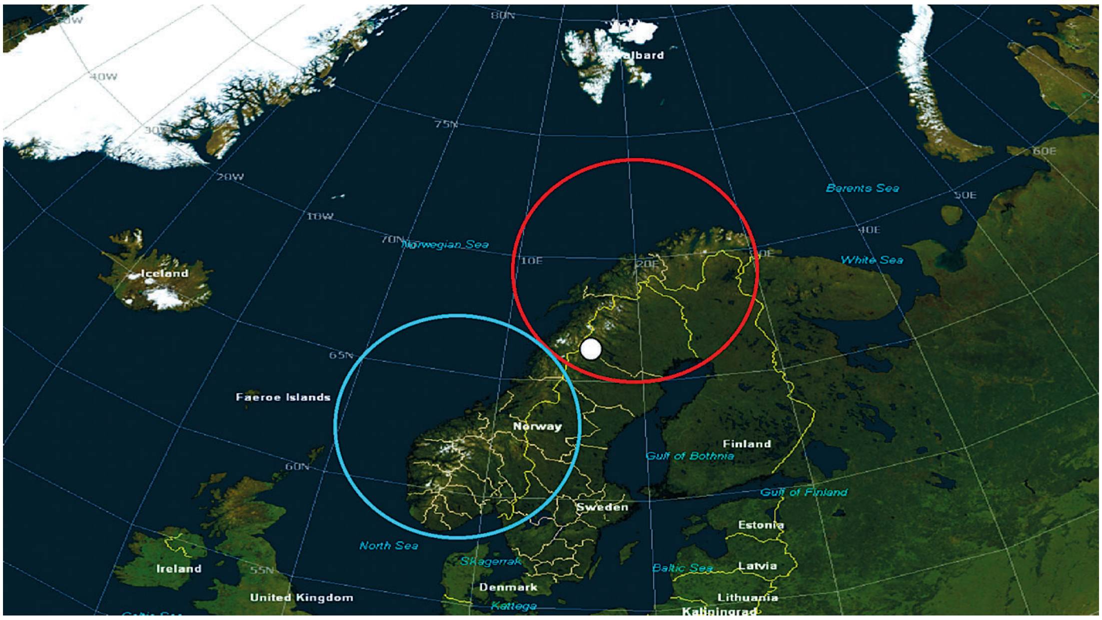
for specialized health care, while the municipalities are responsible for primary health care.

Norway's five regional health authorities are responsible for the provision of specialized care. This includes both somatic and mental health institutions, as well as other specialized medical services, such as laboratory, radiology and ambulatory services, special care for persons with drug and alcohol addictions.

There are at present 30 health enterprises under the four regional health authorities that comprises 4 regional and 70 local hospitals. The names of each region, together with the number of inhabitants, are as follows:

Northern Norway Regional Health Authority (Helse-Nord), inhabitants: 462 000
Central Norway Regional Health Authority (Helse-Midt), inhabitants: 649 000
Western Norway Regional Health Authority (Helse-Vest), inhabitants: 956 000
Southern/ Eastern Norway Regional Health Authority (Helse-Sør/Øst), inhabitants: 2 580 000

The challenges in delivering services in the Northern periphery region is illustrated by this map. It states that even though 45% of the land area is within this region, only 10% of the habitants of Norway live here (incuded Spitzbergen).



2.3 Primary health care

As stated, the responsibility for specialized and primary health services are divided between different governmental levels. The municipalities are responsible for the primary care. The aim of primary care is to improve the general health of the population and to treat diseases and deal with health problems that do not require hospitalization. This including both preventive and curative treatment such as:

- Promotion of health and prevention of illness and injuries, including organizing and running school health services, health centres, child health care provided by health visitors, midwives and physicians, pregnancy check-ups and vaccinations according to the recommended immunization programmes.

- Diagnosis, treatment and rehabilitation, including responsibility for general medical treatment (including emergency services), physiotherapy and nursing.

- Nursing care in and outside institutions. Municipalities are responsible for running nursing homes, home nursing services and home help services.

Contracts between municipalities and private providers are a very important tool in guaranteeing good quality for service users, and also in securing good cooperation with other parts of the health system. The municipalities have a contractual relationship with the GPs, who are part of the national regular GP scheme. These contracts regulate the relationship between the GP and the municipality. For instance, the municipality has the right to order the GP to do municipality health care work (a maximum of 7.5 hours aweek) if this is specified in the agreement.

GPs work as “gate keepers” for the specialized health services. That is, if such services are needed, the GP has to send a referral to a hospital, or a contracted specialist.

Within the limits of legislation and available economic resources, regional health authorities and the municipalities are formally free to plan and run public health services as they like. However, in practice, their freedom to act independently is limited by available resources.

2.4 Health expenditure

According to OECD data, the percentage of GDP taken up by total healthexpenditure in Norway in 2004 reached around 10%. Comparing total health expenditures as a percentage of GDP, Norway ranked fourth in 2002 among the OECD countries. It is important to take into consideration the fact that Norway has a much higher GDP per capita than neighbouring countries. In 2001, GDP per capita was more than 23% higher than in Denmark and Iceland, and more than 37% higher than in Sweden and Finland, according to Statistics Norway. According to OECD Health Data 2003, Norway had the highest real annual per capita growth rates in health spending in the period 1990–2001 with 3.5%, followed by Iceland (2.8%), Sweden (2.1%), Denmark (1.9%) and Finland (0.5%).

According to the European Health for All database, Norway had the highest health care expenditure per capita among Nordic countries measured in purchasing power, followed by Iceland, Denmark, Sweden and Finland in 2003.

The growth in health expenditure in Norway is similar to that in other western countries and can be explained by several reasons, such as the increasing number of elderly people, higher expectations, growth in the real GDP and increasing implementation of new technology in the health sector.

2.5 Reimbursement

The Norwegian health care system is funded primarily from taxes and transfers from central government. The municipalities and counties have the right to levy taxes on their respective population which, together with the government transfer, provide funding for primary health care. Regional health authorities depend on central government's transfer and do not have the right to levy taxes. There is element of out-of-pocket payments, but these are mainly subsidized by the National Insurance Scheme.

Integrated purchaser–provider relations are the dominant feature of the Norwegian health care system. It is, perhaps, difficult to see where the dividing line lies between purchaser and provider, due to the fact that the systems are mainly publicly owned. However, there is a purchaser–provider split trend in Norway.

E-health consultations are reimbursed within the public health service if the consultation is performed by a specialist at the hospital and the patient is not present, provided that the procedure or consultation in question is normally reimbursed. The reimbursement for e-health services is not made to specialists who practise at private hospitals. GPs are not reimbursed for e-health services.

Second opinion, defined as the advice provided from a specialist to a colleague, is not reimbursed. Patients, who request a renewed specialist evaluation, are entitled to a second consultation. The specialists are reimbursed for these consultations.

3 Gaps

3.1 Ageing population

The most apperent challenge for the future Health Services is the aging population. In Norway, the citizens 65+ are supposed to increase from 15% of the population in 2008 to 19% in 2025. In numbers, this is 314 00 persons. At the same time, the group of 25-64 years will increase only by 183 600 persons (from 53 to 35% of the population) (Norgeshelsa.no)

3.2 Centralization

Ever since the 1950s the Norwegians have moved from rural areas to more densely populated areas.

Figures for the period 2000-2005 show an evident increase in habitants living in cities. Almost 8 of 10 persons now live in densely populated areas, in 1950s this was only 50%. (www.shdir.no/kommunehelseprofiler/faktaark)

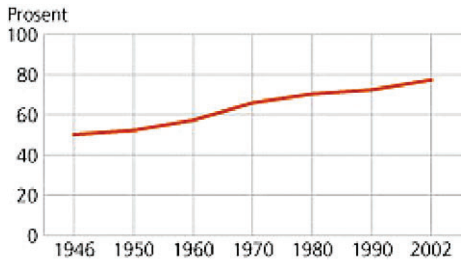


Fig 1: Percentage of population living in densely populated areas in Noway 1946-2002.

Emigration of younger people from rural areas to cities and an aging population are making provision of health services in rural areas even a bigger challenge.

Long distances, form rural to central areas where the hospitals are located, make travel times longer and more costly.

3.3 Challenges due to sickness in population

Cancer is main cause of reduced life expectancy. There were 41 242 deaths registered in Norway in 2006, comprising 21 621 women and 19 621 men. Cardiovascular diseases and cancer were the cause of 60 per cent of all deaths. Mortality due to cardiovascular diseases is still decreasing and 70 per cent of these deaths were among people 80 years or older. Cancer as the cause of death shows only a moderate decrease. More than 60 per cent of cancer deaths were among people younger than 80 years of age, meaning cancer is the main cause of reduced life expectancies for both sexes.

Smoking related lung diseases rises. In 2006 there were 3 767 deaths due to lung cancer and chronic obstructive pulmonary disease (COPD, ICD-10 codes J40-J44), an increase of 22 per cent from 1996. Lung cancer was the cause of death for 792 women and 1 209 men, while 838 deaths among women and 928 deaths among men were due to COPD. About 40 per cent of all deaths due to lung cancer were among people younger than 70 years of age. In comparison, only 17 per cent of all deaths due to COPD occurred in the same age group.
Mortality due to ischemic heart diseases, including heart infarction, angina pectoris and atherosclerotic heart disease, continued to decline in 2006, and was down by nearly 35 per cent from 1996.

Most causes of death vary significantly with people's age and sex. The use of the standard death rate (per 100 000) improves comparability over time within a country and between countries. Using this standardised death rate confirms the decrease in deaths caused by ischemic heart diseases in Norway. The decline in mortality is greater for men than for women. The decrease in deaths caused by these diseases is higher in Norway than in Sweden and Finland. However the level of mortality due to ischemic heart diseases in Norway is still higher than for countries like Spain, Portugal and especially France.

The central concept for classifying causes of deaths is the "underlying cause of death" which means that each death has only one underlying cause. The statistics is based on this single diagnosis. More than 50 per cent of all deaths were among people 80 years or older. Death due to cancer was the main reason for deaths in the age group 0-79 years, while death due to cardiovascular diseases make up about 70 per cent of the group 80 years or older.
(Norway's Division for Health Statistics (sbb.no))

Besides diseases that are related to causes of death, there are other chronic conditions giving challenges to future health services. In Norway special attention has been given to diabetes, psychiatric patients and drug abusers through plans for action, as this seems to be increasing problems.

3.4 Continuity of care

All the elements listed so far gives impact to the nursing services. Less share of people aged 24-64 means less caregivers, at the same time as need is increasing by growing share of elderly, multiple sick and care-needing people

An increasing proportion of elderly people in the population, increased specialization, distribution of functions and free choice of hospitals, increase the need for cooperation between specialist health services and municipal health services. Because of the developments, it is important and necessary to exploit the potential provided by ICT in order to ensure free flow of information and good interaction in the health and social sector. The large volume of information about treatment, care and administration that is exchanged in the sector today would be unmanageable without the use of ICT systems. The “dam” for free flow of information today is to be found where ICT systems and paper-based systems meet, or where incompatible ICT applications are used. (Norwegian ministry of Health, National Strategy Teamwork 2007)

According to this gap, the Norwegian Minister of Health Services just announced a “health care cooperation reform”. By April 2009 he will present the result of an expert group making the document. E-health applications are expected to be an important tool in better cooperation between the different levels of the health services, as well as economic incentives.

3.5 Intermediary care

Conditions that used to be taken care of by hospitalization are more and more handed over to the municipal health care. These are patients with diabetes, COPD (chronic obstructive pulmonary disease) and terminal cancer. This makes it necessary to build an intermediary care service. In Northern Norway this is taken care of by the “general practitioners hospitals”. To make this service work, cooperation with the hospital is needed.

4 The national strategy for ICT development in the health and social sector

Norway has had a national strategy for ICT development in the health and social sector since 1997, mainly through the plans "More health for each bIT", "Say @h!" and "Teamwork 2007". In 2008 the government is launching a new plan.

A national strategy is based on the understanding that comprehensive national measures are necessary in order to realise the potential of ICT in health and social care. The situation in Norway was that a lot of actors throughout the country had initiated various exciting ICT projects. However, there was a lack of coordination between these projects. The vision of "More health for each bIT" was to build bridges between the many ICT islands in Norwegian health services. The consecutive plan, "Say @h!" had the vision of achieving ICT-based interaction in the health services on a broad basis, not just pilot projects. An external evaluation of the "Say @h!" plan concluded that the plan has made a positive contribution to the accelerating and coordinating developments of ICT during the period covered by the plan. ICT is used more and more in different areas and there is more continuity in the implementation and use of ICT. However, there is still a long way to go before the full potential is realised.

The vision of "Teamwork 2007" is that patients and clients should experience continuity of care when using health and social services. The plan has two main priority areas:

- Free flow of information: Well-defined and appropriate information is the premises for continuity of care and cooperation between health and social carers. Sending information through speedy and secure channels must be possible. This presupposes working with infrastructure, information structure, information security, electronic patient records, exchange of electronic messages and access to professional support.

- Electronic interaction with new actors: Central actors in the continuity of care such as pharmacies and municipal services interact electronically to limited degree with their cooperating partners. To achieve continuity of care these more actors must participate in the exchange of electronic information. Patients, clients and relatives must also be included in the interaction.

5 ICT in health care

5.1 The Norwegian Healthnet

The five regional health networks are now connected in a coordinated network. Through the establishment of the Norwegian Healthnet Ltd., an electronic motorway is now in place, with the security, capacity and availability that is required in order to exchange information in the health and social sector.

The Norwegian Healthnet (NHN) is the secured and dedicated arena for electronic interaction and information in the Norwegian health- and social services sector. All public hospitals in Norway and about half of the primary physicians and some private specialists are connected to the health network.

NHN contribute to high-quality and coherent health and social services, by being a sector network for effective cooperation between the various service sections in the sector. The network is built using open Internet technology with a high focus on information security, capacity and availability.

The Norwegian Healthnet Ltd. has national responsibility for supplying secure basic communication between the actors in the health and social sector. This involves responsibility for the communications network and for basic communication services such as address systems, catalogues and support systems for exchange of information.

5.2 Electronic patient record (EPR) in the hospitals [2]

The Patient record is the core of the dissemination of information in the health sector. Information which is produced by all kinds of health personnel are compiled in the records. ICT is an instrument which contributes to fulfil goals in health politics, and electronic patient records (EPRs) are perceived to be an important means to achieve quality improvement in the health and social sector.

Standardization and the employment of common concepts and codification are vital to secure that the information can be transmitted between systems in an unambiguous fashion, and can be interpreted in the same way by both senders and receivers. Standards for the information content in EPRs are developed by the Centre of Competence in Information and Communication Technology in Health Care (KITH).

Even though the hospitals have implemented EPR, studies reveal that many hospitals use the paper record as their primary patient record. Patient records are either paper records, electronic and paper record and electronic. 12 of the 42 institutions are using the paper record as the primary record, 12 institutions are using the electronic record as the primary record and 18 institutions use the are using the electronic record as the

[2] Rapport: IKT I sykehus og elektronisk samhandling I helsetjenesten. Vedlegg til Riksrevisjonens undersøkelse om IKT i sykehus og elektronisk samhandling i helsetjenesten, Dokument nr. 3:7 (2007–2008),

primary record but are being supplemented by a paper record.

A questionnaire revealed findings that the doctors thought that EPR enhanced cooperation and made patient information more accessible across departments. A big majority of the doctors agreed that the use of the EPR lead to quicker lab results.

Some of the challenges of the further development of EPRs are:

- EPR and communication with patients
- EPR as a means of interaction between health personnel
- EPR as a tool for documentation and decision making in clinical work
- EPRs as a knowledge base for management, planning and organising, quality development and research
- Challenges concerning the protection of personal information, the division of information and access control
- The internationalisation of EPRs

Electronic messages and many telemedicine services are now based on the Electronic Patient Record (EPR). EPRs are therefore perceived to be a prerequisite for the dissemination of telemedicine.

5.3 General Practitioners

Most GPs in Norway employ electronic patient records (EPRs). There exist four different EPR systems for general practices and three systems for hospitals. The communication between users of the different systems is not without problems, but there exist software which facilitates this interaction.

5.4 Electronic Messages

The electronic message services are aimed at making treatment and administration of patients more efficient. It replaces traditional letters sent by postal mail. A wide range of messages are being sent. Among the most frequent used messages are electronic discharge letters, laboratory reports, radiology reports and out-patient notes. Other kinds of messages are e-prescriptions, medical certificates, and reports to the authorities, like cancer and birth reports. At present about 42 % of all discharge messages from hospitals to GP offices are sent electronically. The main goal is to make all communication between the primary health care and the hospitals electronic. There are also projects providing secure electronic communication between the patient and the GPs.

The benefits gained from electronic interaction in the health and social sector are only to a limited degree associated with the actual technology and the automation that results from ICT. The benefits, both in relation to quality and effectiveness, are first achieved when electronic applications are combined with changes in work processes and appropriate division of labour between organisations. The benefits are also dependent on the culture in an organisation being amenable to change.[3] A recent study shows that the cost effectiveness of electronic messages depends on the level of use: The more messages which are transmitted electronically, the greater the benefit will be. A full implementation of electronic referrals and discharge letters will imply a benefit of almost € 20 million during the next ten years. The most important benefits are time-savings, as well as savings on paper and postage.[4] Electronic interaction also bring about qualitative benefits, see table 2.

In 2006, approximately 42 % of all discharge letters were sent electronically from hospitals to GPs, while 8% of all referrals from GPs to hospitals were electronic.

5.5 ICT in the municipal health care and social services

Previous studies have revealed that the municipalities have been modestly engaged in the use of ICT in the health and social services. The reason for that is partly the lack of knowledge about the possibilities of using ICT to provide better and more efficient services, partly lack of competence among leaders and health care personnel regarding the use of available ICT solutions. Another reason is that ICT solutions have not been adjusted to the needs of the municipal health and social services, and that the possibilities to communicate electronically with other health caregivers, hospitals and GPs, has been limited.

A questionnaire carried out in May-June 2008, answered by 270 municipalities, revealed that the situation has been changing considerably during the last years. The study shows that 94% of the municipalities have an electronic care documenting system and that almost every one of the remaining municipalities is planning to acquire such a system. The system is used in the home care services and in nursing homes. In the home cares services the system is used for patient administration (93%), electronic patient record (76%) and planning of the work (43%). The figures for the nursing homes are 91%, 75%, 28%. The systems are used in rehabilitation (67%) and in psychiatry. GPs responsible for nursing homes are using the municipal electronic patient record more frequently (58%).

116 out of 344 Norwegian municipalities are connected to the Norwegian Health Net. 69 municipalities are planning to connect in 2008-2009. 34% of the municipalities use the health net to communicate with hospitals, 26% to communicate with the GPs, and 16% to communicate with GPs on off-hour emergency service.

[3] Te@mwork 2007

[4] Aanesen M et al. Samfunnsøkonomisk analyse av elektronisk meldingsutveksling i norsk helsesektor. [Socio-economic evaluation of electronic messages in the Norwegian health sector]. Published by the Norwegian social and Health Directorate. The report is available in Norwegian only.

15% of the municipalities use mobile equipment (PDA), while 34% are planning to acquire such equipment. Only 1% of the municipalities have started to use bar codes.

5.6 Patients

e-health is referring to information and health services delivered to the patients via the Internet. Making knowledge bases of medicine accessible to consumers enables evidence-based decisions and empowerment. A survey on patient's and health consumer's use of Internet health services was conducted in 2005 and 2007 (Andreassen, 2007). A representative sample of seven European countries was interviewed by telephone.

Table 1: Internet health users, Norway 2005-2007. Percentages of total population with (95% CI)

Count (N) 2005/2007	2005 % (CI)	2007 % (CI)
972/1001	59 (56-62)	67 (64-70)

Three third of the population (2007) have accessed health information on the Internet. The survey can be a tool for policy makers when developing future health services. But there is a digital divide and this knowledge should be taken into consideration in future strategies and plans for e-health.

6 Telemedicine in Norway

Telemedicine could be defined as "the investigation, monitoring and management of patients and the education of patients and staff using systems which allow ready access to expert advice and patient information no matter where the patient or relevant information is located" (European Health Telematics research programme Advanced Informatics in Medicine, 1991). Other terms that describe the phenomenon are "TeleHealth", "TeleCare", "Health Telematics", "eHealth", "Medical Informatics" or simply "ICT for health". The term used in this paper "telemedicine" encompass a broad range of issues and are more in line with the various definitions of eHealth, including issues related to consumers and health information as well as clinical applications and eLearning for healthcare personnel and patients.

The number of services offered in the public health sector is large, with many different parties involved in the production, and the scale of information exchange and interaction is enormous. The management and financing of the sector is therefore comprehensive and complex. The political expectation to the use of ICT in the health care sector has been high. ICT-based information- and communication systems can both increase the efficiency and the quality of the information, and at the same time offer new tools for administration and management.

Telemedicine may realize benefits such as increased:

- cost-effectiveness of health care services
- access to health care services
- quality of care

6.1 Telemedicine services in Norway

Telemedicine services are mostly provided by the secondary care centres (hospitals) to local hospitals, GPs and others. The Norwegian Healthnet Ltd. only provides the infrastructure that makes telemedicine services possible. Table gives an overview of some of the services and the technology used.

Several of the telemedicine services are real-time services where the patient and the service providers are communicating live. The services are often based on different types of videoconferencing technologies for providing live audio and video communication, often combined with transmission of monitoring data. The services as used for meetings, distance education and direct clinical use. One example is the dermatology service which runs between the University Hospital of North Norway and the local hospitals in Kirkenes and Hammerfest. The patient and the physician on one end and the dermatologist on the other, communicate via videoconferencing. A video camera is used to convey images of the patient's diseased skin areas to the dermatologist making it possible to make diagnosis and advice on treatments. Both local hospitals have bought equipment for treating dermatological diseases and are able to offer their patients treatment locally. A telemedicine application is also used for supporting dialysis treatment at satellite centres in the region. Videoconferencing enables daily communication between the university hospital and its satellites. Patients are remotely examined by the specialist and the specialist can monitor the haemodialysis machine and patient data at a distance. Other areas using real-time telemedicine services are ear-nose-throat examinations, psychiatry, emergency medicine and adjustments of hearing aids.

Offline telemedicine services transmit either still images or audio files. These are either sent in a secure e-mail system or are included in an electronic referral made by the physician and sent to a specialist. This type of referral provides information and patient data that often enables the specialist to make diagnosis and give advice on treatment directly. If the information in the referral, the quality of the still images or audio file is not adequate for decisions about treatment it will be used for triaging for consultations at the out-patient clinic. Still image referrals are used in ophthalmology as a part of routine check-ups for retinopathy for diabetes patients, dermatology and otorhinolaryngology (ENT). Still images are also used by plastic surgeons in the process of giving priority to referred patients and in the planning process before surgery. In addition this service has been used for parents with children with chronic eczema. This makes it possible to get continues follow-ups by highly specialized nurses and specialists. The use of audio files in an electronic referral has been tested in a case study using pre-recorded heart sounds of children with heart murmurs. Based on the digital audio file the specialist is able to decide whether the murmur is functional or pathological. The radiology service consists of two separate types of services. The first one is the transmission of radiology images for diagnostic purposes for hospitals without radiologists, for second opinions in rare and difficult cases and in connection with transfer of patients. The second one is giving access to the booking- and radiology report system at the university hospital. This makes it possible for a GP to send an electronic referral, to book appointments for patients and to log onto and read reports in connection with patient consultations. Off-line technologies are also used in dermatology/ulcers, ear-nose-throat, pathology, transmitting blood glucose levels among others.

Table2: Overview of telemedicine services.

Service	Offered by	Offered to	Used for	Technology involved
Dermatology still images	Hospitals	GPs	Remote diagnosis and advices of treatment, control after treatment	Digital camera PC with software for transmission of encrypted e-mail*, ISDN-connection, router with access to the Healthnet
Dermatology videoconference	Hospital	GP	Remote diagnostics and advices of treatment	Videoconference Camera Access to healthnet
Plastic surgery	Hospitals	GPs	Giving priority to patients and planning of operations	Digital camera, PC with software for transmission of encrypted e-mail*,ISDN-connection, router with access to the HealthNet
Ophthal-mology	Hospitals	Health care centres, local hospitals	Remote diagnosis	Fundus camera connected to a digital camera, PC with software for transmission of encrypted e-mail*, ISDN-connection, router with access to the Healthnet
Orthopaedics	Hospitals	District medical sentres	Follow ups after fractures of radii	Videoconferencing equipment, Radiology equipment incl. PACS, access to the Health Net and EPR
Otorhinolaryn-gology	Hospitals	GPs	Remote diagnosis, advices of treatment and control after	Endoscopy equipment connected to a PC, digital camera,

			treatment	PC with software for transmission of encrypted e-mail*, ISDN-connection, router with access to the Healthnet
Pre-recorded heart sounds	Hospitals	GPs	Remote diagnosis	Electronic Stethoscope, PC with software for transmission of encrypted e-mail*, ISDN-connection, router with access to the Healthnet
Dialysis	Hospitals	Local treatment satellites	Communication between staff, treatment and diagnoses	Videoconferencing equipment, ultra-sound and stethoscope. Software to monitor the haemodialysis machine and patient data
Radiology	Hospitals	Hospitals	Reading of radiology images without radio-logists, second opinion, connec-tion with transfer of patients	Radiology equipment incl. PACS, access to the Health Net
Radiology	Hospitals	Hospitals and GPs	Bookings and referrals, access to radiology report system	Access to the Healthnet
Leg ulcer	Hospital	Nurses in home care	The nurses at the hospital provide guidance in how to treat leg ulcer	Digital camera, PC with software for transmission of encrypted e-mail*
Electronic communication between patients and GPs	GP	Patients	The patients send questions to the GP and get answer via e-mail	
Electronic communication between nurses in home care and GPs	GP	Nurses	The nurses send questions and prescriptions to the GP. The GPs answers via e-mail	Pc with software for transmission of secure e-mails

* The software used can be implemented in all the electronic patient records most widely used in primary health care.

eHealth and telemedicine projects:

- A tele-obstretric broadband services including ultrasound, videoconferencing and cardiotocogram
- Telepsychiatri (videoconferces)
- eLearning
- Self-help Internet group on the Internet
- Eczema Counselling via the Internet

6.2 Benefits

A systematic review of documentation which dealt with benefits of Norwegian telemedicine was completed in 2006[5]. The review differentiates between economic and other benefits. The latter has largely qualitative measures.

There is a demand for information about the benefits of telemedicine, but in relation to the demands, the documentation can be said to be somewhat limited. This may be due to the fact that telemedicine is a relatively new research field, and that the use of technology and research is under development. Furthermore, the studies that have been made up until now satisfy only a few of the methodological requirements that make generalisation possible. So far, mainly pilot programmes and small scale services have been evaluated and investigated and it is important to observe that the results from different evaluations are based on specific conditions and do not immediately lend themselves to generalisation. This chapter summarises the main conclusions of the review.

Economic benefits

Analysis shows that the cost-effectiveness of telemedicine services and electronic messages exchanged is often dependent on investment costs, the number of consultations or electronic messages exchanged per year that are made with the help of telemedicine, as well as the costs of travelling to a specialist hospital. The results are often presented as a break-even point which expresses the number of consultations that must be made annually with the help of telemedicine in order that telemedicine shall be more cost-effective than the traditional method of holding consultations, which often means that the patient must travel to a specialist hospital. In some off the studies, the conclusion is that the evaluated service is cost-effective; others show that there is some potential for cost-effectiveness; however the services were not used enough at the time of evaluation to show benefits.

[5] The results are reported in: Johnsen E, Breivik E, Myrvang, R Olsen F. Benefits from telemedicine in Norway. An examination of available documentation. HØYKOM report No. 2006:1. http://www.hoykom.no/hoykom/HOYKOM_Prosjekter_ny.nsf/a1b9d00d779649e9c1256d7b0033f036/2629abfbf8cc02e8c12571a2003cb41f/$FILE/HR%202006-1_mf.pdf

Documented areas of benefit		
Economic	Qualitative	
Travel costs Number of hospital admissions Time spent by health practitioner Paper and postage	Time for other tasks Data quality Patients do not have to travel Health benefit where “time counts” Selection of patients	Competence in medical disciplines Professional confidence Access to specialists Efficient use of specialist expertise Patients’ empowerment

Qualitative benefits

The results are presented in three main categories: Electronic patient records (EPR) and electronic messages, discipline-specific solutions and patient-oriented solutions.

A certain degree of integration has been developed between EPRs and electronic information that is exchanged between primary and specialist health services. Documented benefits are that the institutions avoid duplicating tasks and there are fewer errors made in recording patient information. In general practitioners offices (GP-offices), EPRs have contributed to the re-deployment of resources – among other things, medical secretaries have been delegated more interesting duties. In the nursing and care services, mobile EPRs for nursing and care documentation have contributed to simpler routines and fully updated records and to faster communication with the outside world.

In the case of discipline-specific services, documented qualitative benefits can be found in enhanced expertise for health personnel, as well as increased levels of quality experienced by patients. The exchange of monitoring information from teledialysis of patients with kidney failure has contributed to a higher level of care quality. Teleradiology and fundus photography of patients with diabetes contributes to less travelling for patients. For teledermatologi an enhanced level of expertise and a better selection procedure for patients requiring hospital treatment has been documented. In emergency medicine, the solution for acute heart problems saves time and the benefits increase in step with the travelling time to hospital.

In the case of telemedicine solutions that contribute to empowerment for patients, the documentation shows positive results in accordance with the available literature on “Internet-based self-help”. The benefits show as greater openness regarding illness and in some cases it is easier to discuss sensitive issues “online” than face-to-face. E-mail between patients and GPs seem to lead to a relationship of trust between the patient and health service personnel, as well as replacing a number of consultations and telephone enquiries.

7 Legal Issues in Telemedicine and eHealth[6]

Telemedicine and eHealth is still an area where a lot of legal issues need to be clarified and solved. Solutions and services are still very much in their infancy and the level of integration and implementation varies a lot from country to country. It is probably also fair to say that in most cases, legal issues are not in the forefront when it comes to carrying out eHealth projects or implementing solutions.

Having said that, there is no doubt that the importance of clarifying the legal frameworks and overcoming legal barriers is widely recognised as important. In most countries health care is surrounded by extensive legal frameworks, as is information security issues.

There is no specific legislation on telemedicine and/or eHealth in Norway. This means that such services must operate within existing legislation. The challenge is then to assess and clarify the legal framework and to find ways of adapting and adjusting both technology and solutions to fit within the framework. In some cases it might also be necessary to point at the need for legislative changes.

At NST we have approached the work on legal issues by focusing at laws and regulations as a framework within which telemedicine and eHealth must operate. We have found this approach more fruitful than to see laws as barriers at the outset. But of course, to the extent regulations act as real barriers to presumably good services, it is important to work towards finding ways to overcome and/or removing these barriers.

7.1 Responsibility

The term "responsibility" is rather complex and can include at least three situations or aspects:

Responsible practice
Legal and ethical requirements for good, professional practice and conduct. These requirements can be found in formal legislation as well as in many kinds of professional guidelines. In Article 4 of the Norwegian Health Personnel Act[7], this aspect of responsibility is expressed like this:

"Health personnel shall conduct their work in accordance with the requirements to professional responsibility and diligent care that can be expected based on their qualifications, the nature of their work and the situation in general". [8]

[6] Nohr L et al. Croatian Island Telemedicine System Project: Public Health and Technical Evaluation. NST-report: 08-2007.
[7] The Act is attached as an appendix to this report
[8] Unofficial translation. The translation can be found here: http://odin.dep.no/hod/engelsk/regelverk/p20042245/042051-200005/index-dok000-b-n-a.html

“Doctor in Charge”
This aspect of responsibility is about the professional duty to take responsibility for the patient and for her/his treatment. In a treatment “setting” where a number of doctors and other health care personnel are involved, it is necessary to make sure that one (or at least only a few) have the overall responsibility and the final decision making power. This is no less important when it comes to providing health care by telemedicine. In this context it is perhaps even a greater risk that this responsibility becomes unclear – leaving the patient in an uncertain situation.

In many (most) cases, it is clear from the situation at hand who the “doctor in charge” is. If this is not the case, it is recommended that this is made clear among the parties. An example: In a videoconference, the specialist clearly states to the other doctor and the patient that she or he get enough information from the videoconference to make a qualified decision on treatment of the patient and consequently take responsibility – becomes the doctor in charge. If the specialist does not think she or he can do this, the doctor sitting with the patient is in charge and is responsible and the consultation is more a second opinion –consultation.

Sanctions
The final aspect deals with the consequences of the first to – being held responsible and being subject to sanctions.
In Norway we have very few cases where health personnel are sued. In the case of misconduct, most cases are settled and decided by a National Patients’ Injury Compensation Board.

It is in fact difficult to give a more precise answer to these responsibility questions. Responsibility and especially issues concerning good and professional conduct is a so-called legal standard and assessed based on the situation at hand. This is however clearly an important issue in telemedicine and eHealth, and as a consequence the Norwegian Health Ministry issued this “circular letter” which aims at clarifying questions concerning telemedicine and responsibility by interpreting Norwegian legislation. The document is meant to be a guideline for telemedicine users.

The guideline starts out by stating that the legal requirements for responsible practice (as quoted above) are the same in telemedicine as in traditional medicine. A special emphasis is laid on the requirement that all health personnel must practice in accordance with her or his qualifications. Furthermore the duty of documentation (keeping of records) is emphasised.

The guideline lays down one principle that is very important in telemedicine: It clearly states that in terms of responsible and good medical practice, it does not matter how information is transmitted to the doctor. The important issue is whether or not the doctor gets enough and relevant information. It does not matter if the doctor (or any other health care personnel) gets the information by face to face examination of the patient, by email, by videoconference or by any other means. This is actually a quite important statement as we have seen examples of Ministries, Health Boards and Medical Associations taking another approach and making clear statements in the direction that responsible medical practice can only be provided by "traditional" face to face consultations and that all other methods (incl. telemedicine and/or eHealth) are "second-rate" and only suited for general advice and second opinion.

The Norwegian Circular Letter concludes with a summary:

- The use of telemedical services does not alter traditional responsibility requirements
- All health care personnel have a duty to ensure that they make responsible decisions
- A responsible medical assessment must be based on relevant and necessary information
- If the information received is not relevant or sufficient, health personnel in charge of the treatment have a duty to gather more information or to see the patient in person (face to face)
- In a telemedicine setting it is important to clarify the parties' roles and premises.
- It is a duty for health care institutions to establish routines and systems that ensure that the use of telemedicine is responsible towards the patient.

7.2 Privacy, confidentiality and data security

Confidentiality and privacy are fundamental issues in health care – in Norway as everywhere else. These issues are heavily secured by law, both in health care legislation and through legislation on information security. Norway, as an EEA member has passed legislation in accordance with the EU-directive on processing of personal data.[9] Health information shall be considered sensitive and appropriate security regimes must be in place in order to secure it.

Patient privacy is primarily ensured by strict regulation of confidentiality in the doctor – patient relationship. This legislation applies for as many as 28 different types of authorised health care personnel.[10]

Principles and legislation on confidentiality must of course not be jeopardised or weakened by implementation and use of electronic solutions. This is also one of the most essential questions in telemedicine and law; How to ensure strict legislation on information security and confidentiality and at the same time make it possible – and legal – to utilize the enormous potential of modern information- and communication technology.

[9] Directive 95/46/EC of The European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data.
[10] See The Health Personnel Act, article 48

On a technological level, information security, including confidentiality and privacy, is ensured by making sure that technical and organisational measures and solutions meet legal requirements. This is both a responsibility for hospital owners and managers (system responsibility) and for each individual health care personnel (professional responsibility). This is a responsibility on all levels of providing health care and in all parts of the treatment process. The duty of confidentiality is part of the duty of responsible practice.

On a technical/technological level, eHealth and telemedicine solutions must meet legal and ethical requirements. This means both that systems must ensure a sufficient level of security in order to meet confidentiality requirements and at the same time provide solutions that makes it possible to add information, use information, share information, etc, according to legal provisions. As this is a very dynamic field, both in terms of technical development, user demands, new possibilities and legal frameworks, the different technical solutions are constantly changing and hopefully improving.

Encryption of data is a keyword, and is required both for storing and transmitting of information. Both end user applications and networks must be encrypted. Norway has a national health network (www.nhn.no) that connects all hospitals and some general practitioners. Traffic through this network is encrypted. In addition all end users are required to have encryption in place as part of their information security regimes.

According to Norwegian legislation it is required for end users to carry out risk assessments in order to ensure security and to make sure that security regimes meet potential risks and treats to the system. This risk assessment shall also include assessment of network-security.

Breach of legal requirements on information security can be a violation of both health legislation and legislation on processing of personal data. For health care personnel it is probably most relevant to be sanctioned according to health legislation. Sanctions can be in the form of administrative sanctions, ranging from being warned to loosing the license.

7.3 Consent issues

Consent is of course a fundamental basis for treatment – in telemedicine as in all aspects of health care. Accordingly, telemedicine must be based on consent. A more important question is whether or not it is necessary or advisable to ask for specific consent from the patient when using telemedicine or whether it is sufficient to base treatment on presumed consent (i.e.). This is not directly solved by Norwegian legislation and an answer must be based on a more general interpretation of laws and other guidelines.

To the extent that a given (telemedicine) service is new, untraditional and presumably unknown to the patient, she or he should be asked specifically to consent. In the case of telemedicine and/or eHealth solutions being part of a project, it shall in most cases be mandatory to obtain the patient's consent. As the use of telemedicine becomes more routine and part of everyday provision of health care, consent can to a larger extent be presumed.

The need for explicit – expressed – patient consent must also be assessed with relation to the service in question. One would consider consent differently when it comes to implementation of electronic health records or electronic information exchange than one would do with a project where the patient is asked to participate in experimental telecardiology (for example).

It is worth mentioning that Norway, as most countries in the world, follow the Helsinki Convention on research on humans. In the convention it is clearly stated that such research must be based on informed consent and that consent to participate in most cases shall be written.

According to Norwegian legislation, there are no formal requirements for giving consent. This means that consent can be presumed, given orally or given in writing on a consent form or otherwise. But regardless of how consent is given, providing sufficient information is of the essence. We are talking about informed consent, and the patient has a right to get all necessary information about the treatment and procedures, expected outcome, risks, etc. for consent to be valid. It is the responsibility of the health personnel providing the treatment or performing the examination to make sure that the patient is given relevant information and that she or he is giving a valid consent.

There are of course a number of other questions regarding consent that could be discussed (personal competence, consent by proxy, etc) but we believe that it will be to detailed to address them in this report.

7.4 Documentation/recording of data

Documentation is regulated by the Health Personnel Act with additional regulations. According to its Article 40, patient records "…shall be kept in accordance with good professional conduct and shall contain relevant and necessary information about the patient and the health care…". Two core words here are "relevant" and "necessary".

As far as we know, there are no systems in place that actually record all the data, nor is this required by law. Accordingly, documentation systems should be made so that they provide solutions and possibilities for different kinds of health professionals in different situations to add information that they consider to be relevant and necessary in the situation in question. As pointed out in the quoted section of article 40, documentation, both the duty to document and content of records, shall be done in accordance with good professional conduct.

In the case of consultations by telephone between two doctors it will fulfil the legal requirements if the consultation is recorded – in writing – electronically or otherwise by the doctors involved.

With regards to telemedicine services, it has been discussed whether or not videoconference consultations (with patients) should be recorded and the recording added to the patient's records. So far it has not been required to do so, but this might change as records become more integrated with electronic communication between hospitals, doctors, general practitioners and patients.

References:

Aanesen M et al. Samfunnsøkonomisk analyse av elektronisk meldingsutveksling i norsk helsesektor. [Socio-economic evaluation of electronic messages in the Norwegian health sector]. Published by the Norwegian social and Health Directorate. The report is available in Norwegian only.

Andreassen H et al. eHealth trends across Europe 2005-2007
NST-report: 09-2007

Johnsen E, Breivik E, Myrvang, R Olsen F. Benefits from telemedicine in Norway.
An examination of available documentation. HØYKOM report No. 2006:1

Johnsen J R. Health Systems in Transition. European Observatory on Health Systems and Policies. Vol. 8 No. 1 2006.

Nohr L et al. Croatian Island Telemedicine System Project:
Public Health and Technical Evaluation. NST-report: 08-2007.

Norgeshelsa.no (http://www.Norgeshelsa.no)

Norway's Division for Health Statistics (http://www.sbb.no)

Rapport: IKT I sykehus og elektronisk samhandling i helsetjenesten.
Vedlegg til Riksrevisjonens undersøkelse om IKT i sykehus og elektronisk samhandling i helsetjenesten, Dokument nr. 3:7 (2007–2008),

Competitive Health Services

www.ehealthservices.eu

Northern Ostrobothnia Hospital District

OULUN YLIOPISTO
UNIVERSITY of OULU

FinnTelemedicum

1495
UNIVERSITY OF ABERDEEN

Centre for Rural Health
Research and Policy

The University of Aberdeen and UHI Millennium Institute working in partnership

UMEÅ UNIVERSITET

VÄSTERBOTTENS LÄNS LANDSTING

NST | Norwegian Centre for Telemedicine
UNIVERSITY HOSPITAL OF NORTH NORWAY
WHO Collaborating Centre for Telemedicine

Northern Periphery Programme 2007–2013

European Union
European Regional Development Fund

Innovatively investing in Europe's Northern Periphery for a sustainable and prosperous future