Lessons learned from 25 years with telemedicine in Northern Norway

Gunnar Hartvigsen and Steinar Pedersen
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Gunnar Hartvigsen, PhD
Norwegian Centre for Integrated Care and Telemedicine,
University Hospital of North Norway, Tromsø, Norway
and
Department of Computer Science, Faculty of Science and Technology,
University of Tromsø – The Arctic University of Norway, Tromsø, Norway

Steinar Pedersen, MD
Tromsø Telemedicine Consult AS, Tromsø, Norway
Preface

Telemedicine in Northern Norway is widely known for early adoption of telemedicine services to serve the population living in rural and remote areas in the Arctic. Visionary politicians, health administrators, doctors and researchers who saw the possibilities to offer high quality healthcare to everybody regardless of where they live initiated the development of telemedicine services in Northern Norway. In this book we present the journey towards fulfilling the vision of the Norwegian Centre for Integrated Care and Telemedicine (NST) – to create the basis for care over distance:1

“Through interdisciplinary research and advisory services, NST will provide, disseminate and implement new solutions and new knowledge within collaboration, telemedicine and e-health in order to improve, simplify, and increase the effectiveness of the health and care service at the national and international level.”

When starting Telemedicine in Northern Norway, little did we know about the ICT development in the years to come. Phenomenon such as Google and Facebook were many years ahead. Network connections were based on analogue telephone lines, or at the best, ISDN lines. In addition, mobile phones weighed 10 kg and was reserved for the very few. The development of the services described in this book has to be viewed with this as a background.

This book includes a presentation of the following telemedicine services:

- Teleradiology
- Teleotorhinolaryngology
- Telepathology
- Teleophthalmology
- Teledermatology
- Telecardiology
- Teledialysis
- Teleobstetrics/prenatal telemedicine services
- Telemergency service
- Teleoncology
- Telecare
- Teleodontontology/teledentistry
- Telegeriatrik
- Teleendocrinology/-telediabetes
- Telepsychiatry
- Telemedicine solutions for patient empowerment
- Prenatal telemedicine
- Maritime telemedicine
- Videoconference in telemedicine services
- Messages and electronic communication in telemedicine services

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In addition, the book addresses:

- Tele-education/distant education
- Reimbursement of telemedicine services
- International projects in telemedicine

For each service, we present problem, solution, and lessons learned. At the end of the book, we have tried to summarize what we have learned about telemedicine services in Northern Norway. Furthermore, we try to look into the future of telemedicine services. The book is mainly based on published reports and unpublished project presentations from NST, mostly written in Norwegian. With this book we want to make the knowledge and lessons learned from implementation of telemedicine services in Northern Norway available to a broader audience. For several years, a draft version of this book has been used as a textbook in the International 2-years master’s program in telemedicine and e-health at the University of Tromsø – The Arctic University of Norway.

The book is written for clinicians and other healthcare workers; informatics researchers; government healthcare representatives and policy makers; students in health sciences, medical informatics, health informatics, and others who want to learn more about telemedicine in practice.

Upon completion of the book, readers will be able to:

1. Understand the role of telemedicine in health care service in general, and in specialist health care (in rural areas) in particular.
2. Understand the role and impact of information technology in telemedicine.
3. Understand the impact of the technology on patient empowerment, clinical outcomes, safety and quality of life in rural areas with basic health services only.
4. Understand the design and implementation challenges associated with telemedicine systems.

This book does very briefly present some of the research projects that have been done or are going on at NST. Those who want to learn more about NST’s research projects are refereed to NST’s web page.

Acknowledgements

This book is based on the work of more than 200 telemedicine enthusiasts and professionals at the Norwegian Centre for Integrated Care and Telemedicine (NST), University Hospital of North Norway (UNN), University of Tromsø – The Arctic University of Norway (UiT), Telenor Research Department, Norut research institute, Norwegian Healthnet, and Health North ICT. Without their remarkable effort, we would not have had much to report. In particular, we want to thank all staff members at NST who over the years have documented their work through photos and reports. In many cases, the photographers are unknown. Thus, we have added UNN or NST as originator to the pictures found in UNN and NST’s picture archives.

The authors want to thank the Norwegian Centre for Integrated Care and Telemedicine, University Hospital of North Norway, Department of Computer Science, University of Tromsø – The Arctic University of Norway, and Tromsø Telemedicine Consult AS for the opportunity to work on this book.
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Finally, Hartvigsen want to thank his family for being patient with him when his attention has been on the book project.

Tromsø, 8 September 2015

Gunnar Hartvigsen    Steinar Pedersen
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1 Introduction

1.1 The early years

As part of the work of the Executive Committee for Northern Norway efforts were initiated to study research and development (R&D) activities in the region. This was later followed up by the Ministry of Industry and Craft, which appointed a committee that should look into this matter. In February 1987, the committee submitted its report “Growth and innovation in the North. R&D plan for northern Norway.”

The plan was sent out for comments, among others to the Norwegian Telecommunications Administration (NTA), which in its reply provided a list of projects the NTA was working on in order to look at opportunities and needs for new telematics services in the region. The Ministry of Transport, lead by the Minister of Transportation, Mr. Kjell Borgen, thought that the directorate was a little too passive and therefore asked for an assessment in relation to a greater involvement with respect to regional development of research in the telecommunications area. The Ministry asked that it should be considered to create a separate subsidiary of the Norwegian Telecommunication Administration’s research department affiliated with the telematics research groups in Tromsø (University of Tromsø and the Research Foundation at the University of Tromsø – FORUT).

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2 Landsdelsutvalget for Nord-Norge (Executive Committee for Northern Norway).
3 Industridepartementet (Ministry of Industry and Craft). In 1988, the Ministry was reorganized and named “Næringsdepartementet”. Today, the English name is “Ministry of Trade and Industry”.
5 Teledirektoratet (Norwegian Telecommunications Administration)
6 Teledirektoratetets forskningsavdeling (Norwegian Telecommunications Administration’s research department)
7 In 2013, University of Tromsø was renamed University of Tromsø – The Arctic University of Norway.
8 FORUT was later renamed NORUT.
“Based on this background [to establish regional research in telecommunication], we ask that the Norwegian Telecommunication Administration within May answers the question of the possibility of establishing a satellite in connection with the information technology groups in Tromsø, starting with 5-10 staff members.”

The Norwegian Telecommunications Administration’s research department, lead by director Nic Knudtzon, appointed a working group to examine the practical possibilities for the establishment of a department in Tromsø. The group found that it was reasonable to base the activity on the operations the Norwegian Telecom already had going on in the region and in the research collaboration that was already established with FORUT. The following possible priority areas were identified:

- Telecommunications services for business development in Northern Norway.
- Actions related to the Telemetering station in Tromsø (“Telemetristasjonen”).
- Computation / storage and transportation of large amounts of data.
- Transmission of images (among others for the health care sector).

After consultation with FORUT, transmission of images for health care (read: telemedicine) was given priority. The argument for choosing telemedicine was that this would have good social effects in a region with long distances and scattered settlements. Furthermore, in the

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9 “Vi ber på denne bakgrunn [regional oppbygning av teleforskning] om teledirektoratets uttalelse innen utgangen av mai til mulighetene for å opprette en egen underavdeling tilknyttet telematikkmiljøet i Tromsø, med i første omgang 5-10 medarbeidere.” (Original text in Norwegian)
Government's action plan for information technology, health care was given priority. The project would also give the already on-going project “Telematics in Finnmark health care” increased impact. This project was established in 1986 and focused on video conferencing for remote diagnosis, education and scientific meetings, primarily between Kirkenes hospital and what was then called the Regional Hospital of Tromsø (RST). (The hospital was later renamed the Regional Hospital of Tromsø (RiTø) for finally to be called the University Hospital of North Norway (UNN).) Initiator of the telematics project was the director of health care in the county of Finnmark, and the main player was director Ove Uttakleiv at Kirkenes hospital. Both FINNUT and FORUT had been involved in feasibility studies in connection with the project.

The proposal was that a project should be started as soon as possible (Fall 1987) with five researchers during a two years’ period, then a doubling to 10 researchers. It was strongly pointed out that this work should be done in close collaboration with the research community around the University of Tromsø. The Ministry of Transport was now satisfied and the Norwegian parliamentary bill No. 1 from 1987 to 1988 (state budget) had a special section on the establishment in Tromsø. The budget for the project was for 1988 set to NOK 6 million, which also included research grants to FORUT and the University of Tromsø.

The 1st December 1987, the research department established a pre-project entitled “Telemedicine in Northern Norway” with Birger J. Nymo as project manager. The steering committee consisted of the Research Managers Magnar Graffer and Bjørn Løken from the Norwegian Telecom's Research Institute (TF), Manager Atle Andersen from Northern Telecom District and research director Ola M. Johnsen from FORUT (Later, professor Willy Jensen entered the steering committee, when he stepped in for Ola M. Johnsen as head of research at FORUT’s IT Department). In 1989, the Ministry of Health and Social Affairs, represented by Egil Danielsen, entered the steering committee.

The overall aim was to establish research projects in telemedicine, based in Tromsø, in order to study how communications and information technology could contribute to health care improvements in terms of efficiency and rationalization. Specific goals were by the end of 1988 to hire 5-6 researchers, find a physical location in Tromsø, and to establish a master project in telemedicine (consultation, diagnosis, monitoring and control, internal communication and management).

The result (by end of 1988) was that it was established a research group consisting of Birger Nymo, Thore Danielsen, Eivind Rinde, Arne Kjetil Eidsvik, Trine Folkow, Sigurd From and Unni Holand. 1st January 1989 Gjermund Hartviksen and Bjørn Engum joined the team. The group was physically established with offices, laboratories and basic infrastructure in the premises of FORUT’s IT Department at Forhåpningen in Tromsø.

Researcher Thorill Antonsen at FORUT, together with some of TF’s staff from the new subsidiary of “Teledirektorates forskningsavdeling” (TF) research, was asked to provide the status of telemedicine in Norway as well as through contact with the regional health services to study and propose concrete activities attempted to show how IT could contribute to the efficiency of

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10 “Telematikk i Finnmarks helsevesen” (“Telematics in Finnmark health care”).
11 Regionsykehuset i Tromsø (RST).
13 From 1.1.2002.
14 Finnmark Utvikling.
15 St.prp. nr.1 1987-88 (statsbudsjettet) (English; Report no. 1, National budget 1987-88).
health care services. The work resulted in the report “Telemedicine in Northern Norway: Pre-
study” (Antonsen 1988).

The result was also that collaboration with a number of institutions and individuals in the health
Care system in Northern Norway were established in terms of project collaboration. Most im-
portant was that Regional Hospital of Tromsø (RST), with director Knut E. Schrøder in the
lead, became the project's main collaborator (Figure 3). To encourage cooperation, a contract
for “Telemedicine trials” between TF and RST was signed.

Figure 3  Knut E. Schrøder, MD, director at UNN, 1984-2007. Dr. Schrøder’s support of tele-
medicine was vital for the foundation of a telemedicine department at UNN. (Photo: UNN)

Right from the beginning the local doctor in Lødingen, Torbjørn Harr, was involved in investi-
gation of the use of information technology in occupational health service\textsuperscript{16}. (Harr was Norwe-
gian Telecom's company doctor in the Northern Telecom District.)

Doctor Peter Dvergsdal joined early the work of electronic messaging in health care. Eventu-
ally, people started experiments with electronic messaging of test results to the requisitioner
from the clinical chemical laboratory\textsuperscript{17} at the RST. Responsible at TF was Trine Folkow and
from RST Oddvar Gamst was responsible for the project.

Another project was transmission of ultrasound images. In the first round, an experiment with
ultrasonic testing of pregnant women between the health centre Sonjatun\textsuperscript{18} on Storslett and RST
was scheduled. Midwife Erna Ag and municipality doctor Asgeir Hansen-Krone were the key

\textsuperscript{16} Bedriftshelsetjenesten
\textsuperscript{17} Klinisk kjemisk laboratorium.
\textsuperscript{18} Approximately 3 hours drive from Tromsø, given good weather conditions.
persons at Sonjatun. Eivind Rinde participated from TF. At RST it was decided that the gynaecological department should be included. Because of competence conflicts (gynaecologists did not want a midwife to manage the ultrasound!), the practical test was not done. However, collaboration with the radiology department and cardiology department for remote diagnosis based on ultrasound was later established.

The project “Information models in health care”\(^{19}\) was intended to launch one or more conceptual information processing models for sectors within the health care system with regard to proposals for communication services. The project had an analytical nature, but later came to be important in a number of telemedicine trials. Central to the work was TF-researcher Thore Danielsen.

In “Standardization of medical information” the aim was to contribute to the development of standards for exchanging medical multi-media documents between and within institutions in the health care system. Among other things, people from Tromso contributed to the IEEE standardization in Project 1157: Medical Data Interchange (MEDIX) and the European EAURO / MEDIX in the EC program AIM. Sigurd From led the activity and key contributors were Peter Dvergsdal and Tor Ivar Lundgren from RST.

The aim for “Medical information service” (MEDIS) was to show how to exploit information technology to gain access to medical knowledge and experience using databases and electronic messaging. Bjørn Engum led the activity and partners were FORUT and RST with Tor Ivar Lundgren in the lead position.

The project “Broadband Communication in health care” was set to study the applications of broadband communications in the health care system. It was set up video links between RST and Kirkenes Hospital, and through the established videoconference network in northern Norway communication with Hammerfest hospital became also possible. Norwegian Telecom built a videoconferencing network in Norway at this time (2 Mbps). In connection with the project, several hospitals were hooked on: Kirkenes, Hammerfest, RST, Harstad, Gravdal, Bodø and Sandnessjøen.

Within health specialist consultation, telepathology between Kirkenes hospital and RST was the first to be established. Key people were Eivind Rinde from TF and Tor J. Eide and Ivar Nordrum from the pathological anatomy department\(^{20}\) at RST. At this time, the work on the transmission of x-rays was initiated. In the first phase of the project, the goal was to create a multimedia radiology journal. In this part, FORUT was heavily involved. Later, practical experiments between Troms Military Hospital and RST were started. Jan Størmer at the radiology department was a leading force in conjunction with, among others, Torbjørn Sund from TF. The work in radiology was done in cooperation with the EC project TELEMED, funded through the RACE program. This activity also included teaching / counselling. For example, students from the nursing school in Hammerfest, which was doing their practice period at the hospital in Kirkenes, was instructed and monitored by videoconference.

In addition, attempts were made with rehabilitation of clients with aphasia using electronic services (tele-writer). Key people were the leaders for rehabilitation centres for aphasias in Troms and Nordland County. It was also carried out experiments with the use of videophones in advisory activities in psychiatry.

\(^{19}\) “Informasjonsmodeller i helsevesenet” (Original title in Norwegian)

\(^{20}\) Patologisk anatomisk avdeling.
Then came the skin (dermatology) with Svein Erik Stenvold and Edward Falck as the driving forces at RST, ear-nose-throat diseases (otorhinolaryngology) with Daniel Haga, Alta Health Centre, Steinar Pedersen, RST, and Gjermund Hartviksen, TF, as the main players. In microbiology, Lars Vorland was the key player, in psychiatry Deede Gammon and Unni Holand had the same role, and in cardiac diseases (cardiology), Per Lunde was the central driving force. Within gastroscopy, Jon Florholmen at RST did the first experiments.

In 1992, the new University Hospital was opened. In connection with this, chief physician Lars Vorland and Professor Knut Rassmussen, both at RST, had contacted national health authorities in order to let RST have a national function for telemedicine. This was a successful meeting, which also established the financial fundament for the hospital to later start a Telemedicine department (TMA)\(^21\).

In 1997, about 8000 patients were diagnosed at RST using telemedicine solutions. Most of the services in regular daily use were based on video conferencing. Distance teaching was also an important aspect of telemedicine, and 13 different professions used videoconferences for distant teaching. In addition to VC, several hospital departments had started to develop services based on offline consultations, including dermatology, ENT, pathology, and cardiology.

1.2 **Telemedicine department (TMA)**

Late in 1992, doctor Steinar Pedersen (Figure 4) presented the idea of a telemedicine department (TMA) at RiTø. This was realized already in 1993 and organized as an independent research department at RiTø. Dr. Pedersen was TMA’s first director. The Ministry of Social Af-
fairs, Mr. Werner Christie, awarded RiTø national function, i.e., that the department was a national centre of expertise in telemedicine. According to the mandate, TMA should provide six different types of services:

- Remote consultations;
- Dissemination of competence;
- Document exchange;
- Emergency calls;
- Remote monitor services, and
- Medical information.

Figure 5  TMA anno 1994. At the end of 1994, the Telemedicine department had grown to eight people. (Photo: NST)

Figure 6  In 1998, TMA had grown to 27 people. (Photo: NST)

TMA was, with its 4 employees (Steinar Pedersen, Audun Rundhove, Eli Arild and Sture Pettersen), along with TF's staff, the beginning of what today is the Norwegian Centre for Integrated Care and Telemedicine (NST). The goal was then, as now, to offer patients better health
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care by using telemedicine. NST’s vision is “Excellent health services for everybody, independent of time and location”.22

Figure 7 Telemedicine in Tromsø, with Dr. Steinar Pedersen, or Mr. Telemedicine, as he was referred to in Europe, in charge, got very soon international attention for its innovative telemedicine services. (Illustration: Telemedicine and e-Health. February 2006, 12(1): 7-13.)

Many successful services led to increased funding and more people (Figure 5 - Figure 7). At the end of the 1990’s, NST had grown to close to 40 people. With a substantially increased

22 Norwegian: “Gode helsetilbud til alle, uavhengig av tid og sted”.
grant from the Ministry of Health, almost 30 people were employed in the year 2000 (see Figure 8.)

### 1.3 WHO Collaborating Centre for Telemedicine

A new boost in popularity and attention came in July 2002 when the World Health Organization (WHO) appointed NST as its first Collaborating Centre for Telemedicine. Through this role NST has also influenced the implementation of telemedicine services throughout the World. As a WHO Collaborating Centre, NST shall:

- Give strategic advice and support to WHO and member-states globally.
- Create awareness and demonstrate e-health proven practice.
- Facilitate research on telemedicine and e-health.
- Facilitate training and collaboration.
- Support e-learning and human resources development.

![Figure 9 Former Director-General of WHO, Dr. Gro Harlem Bruntland, opens the new WHO Collaborating Centre in Telemedicine, naturally through the use of videoconference 10th December 2002. (Photo: NST)](image)

At the opening on 10th December 2002, Dr. Gro Harlem Brundtland, Director-General of WHO (Figure 9), stated in her videoconference address that telemedicine can play an important role in the strengthening and scaling up of health systems. She continued to say that:

> “Information and communications technologies (ICTs), as a whole, have introduced profound opportunity and potential for the worldwide advancement of medicine and health care. Telehealth, electronic health records, computer-prescription entry systems, and e-health, hold great promise for the future.”
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Dr. Brundtland recognized that there were several challenges that needed to be overcome in order to realize the full potential of telemedicine, such as:

- Organizational barriers, technical knowledge, economic viability, organizational support and behaviour modification;
- Security, privacy and confidentiality issues;
- Legal and ethical challenges dealing with accountability and liability and jurisdiction; and
- Generating evidence that the technology contributes to performance improvement in health systems, helps build human capital for health, and improves access to knowledge, supports decision-making, and leads to better outcomes for patients.

Dr. Brundtland concluded that the WHO Collaborating Centre for Telemedicine in Tromsø will support WHO and its member states in addressing these challenges and helping countries realize the full potential of ICTs in health care.

NST’s role as a collaborating centre has been re-designated in 2006 and 2010. The activities of the centre cover the major aspects of telemedicine. A multi-disciplinary telemedicine team at NST has been appointed for issues related to the WHO Collaborating Centre issues (Figure 10).

Figure 10  Information about NST’s role as WHO Collaborating Centre for Telemedicine can be found at www.telemed.no/who (Last accessed: 7.4.2015.)
1.4 Master’s Programme in Telemedicine and E-health

In 2005 an international master’s and PhD-program in telemedicine and e-health was established at the University of Tromsø (UiT) (Figure 11). The two years Master's Programme in Telemedicine and E-health provides insight into the design, application and implementation of modern technology to public healthcare services. The Master's Programme is collaboration between UiT and NST. It is a stated goal that students should have the opportunity to develop a professional cooperation with NST. As one of the most internationally renowned Telemedicine research centres in the world, NST offers a stimulating research and learning environment for students in the Master's Programme.

During the first year, students follow 6 mandatory courses, each of 10 ECTS. The second year focuses mainly on the student's individual research project and the write-up of the master thesis. The goal is to prepare the students for challenging careers in health sectors and organizations as well as research and teaching in academic institutions.

The Programme qualifies its graduates to:

- Promote and introduce telemedicine and e-health services and programmes;
- Participate in the development of telemedicine and e-health products and services;
- Apply telemedicine and e-health services in professional healthcare; and
- Qualifies for research-oriented education such as PhD programmes.

Figure 11  Information about the International Master of Science Programme in Telemedicine and E-health can be found on the website to University of Tromsø, www.uit.no (Last accessed: 3.1.2014.)

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23 ECTS = European Credit Transfer System. 1 year full-time study = 60 ECTS.
Several students have continued with doctoral studies in telemedicine and e-health after having completed the master’s program. Experiences from the master programme are further presented in Section 4.25, page 313.

1.5 Tromsø Telemedicine Laboratory (2007-2014)

In 2006, NST became the initiator and coordinator of Tromsø Telemedicine Laboratory (TTL), which was a member of the Norwegian Research Council’s initiative for research-based innovation in telemedicine (Figure 12). With a total budget of more than € 30 million (2007-2014), TTL has played an important role in research and development of new telemedicine services. Professor Gunnar Hartvigsen was appointed as director and research manager and Sture Pettersen became administrative manager. Professor Lars Vorland, CEO, Northern Norway Regional Health Authority, served as chairman of the board of directors the first years. Professor Toralf Hasvold and Bjørn Engum, both when they were director of NST, followed him.

The Tromso Telemedicine Laboratory’s (TTL) vision was to become a world leading centre for research and innovation in the field of advanced telemedicine and e-health systems for chronic, age, and lifestyle related diseases. The centre’s aim was to supply the healthcare industry with viable and sustainable technologies that would promote global health, wellness and disease management by facilitating technological advances in the collection, processing and sharing of medical information. These should generate new products and services within telemedicine and
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e-health. TTL’s ambition was to provide results of interest for its partners as well as the Norwegian and international health care sector. The results were in form of new artefacts like software systems, specially developed hardware, methods and improved treatment of patients within the target groups.

Tromsø Telemedicine Laboratory (TTL) was organized into three research groups, Medical Informatics (MI), Mathematics and Statistics (MS) and Information Systems (IS). These groups were connected to one or more of five identified research areas. The description of the research areas constituted the long-term research goals in TTL. For each research area, one or more research projects were described.

The following research areas for TTL were identified:

1. Integrated medical sensors
2. Health terminals for personalized health care
3. Health intelligence
4. Computer aided diagnoses
5. Workflow management

The TTL consortium consisted of research institutions and industry from the areas addressed in the project description:

- DIPS ASA
- Northern Norway Regional Health Authority (Helse Nord RHF)
- IBM International Business Machines A/S
- Norwegian Centre for Integrated Care and Telemedicine (NST)
- Norwegian Healthnet (Norsk helsenett SF)
- NORUT AS
- Telenor ASA (Telenor GBD&R)
- University of Tromsø – The Arctic University of Norway (UiT)
- Oslo University Hospital (OUS)

When TTL officially closed in January 2015, the main results included:

PhD candidates:

- 18 successfully completed their dissertations
- No drop-outs
- ≈ 40% women

Nine PhD students were still working on their dissertations at the end of the official period.

Publications (total):

- 197 Journal papers
- 134 Conference papers
- 387 Abstracts & posters
- 24 book chapters
At the end of 2014, TTL’s researchers had published more than six times the number of journal papers that was stated in the research grant application eight years earlier.

The director of TTL argued in the final report that (Figure 13):

“When we started the grant application work, none of us fully understood the concept of a Centre for Research-based Innovation (SFI) and the potential for research and innovation that comes with it. The excitement when the Norwegian Research Council (NFR) accepted our application very soon manifested in the form of a great number of scientific publications, media coverage and after a few years, a steady stream of PhDs.

From the very beginning, the TTL community was truly international. Researchers and students in TTL spent time with TTL partners and with international research groups in the US, Europe and Australia. TTL also received many international students and researchers who spent from some weeks to a year with us.

Being a centre also means acting as a centre. A major task for the TTL administration has been to establish a common internal culture. Everyone should feel important and be a highly appreciated member of the TTL family. We achieved this by organizing seminars, both locally and abroad, social events at group and centre level, invited lectures and so on.

Several of our projects have been taken further by our partners or together with Nor-innova, the local TTO (Technology Transfer Office). We have learned that commercialization processes might be even more complex and might offer more surprises than the research process itself. In order to succeed, you have to be truly dedicated.”

Figure 13  Final report of Tromsø Telemedicine Laboratory 2007-2014.
Hartvigsen and Pedersen

TTL - in retrospect and in the time to come

Randi Laukli (24 November, 2011)

After four years with Tromsø Telemedicine Laboratory (TTL), it is time for research manager Gunnar Hartvigsen to take a look in the rear view mirror to evaluate the activities so far.

“TTL has met and exceeded all my expectations! I am very pleased with the partners and people involved, and with their enthusiasm and ambitions for the consortium,” he says.

Keys to success

Hartvigsen points out several reasons for TTL’s success: the rising number of papers published, the increased cooperation with the university hospital, the multiple possibilities for commercialization of products, and the will of partners to invest even more time and resources in the centre’s research projects.

“We also have very attractive, functional and welcoming office areas available for people affiliated with TTL. We see that our partners appreciate the possibility to do research here and to be part of our academic environment, and that they make use of this space to a larger extent,” says Hartvigsen.

Increase activity

The research manager believes that the composition of partners in TTL is quite appropriate:

“It reflects the reality of the Norwegian industry, with a few large actors and many small ones.

In the time to come, TTL will be seeking new business partners, as its mandate includes expanding the consortium during the eight-year contract period, as well as being able to attract new affiliates.

Important stakeholders in the field of lifestyle diseases, who can contribute and provide support on decisions in this specific area, will be of particular interest to us in the next project period, as many of our projects concern chronically ill patients,” Hartvigsen explains.

In addition to this focus, TTL will use the following period to increase the international activity even more. TTL also envisages an extension of some kind after 2014, when the present contract expires.

“At this point, it is important to establish the best possible foundation for a continuation of the good work that is being done at this centre,” Hartvigsen stresses.

24 This article was originally written by Randi Laukli, NST, and later translated into English by the authors. URL to the original article: http://www.telemed.no/ttl-in-retrospect-and-in-the-time-to-come.4988813-175772.html (Last acc.: 7.7.2015.)
1.6 **International attention**

More than two decades after the telemedicine activity in Tromsø started, the telemedicine services and research projects is still breaking new ground. Visitors are coming from all over the world to study what has been going on in the northern part of Norway.

After visiting Tromsø in 2008, Microsoft’s worldwide health senior director Bill Crounce, MD, wrote on his Healthblog, 9th June 2008 (Figure 16): “Soaring to New Heights in Telemedicine and eHealth”25

“This might be the last place you would expect to find an internationally renowned research center for telemedicine and e-health but that is exactly what is here. Tromsø is home to the internationally recognized Norwegian Center for Telemedicine, chaired by Dr. Steinar Pedersen.”

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Figure 16 Microsoft’s worldwide health senior director Bill Crounce’s Healthblog. (http://blogs.msdn.com/healthblog/) (Last accessed: 5.2.2013.)

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1.7 Norwegian Centre for Integrated Care and Telemedicine (NST)

Today, NST is an international renowned research and development centre for telemedicine and e-health. The centre is global in its nature and has drawn expertise from many countries around the world. NST's strength is the multi-disciplinary approach. This has been the main strategy from the beginning. In the beginning of 2015, close to 120 people were employed at NST’s telemedicine department. The employees’ background is from medicine (MDs, nurses, psychologists, occupational therapists), technology (computer science, computer engineering, health informatics, physics, statistics, mathematics) and social sciences (anthropology, sociology, political science). In addition, the team include Health economics, lawyers, and pedagogues, to mention the main disciplines. Thirty of the employees hold doctoral degrees, 11 are medical doctors (MDs). This multi-disciplinary way of working is critical in succeeding with the challenges concerned with using new technology in the health services.

Over the years, NST has reorganised several times in order to fit changing requirements from its owners and funding institutions. In 2011, NST was organized into three groups (Figure 18):

- Developing and operating clinical hospital systems.
- Research on telemedicine and e-health.
- Research-based advice to the Norwegian Health services and municipalities about telemedicine, e-health and integrated care.

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(Last accessed: 5.2.2013.)
The Research department consisted of the following three sections:

- Hospital Research
- Primary Healthcare
- Home Services

Advisory Services consisted of the following three sections:

1. Net Based Education Programme (NKU)
2. Health Services Development
3. Personal Health Systems

Clinical Systems consisted of the following three sections:

- Section for Clinical ICT-systems (SKIS)
- Journal Archive
- Joint Office Centre (FKU)

Research has become an increasingly important activity at NST. The goal is to turn some of the research projects into new telemedicine and e-health services and/or to create new businesses together with local and national business partners (Figure 17). Being part of the University Hospital of North Norway gives NST access to one of the most modern university hospitals in Europe.

Figure 17 Research and innovation is the basis for NST’s activities and advisory services.
In 2012, NST was reorganized into four departments: Innovation and Implementation, Prevention and self-management, Coordinated Care and Clinical Systems (Figure 19). The former Research department were dissolved and the researchers distributed within the four departments. The motivation was to increase the synergy between research and consulting services.
In 2013-2015, NST had been organised into five different departments. Figure 20 shows the organization of NST in 2015. When this book was completed, the Health Directorate had announced that the national function as a competence centre in telemedicine would be terminated at the end of 2015. The consequence of this decision is not clear, but NST’s owners will continue the competence in telemedicine and e-health.

![NST's organisation anno 2015](image)

**Figure 20** NST’s organisation anno 2015 (Updated: 26.3.2015).

In 2009, NST’s total budget was 31,5 million euros (EUR). The total amount includes:

- 22,6 million euros for acquisition and operation of computer systems at the UNN.
• 3.6 million euros from the Norwegian state health authorities – channelled through the Northern Norway Regional Health Authority and UNN for the role as national resource centre in telemedicine.
• 5.25 million euros in external project funding (EU, Norwegian Research Council, etc.).

Dissemination and consultation services have been very important at NST. The centre has a professional communication group that on a regular basis contributes with new press releases and articles about NST’s activities. NST is of course present on social media like Facebook and Twitter (Figure 21). Most of the information, news articles and press releases are in Norwegian (Figure 22). The same is true for NST’s project reports. All research projects are, however, published in English.

In order to gather NST at one location, in 2004, NST moved to the Research Park in Tromsø, approximately 200 meters east of the university hospital (Figure 23). The premises in the Research Park enabled NST to gather all its activity in one building and on one floor. The negative effect was that NST’s employees didn’t mingle in the canteen with the rest of the hospital or met other hospital workers in the corridors.

1.8 University Hospital of North Norway

Professor Tor Ingebrigtsen, Managing Director of UNN, presented in 2009 his hospital in the following way:

“The presence of the University Hospital of North Norway (UNN) in the northern regions provides security for the resident population, as well as thousands of visitors and the many people who travel to North Norway to work.

As the leading healthcare provider and health trust in the region we offer medical expertise at several levels. Premier class treatment, research, education and training form the very foundation of our efforts to save, prolong and improve lives. The UNN intends to continue to help advance society in North Norway.

The University Hospital of North Norway (UNN) cares for patients who require highly specialised treatment in a range of specialist areas. The UNN also serves as the local
hospital for residents of Troms and parts of Nordland, providing the full range of hospital functions required of Norwegian local hospitals by the authorities.

The UNN has hospitals in Tromsø, Harstad, Narvik and Longyearbyen (on Svalbard). The UNN runs psychiatric clinics in Tromsø with integrated addiction treatment centres and several regional psychiatric centres in Ofoten, Southern Troms, Central Troms and Tromsø. The UNN operates the regional medical emergency communications centre (AMK), as well as a number of ambulance stations in Nordland and Troms. The UNN also provides healthcare staff for the air ambulance service.**27

![Figure 23 Pictures from NST. (Photo: Jan Fredrik Frantzen)](image)

In 2009, approx. 6000 employees at UNN treated 350,000 patients (Figure 24, Figure 25). This made UNN by far the biggest hospital in Northern Norway. In some medical disciplines, UNN is the leading medical institution in Norway. One of these areas is robotic surgery. Department head at the Gastro surgical department at UNN, Professor Rolv Ole Lindsetmo, was on the 9th March 2015 on the front page of Norway’s biggest newspaper, VG, as a representative of an institution that has taken the lead in robotic surgery.

In 2011, UNN had the following clinics: Emergency clinic; General psychiatry clinic; Children and adolescent clinic; Diagnostic clinic; Cardiovascular and pulmonary clinic; Surgery, cancer and women’s health clinic; General medical clinic; Neurology and orthopaedic clinic; Surgery and intensive care clinic; Rehabilitation clinic; and Addiction and specialist psychiatry clinic.

Centres and staff departments included: Operations and property centre; Norwegian Centre for Integrated Care and Telemedicine; HR centre; Finance and analysis centre; Technical and research centre; Communications centre; and Administration centre.
1.9 **Telemedicine services**

This book offers a historical review of the pioneering activity in telemedicine and includes a presentation of the following telemedicine services: teleradiology, teleotorhinolaryngology, telepathology, teleophthalmology, teledermatology, telecardiology, telenephrology/teledialysis, teleobstetrics/prenatal, teleemergency service, teleoncology, telecare, teleodontology, telegeriatric, teledentistry, teleendocrinology/telediabetes, telesurgery, telepsychiatry, (solutions for) patient empowerment, maritime telemedicine, tele-education/distant education, videoconference in telemedicine, messages and electronic communication, and reimbursement. For each service, problem, solution, and lessons learned will be presented.

2 Necessary prerequisite for telemedicine services

The most important prerequisites for establishing telemedicine and e-health services at a national level are:

- Strong governmental involvement through National plans.
- Access to a secured infrastructure.
- Mandatory use of standards.
- Implementation of Electronic Health Record (EHR).
- Laws adapted to the modern way of working.
- Reimbursement for new, smart ways of health service delivery.

2.1 The utility value of telemedicine

In a report to the Ministry of Health and Social Affairs, Blomberg et al. argue (Blomberg 1988):

“Northern Norway Health Care Region is geographically long and travelling can at times be difficult. Many of NST's projects, particularly those that are now a part of regular operations, help patients to avoid strenuous journeys. Some telemedical services have resulted in reduced waiting times. And in the longer term telemedicine could help to fulfil the national objective of providing equal access to health care irrespective of where the patient lives.”

Figure 26 The city of Tromsø. (Photo: Gunnar Hartvigsen)
Northern Norway has a scattered population with less than 4 persons per km$^2$. When telemedicine was initiated, health specialists were available in Tromsø (Figure 26) and Bodø only (at the University hospital in Tromsø and the regional hospital in Bodø). In the northernmost county, Finnmark County, the population density is 1.5 persons per km$^2$. (Norway as a whole: 12; Australia: 2.6; USA: 31.)

Around 1990, the supply of health specialists in Northern Norway was poorer than in the south, which had a specialist density of 291 patients per specialist, compared to 1194 patients per specialist in the north. Long distances and the lack of specialists made it necessary to provide several alternatives for the transportation of patient, i.e., boats, helicopters, planes and ambulances (Figure 27). Another problem is that patient transportations often have to take place during severe weather conditions (Figure 28).

Northern Norway Health Care Region has, in periods, experienced serious recruitment and instability problems in the primary health care service. The establishment of a medical faculty at the University of Tromsø has changed this situation dramatically for the better over the last 30 years. Telemedicine could help to ameliorate this situation because it allows specialist expertise to be made available to rural districts and to reduce professional isolation. It has also been a goal for the region that through distance teaching and decentralised education make it easier to retain and recruit medical personnel to remote locations. It has been particularly important to ensure that local medical doctors remain in the region.
Telemedicine is used in varying degrees in all health care regions in Norway, and thus helping to offer regional health care cooperation. The regional level has appeared to be manageable as regard the introduction of telemedical methods. In addition, the region has shown to be a suitable level both for creating an identity and for establishing constructive cooperation. However, in the long run, it is the country’s ultimate goal to establish standardized, nationwide, seamless ICT solutions for the health care system. This goal is clearly stated in the Norwegian National Plans for ICT in health.

![Figure 28](image)

**Figure 28** The weather in North Norway in the wintertime can be a challenge for all citizens living in the north. (Photo: Ola Røe / University of Tromsø)

### 2.2 The Norwegian National Plans

Since 1997, there have been several national plans that have had an impact on the development of telemedicine and e-health in Norway. The strategy documents communicate the expectations of positive effects of the technology, both in regard to efficiency and quality.

#### 2.2.1 Telemedicine in Norway: Status and road ahead (1999)

In the report “Telemedicine in Norway: Status and the road ahead” (Bergland, Blomberg et al. 1999) a working group (of experts) lay the foundation for increased activity in telemedicine in Norway (Figure 29). The working group’s mandate was:

“A broad-based working group with representation from ministries, health regions and research has had a mandate to assess the medical usefulness of telemedicine.”
Lessons learned from 25 years with telemedicine in Northern Norway

The working group argued that Tromsø should take the lead in the development of telemedicine:

“All of the country's health regions are currently involved in telemedicine activity. The working group assumes that the Telemedicine Department in Tromsø shall continue to be the country's leading environmental and resource center for telemedicine. Research and development should be done in line with the recommendations and advices given by the Department of Telemedicine.

Methods such as teleradiology, teledermatology, telecardiology, telepsychiatry and distance learning are well developed and resource saving. They should therefore be included in routine operation, financed tediously through tariffs, grants and county funds. Continued development must take place within all fields of telemedicine.

The regional level appears to be a suitable level for operation and testing of telemedicine solutions. Telemedicine should be defined explicitly in the regional health plans. The regional level is suitable both for establishing an identity and a constructive cooperation.

Northern Region should be a showcase for the operation of telemedicine solutions within an overall perspective that takes into account people, organization and technology. Such a holistic concept, in which the integration of technology, interface, organization and users are considered, presupposes a developed and active user community within the region.”

In the report, the working group argues that telemedicine should be “developed within the framework of what is technologically possible, professionally desirable, organizational adapted and economically profitable. To manage the development of telemedicine and its consequences in a desired direction, it must be public policy sifted through within these frameworks. In order for the public policy instruments to have the intended effect, it is necessary to have a continuous debate and research on the effects of telemedicine initiatives.”

In 1999, the development of telemedicine services in Northern Norway had been going on for ten years and many services had already been regularly used for several years. The working group argues:

“Some areas of telemedicine seem to be so well developed that they can go into routine operations. The working group recommends that teleradiology, telecardiology, telepsychiatry and teledermatology are incorporated into regular operations. The same is recommended for ENT (ear-nose-throat) and pathology, but this is subject to the number of patients and a favorable cost-benefit assessment. In addition, distance education is an area the working group recommends adopted on a systematic and regular manner. Coordination of the various services is important for this to succeed. The transition from the good single project to routine operations is important and requires active participation from government sources in a transitional phase. This applies in particular to the development of schemes that encourage adopting new methods.”

The working group recommends that the health regions should “define telemedicine as an area to be included explicitly in the regional health plans. This will clarify the central position telemedicine will have in future health care.”
The working group continues with:

“Most of the information exchange in health care takes place between primary care and specialist health services. The working group recommends to look into whether funding related to equipment specifications, stimulants, operating grants and training can be used to stimulate the use of IT between primary care and specialist health services. This will be an important tool, i.e., to use IT as a means of communication between the various parts of the health service. Specific benefits of this will be that the disadvantage of distance is reduced, the amount of paper becomes smaller, and the costs associated with the submission of paper documents are reduced considerably.

Measures related to the standardization of telecommunications for telemedicine and a Norwegian health network are important to ensure good use of resources in the health care sector. For the business sector, the interest in the health care market will be influenced by the health care sector's ability and willingness to coordinate procurement of IT solutions. The standardization work will in this context be crucial. This is work in progress under the auspices of SHD’s standardization program where KITH, KKom and TMA play important roles. The working group recommends that this work be given high priority in the future. Actors in the health care sector shall adhere to the standards that have been developed or approved by the institutions that develop and approve standards.

The Telemedicine Department at the University Hospital in Tromsø will continue to be an environment that tries to be ahead of the development and do research on solutions of tomorrow and their consequences. The Department must have a special responsibility to initiate and push forward pilot and development projects. The Department will be a center of excellence both nationally and internationally, where it is natural to turn to for advice and guidance on issues of telemedicine. This is important for the sector in order to avoid extra work related to the use of telemedicine methods. The Telemedicine Department will be a trendsetter in the development of new telemedicine services, and ensure that the patient is in focus also within this area. The group recommends that the Telemedicine Department’s focus should be directed towards the development, research, distribution and introduction, and not the operation of telemedicine solutions.

The Telemedicine Department must interact with other Norwegian institutions. The working group has thus imagined that it can establish a form of regional telemedicine board, which may contribute such that the telemedicine prevalence in Norway takes place in a coordinated manner.

The international development of telemedicine concepts competes directly with the Norwegian solutions. Slow progression of the Norwegian initiative could eliminate the competitive advantage we have today. The Telemedicine Department currently has a good international reputation, and WHO is considering defining the department as a WHO collaborating center in telemedicine. The working group therefore recommends that the Department's international reputation continue to be maintained and further developed.

28 SHD, Sosial og helsedepartmentet (Eng., Ministry of Health and Social Affairs)
29 KITH, Kompetansesenteret for IT i helse- og sosialsektoren (Eng., Competence center for ICT in health- and social care)
30 Nasjonalt kompetansesenter for helsetjenestens kommunikasjonsberedskap (Eng., The National Centre for Emergency Health)
31 TMA, Telemedisinsk avdeling (Eng., Department of telemedicine)
For TMA to maintain a good competitive force, the Department should get some competition from other Norwegian groups. Thus, it should be telemedical activity in all health regions.

Development and research should, according to the working group, be made on the basis of the expertise possessed by the Telemedicine Department in Tromsø. Development and pilot projects may also run various places in the country. Our advice is that they operate in accordance with the recommendations provided by the Telemedicine Department in Tromsø. This is in line with their function as national resource centre.

Telemedicine Department's role is to contribute to the quality of projects. The Department will have an advisory function. The Ministry will be able to use the Department's expertise when it comes to assessment of financial support for research and development. This can be organized through telemedical program councils that can be organized in conjunction with the secretariats of the regional health committee. They will, as such, be a recorder to the regional health committee. Such advice may be organized into a network, where the Telemedicine Department may be included as a hub, i.e., as a network center.

A national center for telemedicine, which has advisory and referral source function in relation to the use of telemedicine methods, can be an instrument for the coordination of a fragmented sector. Furthermore, a national telemedicine center could create a basis for new businesses. It is realistic to imagine that the competence telemedicine development generates can be used in other industries and sectors.

The working group looks at evaluation as a very important tool in order to steer the development of telemedicine in the desired direction. It is the working group's view that evaluation must be included as a regular part of any telemedicine project. Also services operated on a routine basis must be subject to evaluation.

(...)

Region North should be a display window for telemedical solutions. It should be accessible and informative towards participants both nationally and internationally.

The working group summarizes their report stating:

- “There is a need for a competence center for telemedicine.
- Telemedicine is a tool for organizing and developing the health care sector. The Ministry will seek advice from TMA in academic matters related to telemedicine.
- TMA will be an obvious and independent advisor when major development projects take place.
- TMA should be development-oriented and have an academic base.
- Region 5 must facilitate widespread use of telemedicine and act as a showcase for telemedicine services.
- Relations with the Ministry’s Standardization Program and KITH must be made visible and be binding.”
The working group then pointed to some areas that need further studies:

“Funding arrangements and organization associated with telemedicine must be studied further. An active and versatile use of telemedicine solutions requires that reimbursement schemes shall be developed with this in mind.

Telemedicine has a great potential in emergency care. Telemedicine can in many cases be the decisive length-compensatory effort that enables advisory services to local entities.

The biggest challenge of adopting new technology is on the organizational plan. This challenge will always exist, and efforts must be continuous with administrative, legal, ethical, regional policy and organizational aspects of using telemedicine method. The investigations undertaken have been made based on existing technology. Therefore new investigations initiated as technology develops and its use is increasing.

The working group claims to have shown that the telemedicine method in a number of disciplines is an equally good option as traditional method, and that the method in some contexts has an advantageous economic profile. The working group considers the use of telemedicine as medically necessary. In keeping with its mandate, the working group
Lessons learned from 25 years with telemedicine in Northern Norway

has not conducted a full assessment of commercial and financial issues related to the establishment of a telemedicine center. This must be given high priority in the next phase of work. The working group therefore believes that the Ministry of Health and Social Affairs should recommend further study of a telemedicine center in Tromsø.”

2.2.2 More health for each bIT (1997-2000)

The vision of the action plan “More health for each bIT” was to build bridges between the many IT islands in Norwegian health care services (Sosial- og helsedepartementet 1996) (Figure 30). In the action plan, the Ministry of Health and Care Services states that the goals of the action plan were to implement some concrete measures that meet certain, specific and time-limited objectives and targets for the introduction and use of IT in health care. These were goals and objectives that were derived from five main objectives for the introduction and use of IT in health care:

Figure 30 The action plan “More health for each bIT” (“MER HELSE FOR HVER BIT”).

1. Increasing health care expertise – “better diagnosis and treatment”.
2. Simplify procedures for updating and storing of information – “more time for the patient”.
3. Better communication between different parts – “better coordination and interaction”.
4. Promote good information to the patient – “more power to the patient”.

42
5. Maintain adequate information security – “safeguard both safe and effective patient care and a strong privacy”.

Figure 31 Information technology in the health care sector: Challenges and government action. Government action plan for following up "more health for each bIT - 1999-2000" (Original: “Informasjonsteknologi i helse- og sosialsektoren: Utfordringer og statlige tiltak. Statlig tiltaksplan for oppfølging av ‘Mer helse for hver bIT – 1999-2000’”)

In addition to the main report, a separate action plan (tiltaksplan) for IT was published (Sosial- og helsedepartementet 1999) (Figure 31). The purpose of this action plan “is to attach an organizational move in relation to the key challenges in the continuation of ‘More health for each bIT’”:

- “Prepare the (Norwegian) state’s responsibility, roles and tasks in the continuation (of the main report).
- Strengthen coordination at the national level and in relation to the sector in general through a ‘Partnership for IT’.
- Better focus and prioritization of the actions to be implemented.
- Facilitate funding- and subsidies that encourage IT investments locally.
- Channeling funds to where they have the greatest effect in relation to the action plan's priorities.”
2.2.3 Say @h! (2001-2003)

The vision of “Say @h!” was to achieve ICT-based interaction in the health care services on a broad basis, not just in pilot projects (Sosial- og helsedepartementet 2001) (Figure 32). The plan “Say @h!” outlined the Governmental measures for electronic communication in the health care sector in the period 2001-2003. The purpose was to stimulate to electronically interaction that strengthened and enhanced the cooperation between various disciplines and management levels in the health care sector, improved the contact with patients, care receivers and clients, and strengthened the quality of services. “Electronic interaction” was defined as cooperation and information retrieval using information technology (IT) and suitable infrastructure for communication.

![Figure 32](image)

The plan identified four priority areas for enhanced electronic interactions in health and social sector:

- **A National Health Network**: The national health network connects service providers through a physical infrastructure and supportive public services.
- **Integrated Care**: Through this network and other infrastructure services health care pro-
providers will interact by sending standardized electronic messages as referrals and discharge summaries, which are recorded in electronic medical records and other end-user systems.

- **Telemedicine**: The health network will also be used for telemedicine consultations, partly in the form of advanced services that require broadband capacity of the transmission.

- **Services for the general public**: The general public will interact with health and social services via the Internet.

### 2.2.4 Te@mwork 2007 (2004-2007)

The Te@mwork 2007 (Norwegian, S@mspill 2007) strategy gives direction and continuity to ICT development (Helsedepartementet og Sosialdepartementet 2004) (Figure 33). The vision for the work was that patients and clients should experience continuity of care when using the services. Realizing this vision entails considerable development and change in the way that this interaction and other performance of tasks take place in the health care sector. Appropriate application of ICT should contribute to this in an effective way.

This national strategy had two main priority areas:

- The first main priority area involved improving the flow of information in the health care sector. This presupposed working with infrastructure, information structure, information security, electronic patient records, exchange of electronic messages and access to professional support.

- The second main priority area involved greater inclusion of new actors in electronic interaction in the sector. So far electronic interaction had mainly been developed between health care enterprises, general practitioners and the National Insurance Service. Patients, clients and relatives, pharmacies and municipal health care and social services were actors that needed to be included more closely in the interaction.

Objectives for 2006 and 2007 were:

- The user council for the Norwegian Healthnet Ltd. is intended to function as an active channel for communicating needs and expectations and for advising the organization's administration and board about what is strategically important to its users.

- Seventy % of general practitioners (GPs) (about 1300) are to be connected to the Norwegian Healthnet.

- The Norwegian Healthnet should be able to offer linkup of municipal GP practices. Municipalities that take part in projects are to be offered linkup, based on recommended reference models from the Beacon Municipalities' joint project for linkup.

- A directory of addresses for participants that can communicate electronically (“Helsetjenesteenhetregisteret”, the registry of health service units, abbreviated to HER) is to be established and in operation as a service in the Norwegian Healthnet.

- The health enterprises are to start using the Norwegian Healthnet for exchange of electronic messages with other health-service players, and have solutions for discharge summaries and referrals over the Norwegian Healthnet.

- Directory and validation services for PKI must be made available over the Norwegian Healthnet.
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 33 The Norwegian activity plan “Te@mwork 2007” (“S@mspill 2007”). (The plan is available in both Norwegian and English.)

“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 care and social sector.”

The five regional health care enterprises have defined ICT as one of the areas for common strategy development, through the National ICT. The group has developed an overall ICT strategy for the regional health care enterprises. Along with other common initiatives, they have defined the priority areas in Te@mwork 2007 in which the regional health care enterprises are involved. In other words, parts of the National ICT group’s strategy define the role and the responsibilities of the regional health care enterprises in achieving the goals of Te@mwork 2007.

2.2.5 eNorway (eNorge) 2005

The eNorway plan, released in June 2005, mirrored the eEurope plan for electronic interaction. The development of the Norwegian Health Network and the expansion of electronic interaction between health care enterprises, general practitioners, nursing and care services and the National Insurance Service are central elements of this initiative for improving organization and for achieving more effective performance of tasks in the public sector (Moderniseringsdepartementet 2005) (Figure 34).

32 http://www.nasjonalikt.no
According to the eNorge plan:

“The Government wants a knowledge society where everyone can participate and where the potential of information technology is exploited. Norway's advanced use of technology shall offer citizens and businesses an easier life and help to promote wealth creation and thereby safeguard the welfare of future generations. Information must be offered to support the development of a public sector that delivers the best possible services based on the resources it has available. Citizens and business needs will be central to the development of the digital Norway.”

Figure 34 The eNorway 2009 (eNorge) plan.

The goal is that the public sector shall adapt to and exploit the use of technology. The quality of services is expected to improve through electronic management as the primary interface with the citizens and businesses and increased coordination between various health agencies. The Government argues that the potential is especially large in the health care sector, where each patient is dependent that the players in the health care sector works closely across agency boundaries and administrative levels, forming a linked-chain of treatment.
Lessons learned from 25 years with telemedicine in Northern Norway

According to the plan, the Government will actively use IT as a tool to create improvements for patients and care for the patients. It will also lay the groundwork for more effective utilization of resources. Through the national strategy for IT development in health and social services sector, Te@mwork 2007, the use of the Norwegian Health Network is going to expand and several players will be tied to the grid.

2.2.6 The Coordination Reform

The Coordination reform is viewed as one of the most important health care reforms in recent years (Helse- og omsorgsdepartementet 2009) (Figure 35):

“Coordination has been recognised for many years as a problem within the health care services, and many good initiatives have been implemented or are underway. These services are of high quality and most patients are well taken care of within the services. Users, patients, relatives and the services themselves nevertheless have reported that coordination remains a major problem.”

This represented the starting point for the Coordination Reform - better coordination should be one of the health care sector’s most important areas to further develop. The Coordination Reform identifies three principal challenges in the Norwegian health care services and suggested five main steps to face them. The goal is for the patient to get proper treatment – at the right place and at the right time. The three principal challenges are:

• “Patients’ needs for coordinated services are not being sufficiently met.
• In the services there is too little initiative aimed at limiting and preventing disease.
• Population development and the changing range of illnesses among the population.”

The challenges are:

“Challenge 1: Patients’ needs for coordinated services are not being sufficiently met

There are few systems oriented towards cohesion in those services that should meet patients’ needs for coordinated services. But we have many systems involving the various partial services, for example division into organisational units and separate systems for rights, financing and ICT. There are also differing perceptions as to the goal of health services: the specialist health care services are largely concerned with the goal of medical healing, while the municipal health services are far more focused on patient functioning and coping. Differing perceptions of goals affect which issues to emphasise, which can lead to coordination problems.

Much has improved, yet feedback from patients and users indicates that coordination is often poor. This is perhaps the greatest challenge facing our health and care services. Poorly coordinated services indicate an inefficient use of resources.

Challenge 2: In the services there is too little initiative aimed at limiting and preventing disease

The health services place greater emphasis on treating illnesses than on services aimed at coping with and reducing the development of chronic diseases. Prevention and early
intervention efforts often lose out in the battle for resources, where the more specialised services tend to prevail. We need better systems for analysing and determining where and how our resources should be invested in the chain of prevention, diagnostic work, treatment and rehabilitation.

**Challenge 3: Population development and the changing range of illnesses among the population**

As in other Western European countries, the demographic and epidemiological patterns in Norway are undergoing great change. There are more and more elderly and increasing numbers of people with chronic and complex illnesses. Chronic obstructive pulmonary disease, diabetes, dementia, cancer and mental disorders are all increasing sharply.

These are large patient groups with a growing need for coordination. These challenges will call for more efficient management of services, and politicians will face some hard decisions on setting priorities.

The changes will create major challenges in terms of maintaining and refining Norway’s central welfare schemes, so in addition to the Coordination Reform, the Government is carrying out both pension reform and the reform of the Norwegian Labour and Welfare Organisation (NAV). These three reforms are necessary for ensuring the sustainability of the Norwegian welfare system and the Norwegian National Insurance Scheme for future generations.

The challenges must be approached with the willingness and ability to work out new solutions. If not, the choice will be between the lesser of two evils: we would either see development that threatens society’s sustainability, or it would become necessary over time to take prioritising decisions that conflict with the basic values of the Norwegian welfare model.”

The Coordination Reform recommends five main steps for meeting the three principal challenges. These are:

- "A clearer role for the patient.
- A new municipal role emphasising prevention, early intervention efforts, low threshold initiatives and interdisciplinary measures.
- Changing the funding system so that municipal co-funding of the specialist health care services is a vital element.
- Developing the specialist health care services to enable them to apply their specialised competence to a greater extent.
- Facilitating better-defined priorities.
- Additionally: ICT, R&D, competent health care professionals.’’

For a description of each of these steps, see (Norwegian Ministry of Health and Care Services 2009).
2.2.7 Research and innovation for better coordination

The Coordination Reform’s goal is to promote public health and prevention, and through more coordinated health services provide users with secure services with better quality. To reach this goal the reform is partly based on research-based knowledge. In a separate report on research strategy, “Forskning og innovasjon for bedre samhandling” (“Research and innovation for better coordination”), the Norwegian Ministry of Health and Care Services states that (Helse- og omsorgsdepartementet 2012) (Figure 36):

“In the implementation of the reform, research and development of new innovative solutions, along with education, skills and ICT will be used. Reform must additionally be accompanied by research to evaluate the effectiveness of the measures in the reform. The reform further assumes that a greater share of health care services is to be provided by community health.

Research and innovation is a prerequisite for knowledge-based, future-oriented health care and effective health promotion. The following definition of collaboration research is applied in the design of the strategy: Coordination Research is research where one in a patient care perspective should establish knowledge on how organizational, cultural, economic, technological and skills-related criteria for success and barriers in service(s) seems to support the coordination reform objectives.
Innovation is a new product, a new service, a new production process or new organizational form that is adopted and creates value as increased quality, improved efficiency, increased productivity in the health care sector and increased satisfaction among patients, families and staff: Innovation related to coordination can be understood as innovation to support continuity of patient care and collaboration between municipal health care services and specialist health care.

The strategy's focus is service research, i.e., research that can stimulate the development of relevant new knowledge about cooperation in health care services, including status, trends, conditions and effects.”

Figure 36 The Norwegian activity plan “Forskning og innovasjon for bedre samhandling” (“Research and innovation for better coordination”). (The plan is available in Norwegian only.)

The overall goal of the strategy is: “Interaction research strategy will help to ensure greater knowledge about health and social services to improve coordination between different levels and within different service areas.”

The Ministry wishes through this strategy to lay a good foundation for:

- “A holistic, coordinated and long-term commitment to research and innovation as part of the implementation of the Coordination Reform.
• *Increased focus on research and innovation to support comprehensive and coordinated services in line with the interaction reform objectives.*
• *High quality and relevant interaction of research and innovation related to health care services."

Further information is found in (Helse- og omsorgsdepartementet 2012).

### 2.2.8 One citizen – one journal

The Norwegian Government launched in November 2012 the white paper “St. 9 (2012-2013) One citizen - one journal. Digital services in the healthcare sector” (Helse- og omsorgsdepartementet 2012), which shows the direction and defines the overall objectives for ICT development in the health care sector:

- Health professionals should have easy and secure access to patient and user information through the course of treatment, regardless of where in the country the patient and the user is ill or is receiving treatment. Decision shall be included in the journal system.
- Residents will have access to simple and secure digital services.
- Data should be available for quality improvement, health monitoring, management and research. Reporting shall mostly take place automatically and be an integral part of the work.

To achieve these goals, the Government will focus on:

- *Investigate one journal.*
- *New digital services for patients and users.*
  - "My health" on-line.
- *Stronger national management and coordination of ICT development in the health care sector.
- *Completing initiated measures."

The white paper presents the statement “one citizen – one journal” in the following way:

> *It is necessary to reduce the number of electronic record solutions and patient administration systems. The Government will initiate a study to assess alternative solutions. Such a study will include risk analysis and organizational consequences for each option.*

*An integrated and comprehensive electronic records system will provide healthcare professionals, patients and users easier access to relevant information, contribute to better coordination and resource savings. In addition, with one journal it will be easier to facilitate the re-use of data and automatically extracts from the registers.*

*Patients and users must have confidence that the information systems are secured in the best possible way. Information security will be enhanced by better management and monitoring of access to medical records. For that records information seamlessly to follow the patient and user through the course of treatment, there is a need for a comprehensive review of legislation."*
More information can be found in (Helse- og omsorgsdepartementet 2012).

Figure 37 The Norwegian white paper “En innbygger – en journal. Digitale tjenester i helse- og omsorgssektoren” (“One citizen – one journal. Digital services in health care”). (The white paper is available in Norwegian only.)

2.2.9 Norwegian action plan for e-health 2014-2016

In the preface of the National action plan for e-health (2014-2016) (Helsedirektoratet 2014) the Directorate of health in Norway states that:

“National action plan for e-health contains a comprehensive presentation of current and planned e-health initiatives of national importance for the period 2014-2016. The target audience for the plan is anyone who will be making decisions about the use and participate in the work of development and implementation of ICT in the healthcare sector. The action plan is ambitious and provides direction for extensive work in the short and medium term. The priorities and measures must also be seen in the context of the on-going assessment work to follow up the report. St. meld. 9 "One citizen - one journal" which has a long-term perspective."

The action plan states that to achieve the goals of “One citizen – one journal”, we shall focus on these strategic moves:
1. "Investigate msgs. St. meld. 9 "One citizen - one journal".
2. New digital services for patients and users - "My Health".
4. Completing initiated measures. Realization and consolidation of existing services and solutions shall be secured. Measures to ensure electronic interaction will be continued, including the development of a common infrastructure.”

Figure 38 The Norwegian activity plan “Nasjonal handlingsplan for e-helse 2014-2016” (“Norwegian action plan for e-health 2014-2016”). (The plan is available in Norwegian only.)

The action plan contains:

“a comprehensive presentation of on-going and planned e-health initiatives of national importance. The main part of ICT development in the sector, however, takes place in individual companies, including the development of work processes and functionality, and the consolidation of systems (…). This is not covered by this action plan. Separately, they will have great importance for achieving the objectives of St. meld. 9 “One citizen - one journal”, and can also form the basis for further development of national solutions.

(…)

54
The measures section for the entire planning period provides an overview of measures to be carried out or initiated in the period 2014-2016, for all or part of the sector. This survey is extensive and requires the necessary funding and capacity within the project owner and affected stakeholders.

This survey is not priority and impact-assessed. The survey adds however the basis for preparation of annual action plans for priority in relation to the annual budget processes. The annual plans will be more detailed in terms of efficacy, investment requirements, dependencies, deliveries, stakeholders, risks and implementation capacity etc. Priorities must be in line with agreed priorities criteria. Affected stakeholders and users must be involved in both the planning and implementation phase. The national measures must be considered in the context of and coordinated with the work done locally, regionally and intersectoral. Several of the measures will also require changes in regulations.’’

For further details, see (Helsedirektoratet 2014).

2.2.10 Other relevant White Papers

This sub-chapter has given an overview of some of the major white papers and action plans related to IT in health care from the Norwegian government and relevant ministries and directorates. The list is not complete. As mentioned in “Nasjonal handlingsplan for e-helse 2014-2016” (“National action plan for e-health 2014-2016”), the following white papers particularly provide framework, guidelines and ambitions for national e-health:

- White Paper 10 (2012-2013) Good quality - services are safe (“God kvalitet – trygge tjenester”)
- White Paper 29 (2012-2013) Tomorrow’s care (“Morgendagens omsorg”)

The White Papers are available from regjeringen.no.

2.3 The Norwegian Healthnet

Norway has a well-functioning and well-structured public health service with a strong infrastructure and a high level of competence. The backbone of telemedicine and e-health in Norway is the Norwegian Healthnet (Figure 39). This computer network is, together with the electronic health record (EHR), prerequisites for telemedicine and other e-health services.
Lessons learned from 25 years with telemedicine in Northern Norway

The starting point for the Norwegian Healthnet was the project “Display Window” that created a prototype for a secure, closed network of communication between hospitals and general practitioners within the County of Troms. Initiators to this prototype were Finn H. Hansen (Nordland County administration), Thomas Bårdseng (Norwegian Ministry of Health and Care Services) and Sture Pettersen (NST). The project was then continued as “Intramed” where the network was extended to include all hospitals and general practitioners in the three northernmost Counties of Norway (Nordland, Troms and Finnmark). This was so successful that the same Counties took over the ownership of the Northern Norwegian health network as it was spun off as a separate inter-county administrational company (Figure 40). A similar development took place in other Norwegian regions. After the health care reform with regionalization was implemented in 2002, ownership of the regional health networks was taken over by the five regional health authorities.

The Norwegian Healthnet (NHN) is the electronic interactive arena for the health and social service sector in Norway. The goal is through “Unified patient information” to provide increased interaction, improved quality and efficiency and support national objectives for integrated care. NHN supports interaction and the needs of the sector in regard to services, capacity, security etc. The Norwegian Healthnet is an organization with the main objective to ensure that participants in the health care system are connected to a common, secure infrastructure. This infrastructure provides access to basic services such as electronic messaging, video conferencing and email (Figure 41).

Figure 39 The webpage of the Norwegian Healthnet (Norsk helsenett SF) (http://www.nhn.no/) (Last accessed: 5.2.2013.)

33 Norwegian, “Utstillingsvinduet”.
The company Norwegian Healthnet was established as a state enterprise on 1st July 2009. The Ministry of Health and Care Services own the company. In 2010, the Norwegian Healthnet was 100% user funded through the sale of services – sales approx. NOK 215 million. NHN had in 2010 approximately 80 employees, located to Tromsø, Trondheim and Oslo.

The Norwegian Healthnet is fundamentally important because:

- It allows for more comprehensive planning and implementation of communication of patient information.
- Patients and their families shall experience the meeting with health care services as a comprehensive and informed progress. Electronic, standardized cooperation is essential to ensure the necessary information flow to achieve this goal.
- New opportunities for distributed workload, specialization, security cooperation and virtual groups of professionals.
- It will be easier to discuss conditions and treatments across the enterprise and region boundaries.
- We will be able to get more free choice of hospital when GP practices will eventually be able to refer and book electronically to any hospital in the country and get feedback in the form of electronic notes and discharge summaries.
- It provides opportunities for better cooperation and coordination of IT services within the health and social sector, including possible cooperation in the operation and maintenance of IT systems and quality systems.
- Significant savings are achieved in a simple, efficient and secure flow of information within patient care.
- The goal is increased utilization of expensive equipment, expertise, increased resource sharing and the ability to be able to maintain a fast and safe patient flow. A standardized health network is important prerequisite to achieve the benefits.

A prerequisite for efficient many-to-many communication in a health network is that hospitals and medical offices are connected to the health network. At the end of 2011, nearly all hospitals in Norway, ca. 600 physician offices and other stakeholders were connected to the net. Northern Norway and Central Norway were the areas that, in percentage, had the highest number of doctor’s office connected to the health network. In 2004, the Directorate for Health and Social
Affairs offered free support to GP offices to connect to the health network. GP offices were offered access to a mailbox for the exchange of messages and electronic signatures (PKI) for secure communication.

Figure 41  The Norwegian Healthnet connects all stakeholders in the Norwegian health care service. (Illustration: Norwegian Healthnet)

Another prerequisite for communication and interaction is that there are services in the health network that contributes to a safer and simpler many-to-many communication. To provide this service NHN has established the health unit index (HER) and directory services. Norwegian Healthnet has also focused on linking nursing and care sector to the health network. This will provide an important sector access to electronic information exchange and integrated care between different levels in health care.

Table 1 gives an overview of some central aspects of the development of the Norwegian Healthnet from the 1980s and until today. (See also the facts box on page 64.)

34 Helseenhetsregisteret (HER)
The establishment of the Norwegian healthnet is one of the most central IT-strategical initiatives in this sector. NHN safeguards data quality, information security and personal information protection in the exchange of sensitive information.

NHN’s services:

1. NHN-Adresseregister (Address register)
2. NHN-Basis
3. NHN-Domene (Domain)
4. NHN-EDI
5. NHN-Flex
6. NHN-RESH
7. NHN-Hjemmekontor (Home office)
8. NHN-Pasienttransport (Patient transportation/travel)
9. NHN-Samband (telecommunication)
10. NHN-Sikret Internett (secure Internet)
11. NHN-Video
12. NHN-Web/e-post, flex (Web/email)
13. NHN-HPR

In addition, NHN offers additional services, such as:

- NHN Address Register: Contains information to identify and address each member of the health network.
- NHN Home: Access to workplace resources home.
- NHN Payment: Transactions traffic on terminal overlays the health network.
- NHN Patient: Access to the national ICT system for ordering patient transport.
- NHN Video: Access to, among others, equipment for setting up and monitoring videoconferences with more than two users.
Lessons learned from 25 years with telemedicine in Northern Norway

Plans above 2011 for NHN include:

1. Operation and management of national registries.
2. The national core electronic patient record.
3. Further development of the Health Forum.
4. Development of coordinated support 24/7.
5. Next Generation Health Network.
6. Further development in cooperation with the authority and/or customers.

An experience from Norway is that establishing a health network is a comprehensive and log-lasting process. In 2011, Norwegian Healthnet had existed for seven years, and its five predecessors had been around for the same amount of time. But it will still take some years before the digital highway for health-Norway is completely finished.

According to an article in Computerworld Norway in November 201136 (Figure 42), the Norwegian Health Network has been controversial since its inception. For most people it sounds like a good idea to create a national health hub that handles all communication in the health care sector. But there are some problems with such a master plan. First of all, the health care system is a fragmented sector with many different actors. The actors vary from the large...

Figure 42 As leader of the Norwegian Healthnet, Haakon Grimstad travels a lot. He met the journalists in Computerworld at the airport between a meeting and two flights.35

35 http://www.idg.no/computerworld/helse/article228827.ece (Last accessed: 5.2.2013.)
university hospitals within the specialist health care services down to the small general practitioner’s offices. Add some ambiguous payment structures and strong interest groups, and it becomes obvious that this is a difficult area to move in.

The article reports that the GPs have been significantly more dissatisfied with the health network over the years. Especially since they have had to connect to the health network on their own expense, without having experienced that the services have made life easier for them.

In an interview in the Norwegian newspaper “Helgeland Arbeiderblad” in 2004\(^\text{37}\), general practitioner Reidun Kismul, expressed a concern with extensive use of technology:

> “–All paperwork that can be replaced online is great. But nothing should replace the personal contact between doctor and patient. This says Reidun Kismul, a specialist in general medicine. She is a general practitioner in Mosjøen and has been connected to the North Norwegian health network in a couple of years.

> –But we must never forget what is most important. It’s about the meeting between doctor and patient, she says.

Northern Norway Regional Health Authority has offered all the doctors in the region free access to the North Norwegian Health network, and according to the security manager Haakon Meland Eriksen, the degree of participation from doctors in Nordland County has been close to 100 percent. Doctors pay a subscription fee depending on how many users the office has. Offices with less than nine users pay NOK 8,500 per year for a service that includes Internet, e-mail and so-called web hosting.

> –A great initiative, said Reidun Kismul.

> –I am very excited about all the mail we receive electronically, directly into the electronic patient record. It has saved us a lot of medical secretary work, and it speeds up the procedure. From the spring we have been able to electronically send referrals to our local hospital, and this should be extended. This is great. But right now I don’t have the energy to increase the amount of electronic contact with patients, says Kismul.

She emphasizes that she has a large proportion of elderly patients, and believe this also affects the relationship between doctor and patient.

> –Had I been young and newly educated and had experienced younger patients, I had certainly been more inclined to use electronic solutions.

In addition, many elderly patients do not have access to or are familiar with network solutions. The new technology is also increasingly demanding for the doctor. Kismul says that some of the technology is too fancy. Some functions are seldom used. The result is that a general practitioner does not become familiar with this. In this way, one does not manage to exploit the efficiency potential.

Lessons learned from 25 years with telemedicine in Northern Norway

–Maybe this is easier in a larger medical practice with several colleagues. There will always be one that is better with computers than the others, and that the others can rely on. In small offices, it quickly becomes too much technique to deal with.

Kismul’s objections are grounded on a desire to meet patients on their level and prioritize what she believes is the most important tasks.

–The sickest patients are not necessarily those with Internet connection, she says.

–Some people think everything can be solved technically. And we can feel free to send general questions to the specialists and get a quick response. But most issues are not general. When I ask for advice for my seriously ill patient, I will get my specialist's intonation and hesitation or security of the voice.

Yet she sees potential improvements for her own use of the health network. A form of booking system for appointments does not necessarily have to be so far away.” (Original in Norwegian)

Important North Norwegian contribution
(28 September, 2004)

“Northern Norway has been crucial to establishing a national health network. The three counties that visionary established the Northern Norwegian Healthnet (“Nordnorsk helsenett”), Northern Norway Regional Health Authority which has developed this, and the health services in the region have every reason to be proud of our contribution to the establishment of a national health network.” In this way CEO Lars Vorland in Northern Norway Regional Health Authority (Helse Nord RHF) comments the establishment of the Norwegian Healthnet from 27 September 2004. The five regional healthnet companies where all incorporated in the national company to be established by the five regional health authorities and the Norwegian Directorate of health. The Norwegian Healthnet will supply current IT infrastructure and basic services to the healthcare sector.

Northern Norway Regional Health Authority has a strong focus on electronic exchange of information. In autumn, close to 100% of GP practices in the region, including a number of private specialists, will be connected to the regional health network. These GP offices will be offered to use services like discharge summary (report) and referral to hospital. All hospitals in the region can today send summaries as well as receive referrals electronically. For Helse Nord the strong commitment one has had involves that that the region will not immediately make new gains by the Norwegian Healthnet. The long-term effect will be increased efficiency and cost reductions, faster creation of new services in the health network and ensuring equitable online offering in Health Norway. Northern Norwegian Health AS in Tromsø will be running the department in this new organisation. The head office is in Trondheim.

38 This article was originally published by Northern Norway Regional Health Authority (Helse Nord RHF), and later translated into English by the authors. URL to the original article: http://www.helse-nord.no/aktuelt/viktig-nordnorsk-bidrag-article5504-19948.html (Last accessed: 5.2.2013.)
Busy times in the health network39
By Jan Fredrik Frantzen (23 May, 2008)

The support department at the Norwegian Healthnet has plenty to do during the day. More and more municipalities go online, more and more general practitioners and other users of the health network install home offices, and the number of messages that are sent through the secure network is increasing.

Today, all GP practices in Northern Norway are connected to the health network, and on a nationwide basis it is estimated that 90 percent of GPs have access to safe communication through this network. In addition, 90 of the 430 Norwegian municipalities have joined the network, and more are coming.

It manifests itself in increasingly digital healthcare traffic, and Ellen Appelbom, communications director at the Norwegian Healthnet, says that only in Health North over 2 million electronic messages went through the health network in 2007. Of the 2 million messages, UNN alone sent 650,000 EDI messages such as discharge summaries, answers to laboratory tests and X-ray responses. In addition, the hospital received more than 40,000 electronic referrals from GPs. For comparison, figures from the Health North ICT shows that in 2006, 629,968 electronic messages went through the health network in the Health North, but this number did not include UNN. This means that the number of messages in the Health North, with the exception of the University Hospital, went up from about 600,000 in 2006 to 1.5 million in 2007. If we include UNN, then we sent more than 2 million messages in the course of last year. “We see that there is a development where the traffic is definitely picking up, and traffic will be even greater because hospitals in health regions expand number of services that GP practices can take advantage of, such as X-ray response and electronic ordering laboratory tests,” Appelbom explains.

Currently the most popular service in the health network is the system for secured home offices for primary care doctors. Many of them have for long been working from home one day a week, but now they can also connect to the web, update records and check whether the patient’s laboratory test is fully analysed at the hospital. The new scheme has actually been so popular among doctors that the support department of the Norwegian Healthnet has had long open hours the last few weeks for everyone to get answers to their questions about the new service. The phone has not stood still, and the last phone guards have not gone home before eight o’clock in the evening. Only now, after several weeks of telephones, the telephone operators can relax and take a breath.

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39 This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.unn.no/getfile.php/UNN-Internett/OmUNN/Pingvunu/PDF-arkiv/2008-09/Pingvinen_nr11-08_LR.pdf (Last accessed: 5.2.2013.)
Facts: From North Norwegian Healthnet to Norwegian Healthnet AS and Norwegian Healthnet SF

1997-2004: Regional healthnet
The predecessor to the Norwegian Healthnet was the IntraMed project, which started at the National Centre for Telemedicine (NST) in 1997. IntraMed was in 2000 transformed into the company North Norwegian Health Network, which was owned by the northern Norwegian counties. In 2002 the company was taken over by Health North, and two years after it went all over to the Norwegian Healthnet. The development of IntraMed was funded by the Norwegian Directorate for Health, and partners, Telenor, as well as the counties of Nordland, Troms and Finnmark. The project leader was the Norwegian Centre for Telemedicine. Before Norwegian Healthnet was founded on 1 July 2004, we had six different Health Network in Norway. There were five regional health networks (owned by regional health authorities) and a network that linked together the five regional grids. The six health networks were merged into one operational health network from 1 July 2004.

Norsk Helsenett AS (NHN) (Norwegian Healthnet) was established on 1 October 2004. The founders and shareholders were the five regional health authorities (Health Northern Regional Health Authority, Health Central Norway Regional Health Authority, the Eastern Regional Health Authority, the South Regional Health Authority and Health Western Regional Health Authority). The company had a responsibility to provide basic communication with high capacity and easy access, safe and efficient interaction between the various players in the health care sector. Through the closed health network, the users got access to a wide range of services in a safe and secure manner. NHN got exclusive rights to offer network services in Norway. The head office was in Trondheim, with operations in Tromsø, Oslo, Førde and Arendal. The operational unit was in Tromsø. The focus for 2006 was to further develop the infrastructure, and to recruit more players. In 2007, branch offices were reduced to Tromsø and Oslo. The structure of NHN led to restructuring of the workforce. Twelve people were employed in 2007. From 2007, the company's business was based on a pricing model where all customers paid application- and membership fee.

2009 - : Norsk Helsenett SF (SF = State enterprise)
The state enterprise “Norsk Helsenett SF” was founded on 1 July 2009. The founder and owner is the Ministry of Health and Care Services (“Helse- og omsorgsdepartementet”). On 30 October 2009, the new state enterprise took over the total activity in the Norwegian Healthnet AS. The main office remained in Trondheim, with branch offices in Tromsø and Oslo. The operational unit was still in Tromsø. A new strategy was added to the company. Norwegian Healthnet SF was created to address the need for a secure and unified communications networks for information exchange and sharing between actors in the Norwegian health care sector. The company supports national strategies and priorities, and has also contributed towards the national action plan for e-messages in 2010. In 2011, a major task was strengthening network security through a focus on CSIRT (Computer Security Incident Response Team), a dedicated resource in the efforts to address security incidents and adverse events.

2.4 The standardisation work in Norway

Until 2012, KITH AS\(^\text{40}\) was responsible for standards for electronic communication in the healthcare sector. Since then, the Health Directorate has constituted the national body for standardisation in areas of Electronic communication, Information security, Electronic Patient Record (EPR) systems, Digital radiology (PACS) systems and Coding systems, classifications and terminology.\(^\text{41}\) The Health Directorate contributes to international standardisation in health informatics, and participates actively in the work of the Nordic Centre for Classifications in Health Care, which is a WHO Collaborating Centre for the Family of International Classification. The Nordic coordination is taken care of through the membership of the Nordic network of competence centres, together with Carelink (Sweden), Medcom (Denmark), STAKES (Finland) and the Ministry of Health (Iceland).

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\(^\text{40}\) Norwegian Centre for Informatics in Health and Social Care (KITH) is from 1 January 2012 part of the Norwegian Directorate of Health. KITH was a limited company owned by The Ministry of Health and Care Services, The Ministry of Labour and Social Inclusion and The Norwegian Association of Local and Regional Authorities.

\(^\text{41}\) https://ehelse.no/Sider/Standarer.aspx (Last accessed: 3.3.2015)
Through the take over of KITH, the Health Directorate got an established centre for testing and approving electronic messaging standards for vendors. They offer advice to vendors in the implementation phase, enabling their systems to be approved for a given messaging standard. They have also set up a test-server, which vendors can use for automatic testing of syntax and semantics. All electronic communication containing personal health information in Norway should be implemented utilising secure PKI-solutions. The Health Directorate gives advice on standards and methodologies for secure electronic communication. They also participate in a national network to develop common solutions for PKI and information security in Norway.

The Health Directorate also has been assigned the national responsibility to establish and maintain coding systems, classifications and terminology used in health care and social services. Cooperation with other Nordic countries in this area exists through the Nordic Centre for Classifications in Health Care and NOMESCO (Nordic Medico- Statistical Committee). In addition to broad cooperation through the Nordic committees, the Health Directorate, on behalf of WICC (WONCA International Classification Committee) maintains a website for downloads of international master versions of ICPC2—E (International Classification of Primary Care 2nd Edition, electronic version). The Health Directorate also provides user support on coding-related issues.

2.5 Law

The Norwegian Ministry of Health has acknowledged telemedicine as a legitimate way to deliver health services in Norway, and has politically and financially supported the development in this area.

2.5.1 Norwegian laws

A number of laws are related to telemedicine by regulating areas like responsibility, data security and protection of personal information. The most important laws are:

- The Norwegian Health Register Act
- The Norwegian Health Personnel Act
- The Data Processing Directive/The Data Processing Legislation
- The Data Protecting Act
- Personal Data Act

2.5.2 Privacy, confidentiality and data security

When legal issues are concerned, privacy, confidentiality and data security stand out as some of the most important in the whole area of telemedicine and e-health. Nohr et al. (Nohr, Nymark et al. 2005) argue that most of the large amount of heterogeneous information generated in health care is considered sensitive. All relationships in health care are based on trust and the basic principle is confidentiality. All health care personnel are dependent on the information provided by the patient and the patient must trust that health care personnel regard the information given as confidential.
According to Nohr et al. (Nohr, Nymark et al. 2005), the professional duty of confidentiality is regulated under national health acts and/or health personnel acts. The Norwegian Health Personnel Act (Helsepersonelloven) states in its article 21 that:

“Health personnel shall prevent others from gaining access to or knowledge of information relating to people’s health or medical condition or other personal information that they get to know in their capacity as health personnel.”

(Official translation)

Nohr et al. (ibid.) argue that:

“This article imposes both an active and a passive duty on health care personnel; both a duty to actively protect such information and a duty not to give out such information, being it orally or otherwise. And the Norwegian Patients Rights Act establishes confidentiality as a right for the patient.

Similar legal provisions can be found in most countries. In a way it can be said that this is the legal standard or requirement that organisations, routines and technology must meet. Telemedicine solutions must provide levels of security and safety that meets these legal requirements and enables personnel to use the solutions without the risk of breaching an important professional duty.

Regulations on data processing have relevance in health care when it comes to processing of information, and especially in terms of processing by electronic means. Under the Data Processing Directive and national Data Processing legislation, one needs a legal foundation for processing of health information. Such a foundation is found in health care legislation, especially in relation to provisions on medical-/health records and exchange of information.” (Page 6)

“Security” is another aspect of privacy and confidentiality. According to Nohr et al. (ibid.), this includes more than security from illegal intervention to systems. It also comprises protecting information, ensuring that the recorded information is valid and true and having it stored in a way that makes it possible for an authorized person to access it.

Nohr et al. (ibid.) argue that:

“The right to privacy is considered a Human Right. The right to privacy is derived from the notion of individual autonomy and integrity. Respecting and enhancing (in our case) patients’ and clients’ rights to privacy is showing respect for personal integrity and autonomy.

Introducing “e-solutions” to health care should not jeopardize any of these important principles. Hardware, software and communication need to be built and used in a way that secures information, meet confidentiality requirements and uphold the right to privacy of those whose information is stored and processed. This is not a small task for any information-system, being it paper-based or electronic.

On the other hand, one should recognise the benefits of implementing information technology solutions in health care. IT is regarded by the health care providers as a tool to meet general and primary goals specific for the health care sector in terms of, e.g., cost
efficiency, co-operation between health care providers, continuity of care, patient safety, etc. In this perspective IT tend to increase the risk of a collision between those general and primary goals and – on the other hand – the legal interest of upholding the patient’s right to privacy.” (Page 7)

2.5.3 Problems and challenges

Nohr et al. (Nohr, Nymark et al. 2005) claim that:

“Modern information- and communication technologies in a way represents a new “information culture” compared to the way information is regarded within health care. In the latter setting, the focus is (or has been) on gathering and storing as little information as possible and keeping it as secret as possible. Modern information technology is in essence more about make storing of huge amounts of information possible, spreading it widely and without limits, and making it widely accessible. Merging these two cultures obviously meets challenges, conflicts of interests and barriers.

Several laws regulate information processing under national legislations. Privacy and security is protected under Data protection acts in all Nordic countries. In addition EU regulations\textsuperscript{42} apply both to the EU- and the EEA\textsuperscript{43} countries. In terms of health care provision, specific legislation is in force, regulating the duty of confidentiality for health care personnel with additional penal provisions. Acting with respect for the patient’s privacy and right to confidentiality is a fundamental part of what constitutes responsible and good conduct by the health care provider.

As there may be state-to-state differences between legislations, they all have patient confidentiality in common. The main goal is to establish the basis for trust and confidence in the doctor – patient setting. And it is first and foremost health laws that set the standards that modern technology must meet. The challenge is to create, establish and implement solutions that meet strict confidentiality requirements. And the term “solutions” in this respect not only refers to hard- or software but also to organisational changes, new practices and, not to forget, ethics.” (Page 7)

In many ways, ICT has revolutionized the health care sector. However, the same technology infers new threats towards the integrity and safekeeping of health information. According to Nohr et al. (ibid.), “many of the so-perceived legal barriers are found where the realities of existing regulations on confidentiality, privacy and security meet the possibilities and desires of ICT. Not all that can be done with these new tools in terms of storing, accessing and communicating information, can be done due to legal hindrances, and not everything that can be done, should be done. The challenge is to a large extent to find acceptable technological solutions that meet the legal requirements.” (Page 8)

Nohr et al. (ibid.), argue that a major concern with technological development is that until the end of 2014 legislation did not fully covered transformations in opinion with regards to health care, treatment, patient focus and processing and sharing of information:

\textsuperscript{42} 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.

\textsuperscript{43} European Economical Agreement (EEA).
“Legislation regulating confidentiality, sharing of information and patient records in the public health care sector derives from a time when health care was an isolated phenomenon, a final visit, and there were no imposed need for the GP to share his or hers medical records with other health care providers. Health care has been considered a static activity, not process oriented as it is today, often with several health care providers sharing their part (and obviously needing to share the same medical information) in the treatment of the patient. Furthermore, current legislation often does not take in to account the increased mobility of both patients and health care personnel. Legislation is based on paper medical records. It is not fit for electronic information processing and the great amount of information that needs to be stored, received, handled and communicated without being at the same time an obstacle for the health care.

These legislative challenges are a concern for health- and juridical authorities in many countries. One needs to establish technical, organisational and legal measures that both ensure confidentiality and privacy, and at the same time make sharing and distribution of information possible. One can say that there is a need to “synchronise” legislation with information technology.” (Page 8)

According to Nohr et al. (ibid.), in Norway there has been a yearlong debate on exchange of and access to medical-/patient information. They argue that until the end of 2014 the legislation limited the possibility to share information by granting access to information stored at one site for an external requesting party, e.g. another hospital or a general practitioner. Nohr et al. (ibid.) argue that “the Norwegian Health Register Act draws a “line” or border around each institution and places clear responsibilities on different parties within the institution. Access to information is largely granted within each institution (naturally based on a “need-to-know” principle), but externally initiated access, e.g. from other institutions or doctors, is as a general rule prohibited.”

Nohr et al. (ibid.) add that the restriction on external access to information does not (and should not) change the duty and right to share information through exchange and transmission that is initiated “internally” from the party hosting the relevant information database. They argue that:

“Our technological level, this has the implication that systems must prevent external access to the data-systems and instead be set up to communicate by exchange of messages. One reason for this difference is that from a security and risk-analyses/risk-management point of view it is inherently more “risky” to grant access from external “sources”. This is a statement or understanding fully shared and argued by the Norwegian Data Inspectorate (Datatilsynet), and a framework within which also health institutions and professionals must act. In assessing the usability and safety/security of given systems, a key process is to perform thorough risk-assessment analyses.

What is utterly important, however, is to have a clear and precise understanding of what the legal requirements are and how these are interpreted under different legislations with regards to the use of IC technologies. Both health authorities and public bodies that supervise data processing legislation play important roles in the process of finding solutions all parties – patients, professionals, authorities – can live with.

44 Lov om helseregistre og behandling av helseopplysninger (helseregisterloven) LOV-2001-05-18-24. (Act on health records and processing of health information)

The use of electronic means and solutions in fact can enhance security, privacy and confidentiality. As an example, the use of electronic health records gives new possibilities when it comes to secure storing, better access when needed, possibilities to change/correct/erase and logging. Furthermore, the use of electronic patient records can contribute to the reduction of medical errors.46” (Page 9)

In 2015, the Norwegian legislation regarding medical records and health registers was updated. The current law has eliminated many of the access restrictions. Except for the press release below, this will not be further discussed in this book. The reason for including the text about the now out-dated law is to show under which conditions telemedicine and e-health services have been implemented.

In a press release regarding the new laws (“Good treatment and good privacy with new laws”), the Government explains the major updates in the law in the following way:47

“Health information must accompany the patient and be available for health professionals to provide health care. That is the main purpose of the government's proposed new law on patient records.

The Government proposes new rules on the use of health information in patient records and health records.

- We are currently making arrangements for the use of new technological solutions in a way that gives both better treatment and better privacy. The new legislation adapted to new working methods and electronic processes. In order for us to create the patient's health care service this must be in place, says the Minister of Health and Care Services Bent Høie.

Today's Health Registers Act are now being divided in two laws: a Medical Record Act concerning health professionals' use of health information in connection with health care and health registers act on the use of health information for research and statistics.

The new Medical Records Act allows that necessary information about a patient is made available to health professionals regardless of where the patient previously received medical care and how the sector is organized. It should also be opened up for health institutions to collaborate on patient records.

The new Health Register Act will make it easier to establish health records with voluntary participation.

- We should have strict control of who gets access to health information. Electronic security mechanisms can safeguard this in a good way. Patients will also be able to control who has read the journal and health registries. Anyone who has access to data is bound by confidentiality, says the Minister of Health and Care Services Bent Høie.”

For those who want to learn more about the updates, we refer to (in Norwegian):

46 See the report “CPR Generation Effectiveness in Reducing Medical Errors”, issued by the Gartner Group at www.gartner.com
47 https://www.regjeringen.no/no/aktuelt/God-behandling-og-godt-personvern-med-nye-lover/id757282/
• “Lov om behandling av helseopplysninger ved ytelse av helsehjelp (pasientjournalloven)”\textsuperscript{48}
• “Lov om helseregistre og behandling av helseopplysninger (helseregisterloven)”\textsuperscript{49}

\subsection*{2.5.4 Responsibility}

According to Nohr et al. (Nohr, Nymark et al. 2005), the term “\textit{responsibility}” is multi-facetted. They argue that there are at least three aspects of it (ibid., page 12):

• \textit{Being responsible}: For instance when we are dealing with issues like assigning a doctor who is responsible for the treatment of the patient when she/he is at the hospital. In our setting: Who is responsible for the patient in a telemedicine setting?

• \textit{Acting responsibly}: This refers to the ethical-legal norm put on all health care personnel to conduct their practice in accordance with the best standards, and to be “measured” against these standards. This is the aspect of responsibility as a so-called legal standard.

• \textit{Being held responsible}: Refers to the fact that a doctor (or any/many other health care personnel) can be met with sanctions if the legal requirements (or ethical requirements) are not met or not satisfactory fulfilled.”

Nohr et al. (Nohr, Nymark et al. 2005) argue that:

“Responsibility is a “legal standard”. In terms of law making, this means that the legislator in the relevant act and article refers to the standard as a legal requirement. The law or article itself does not further detail the content of the standard (or do this only to some extent). What is “in” the standard is based on a judgement of what is the state-of-the-art performance of (e.g.) a procedure at a given time. As research, practice and competence changes, so will the requirements under the standard. Ultimately, the level will be set by courts or disciplinary boards in cases where a procedure is disputed.

As we see, these are different aspects of the issue and not different issues. The aspects are intertwined in each other. If not anything else, this shows that responsibility is a difficult issue. It is difficult to define and limit, and difficult to discuss.” (Page 12)

The question of responsibility has been a major concern for telemedicine in Norway. Both health personnel and patients dislike any ambiguity regarding responsibility. According to Nohr et al. (Nohr, Nymark et al. 2005) it is reason to assume that this is a common impression worldwide.

Nohr et al. (Nohr, Nymark et al. 2005) argue that:

“In a simple form, the question has been who the responsible practitioner is, where the patient meets with his GP, and the specialist is present via videoconferencing. As services and solutions have evolved, the question has been expanded to encompass all settings where the patient – doctor contact goes through some kind of interface, online or offline.

\textsuperscript{48} https://lovdata.no/dokument/NL/lov/2014-06-20-42
\textsuperscript{49} https://lovdata.no/dokument/NL/lov/2014-06-20-43
Distance is the core of the issue. And in relation to the three aspects of responsibility mentioned above, the following questions can be asked:

- Can a doctor be the responsible (treating) doctor for a patient that she or he does not see face to face?
- Can a doctor treat a patient that is not physically present and still meet requirements of responsible conduct? Can only some kinds of tele-treatment be considered responsible?
- Can a doctor be held responsible for misconduct or malpractice when treating a patient via a telemedicine?" (Page 13)

2.6 The use of Electronic Health Records (EHR) in Norway

For many years, almost 100% of the Norwegian GPs have used Electronic Health Records (EHR) for their documentation of patient’s information. The market has been covered by two large companies, which deliver three EHR systems. And one company which deliver a fourth system.

All (approx. 70) hospitals in Norway use EHRs. The public hospitals in three of the four health regions in Norway use an EHR from the same company. In addition, all hospitals use supporting electronic systems, e.g., radiology systems, laboratory systems, obstetric systems, and surgery planning and documentation systems. Many of these systems are integrated with the EHR, but not all. The EHR market for hospitals is divided between 3 companies. Both the hospitals and the GPs have been busy thinking of their in house need for documentation of their own work than the possibility of sharing the same information electronically between them when patients are refereed from the GP to the hospital or when the patients are refereed between hospitals.

Ad to this that the nursing home sector has five other system for documentation of their work, it is understandable the Norwegian health care sector is confronted with a huge challenge when trying to create interoperability between these systems. However, today the majority of request and reports between the GPs and the hospitals in Northern, Mid and Western health care regions in Norway are done electronically. And the electronically communications between the GPs, the hospital and the nursing home are also increasing as a result, among others, of the standardisation work done in Norway.

2.7 Security when electronic messages are used in direct communication between patient and doctor

In addition to the security solutions that are required in electronic communication between health workers in health institutions, as described in the chapter about the Norwegian Health Network, there is an increasing desire of patients to be able to contact health services directly via electronic messages. Thus, solutions with satisfactory safety standards have been developed by NST.

PatientLink (PasientLink) was a solution developed in 2001-2002 that enabled patients to contact their GP (doctor) over the Internet in a secure manner. Patients used a web browser to post questions and read the answers. They logged in to the service by entering a user name and password followed by a one-time code that they received from the PatientLink service via SMS.
The GP received the messages and responded to them via the communication module of his/her EHR system.

The solution satisfied the national security requirements at the time the solution was developed. This implied that the solution met three strong security requirements that affected the selected architecture: 1) Health information should not be sent outside the health network to computers we cannot prove are adequately secured. This means that ordinary e-mail systems cannot be used for communication between health care personnel and patients. 2) Computers that contain sensitive information should be managed in a secure network and no communication with such computers should be initiated from an unsecure network. The PatientLink service used a reverse proxy solution in combination with encrypted messages that were sent to the GP to fulfil this requirement. 3) A form of two-phase authentication was required for accessing sensitive information via an unsecure network. In PatientLink the one-time code sent to the patient via SMS after approval of the username and password of the patient, provided this two-phase authentication.

All software in the project was made available under an open BSD license as help for vendors who wanted to create services for the patient-health worker communication. One vendor of an EHR system for general practitioners utilized this in the development of a communication solution called MinDoktor (MyDoctor).

Today the security requirements for web based patient-health worker communication are mainly the same as mentioned over. There is, though, a stronger requirement with respect to the two-phase authentication of the patient. The security level of the authentication should be at the same level as the Norwegian BankID solution provided by most Norwegian banks. The mobile BankID is not regarded as secure enough, only the ordinary BankID solution with a physical one-time code generator.

The Norwegian health authorities have developed an official web site for the Norwegian inhabitants, called Helsenorge.no, with the intention to present all web based health care services for the inhabitants in one place. Helsenorge.no will also provide solutions for communication between patients and health care workers in the future.

Another safety aspect is to give citizens knowledge of “how to evaluate health information available on the Internet.” This NST tried to accommodate by making Health wit (Helsevett) that is a web page with guidance for people that use the Internet for health purposes. The target group is mainly users of health site on the Internet, but also providers, authorities and others who want to improve the quality of the Internet may find the web page useful. The web page has been available since 2002.

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50 This can be downloaded from: http://www.telemed.no/last-ned-programvare.78217-7457.html (Last accessed: 5.2.2013.)
Full technical description can be found at: http://www.telemed.no/technical-description-of-the-solution.69522-7457.html (Last accessed: 5.2.2013.)
SMS Authenticator is now licensed under an “open source” license, and available for download: http://www.telemed.no/index.php?id=58179 (Last accessed: 5.2.2013.)
51 Helsevett is primarily contructed for Norwegian citizens and can be found on http://www.helse-vett.no/ A short version is also available in English at: http://www.helse-vett.no/english.4866.no.html (Last accessed: 5.2.2013.)
2.8 Reimbursement

The issue of reimbursement of telemedicine and e-health services has, for many years been high up on the international agenda, so also in Norway. The issue of reimbursement is closely linked to the notions of cost effectiveness, return of investment (ROI) and cost benefit. Another aspect of this discussion has been to discuss quality of services instead of ROI.

Whatever term that are put on the economical aspects of this, it always come back to “who is paying for what” when electronic-based patients information travel around on the information superhighway without being aware of the fact that it is crossing long time ago established organizational boarders. And the health care providers, whether it is a hospital or a GP, will not use the new possibility unless they are reimbursed for the work.

And like the way the spinning several hundred years ago were challenged, and took away, hundred of thousands of good weavers achievement, and income, telemedicine and e-health today has the capacity to do similarly with the health care systems. Or to put it in another perspective, why invest in all the PCs, billions in EHR systems, the money for all the national infrastructures for health, all the money into the maintains contracts, all the money into research in the area without taking out the benefits in using it for the best for the patients and the health care system?

Health services in Norway are mainly publicly financed. In addition, the patients pay fees for receiving health services. There also exist, though very few, clinics and hospitals which are privately financed. The cost-effectiveness of telemedicine services and electronic message 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. In Norway some E-health consultations are reimbursed within the public health service if a specialist at the hospital performs the consultation 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.

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 if done physically in the same room. Responsible for telematics development in Helse Finnmark, special consultant Morten Dahl of Health North ICT, has calculated that only in psychiatry in Finnmark saves a million NOK a month by using video conferencing instead of traveling in the traditional way.

In the Høykom report No. 2006:1, “Benefits from telemedicine in Norway, An examination of available documentation” (Johnsen, Breivik et al. 2006), the authors write in their summary:

“Nine of the studies of the economic consequences of telemedicine show benefits or potential for benefits. Analysis shows that the cost-effectiveness of telemedical 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 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 two of the studies, the
conclusion is that the evaluated service is cost-effective; seven of the studies show that there is some potential for cost-effectiveness; however, the services were not used enough at the time of evaluation to show benefits.”

Johnsen, Breivik et al. (ibid.) argue that based on the review of the projects, they can conclude that the economic benefits depend mainly on the volume of use of the services. Often, the use of telemedical services is not great enough to achieve benefits, however when their use reaches a certain scale, the service will be cost-effective.

Bottom line is, we think, that it is a clear relation between the investment and the numbers of users, and the benefit, in cost benefit terms, clearly depends of a “all or nothing” participations between the different stakeholders within the health care system. This conclusion is also strengthened by the results from the NORUT report published 24th February 2006 where the researchers applied a traditional cost-benefit analysis on message exchange in the Norwegian health sector and showed that with 100% implementation of electronic messages there are potential aggregated net benefits to the society. In the course of a 15-year period, the health enterprises would be able to save about 40 million Euros by changing to electronic message exchange. The doctors’ surgeries will have an economic loss at about 3,5 million Euros, provided that the implementation takes place during 10 years. Presently, when 42 % of all discharge summaries and 8 % of all referrals are treated electronically, only a few actors in the Norwegian health care sector have realised benefits of electronic message exchange. The reason is that the number of messages sent electronically is still too low.

Prerequisites for generating the benefits are that the transitional stage of practicing double routines is made as short as possible and that network costs ascribed to electronic message exchange are limited. Reimbursement is further discussed in section 4.24.

2.9 Summary

If our six allegations in the opening of this chapter are important prerequisites for successful implementation of telemedicine and e-health, it is obvious that Norway still has some steps to go before the country has achieved its goals as described in the national plans:

- The national plans are there, but are not well enough coordinated. And they are not followed by sufficient economically resources.
- Access to a secured infrastructure is to a great extent in place.
- The use of standards is not mandatory. It is necessary to change the governmental messages on the implementation of standards from “ought to” to “must”.
- The implementation of Electronic Health Record (EHR) is very good, but there is still some work to do on interoperability.
- Laws that are not adapted to the modern way of working, but this work are in progress.
- Reimbursement for new, smart ways of health service delivery are not in place.
3 Getting started with telemedicine

3.1 Two different ways of communication

The use of videoconference (VC) for telemedicine services started in 1989, and has been used regularly from 1994. This has enabled procedures where specialists, doctors, and patients have been able to meet without travelling. Most of the VC activity is in Northern Norway. Helse Finnmark alone uses 1/3 of the traffic in the Norwegian Healthnet. All hospitals in Northern Norway use VC. The biggest users are the clinics. The success factor is that VC has become a natural part of the work to doctors, psychologists, nurses, etc. The use of VC in education has been very important for the development health services in Northern Norway. It is expected that PC-based VC solutions will improve the use of VC even more.

There are several ways to assemble videoconferencing equipment. The basis of a videoconferencing system is the codec (COder - DECoder) with associated camera and microphone. In addition to this there will be need for one or more monitors, and in some cases, additional equipment for mixing of additional audio and video sources. The composition will be dependent on the room size, number of persons, whether videoconferencing equipment will be mobile (portable), etc. The most common composition is a “rollabout”. That is a videoconferencing unit, monitors and any peripherals, fitted or supplied pre-mounted in carts. It should also be assessed the number of monitors that are needed, or eventually a video projector for larger image (Figure 44).

In a normal rollabout solution we use two monitors (dual), one for outgoing and one for incoming image. The monitor with the outgoing image is used as the reference monitor for the pictures that are sent out. In a dual solution the camera is placed on top of the monitor that displays the incoming image. This is because it is easier for a natural approach / direction in relation to the counterparty. It is also possible to use a single monitor, called a single solution. In a two-party conference the main picture is of the opposite party, i.e., incoming, and if you want a reference on what you yourself sends out you must use a PIP function (Picture in Picture).

In a multi-party conference, in most cases you can choose between Voice and so-called Continuous Presence. Voice means that all participants will see the image of the party is currently active. As soon as another party is participating in the dialogue, the image switches to this person. Continuous Presence means that the image is divided into an image for each participant, split screen, normally up to a four-division of the screen. The advantage here is that everyone can see everyone all the time, but if it is used for small screens it can also be a disadvantage when the image of each participant location may be too small. This is especially true when viewing images with lots of details, such as a PC presentation.

In some cases it may be desirable to use a video projector. This can then be used alone or in combination with the above solutions. The latter combination will depend on the number of video outputs of the Codec.

The telemedicine link uses different types of medical equipment in video conferencing. This can be stethoscopes, ultrasound machines, laparoscopic instruments, etc. In addition, video players or similar devices may be used for both recording and playback. In some cases it may be necessary to connect multiple types of equipment simultaneously. The limitations here will lie in how flexible codec is with respect to the connection of external devices and the number of inputs / outputs on this. The choice of the videoconferencing equipment should be given
considerable weight when one can quickly get in the situation that required enhancements such as video and audio-splitters for connection. This may also soon have financial implications, as this type of equipment can be expensive.

Videoconferencing on the Internet, IP-based video conferencing, are becoming more and more common. Here we use a codec for IP. These are now being delivered as an ordinary part of a PC. Videoconferencing is often described as an on-line service, a service that takes place in real time. This is in contrast to off-line services: Messages and electronic communication, where the service can most easily be likened to send and receive e-mail. This means that the sender sends and the receiver responds when it fits into other work.

The best examples of this type of service are referrals and discharge summaries. Together with laboratory results, these constitute the largest volume of information exchanges between the 1 and 2 lines of health care services. Electronic referral and discharge summary implies that the information sent from the electronic health record of the sender to the electronic health record system of the recipient. In 2000, NST in cooperation with the IT department at UNN, 5 GP offices, (North-) Norwegian Healthnet and Well diagnostics52 established a service for electronic submission of discharge letters between the hospital and GP offices. After the test phase was completed, the service was extended to include other hospitals. In 2004, this service was included to cover all hospitals and GP offices in Health North area. In addition, the GPs could send referrals and x-ray requisition to all hospitals in the area.

This means that healthcare institutions both avoiding duplication and reducing the chance for error input, i.e., that patient should not be entered manually into the patient record systems

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52 Well Diagnostics was later acquired by DIPS.
several times. Security is increased by the nature of the information not be wrong or going away. The service provides savings by saving costs of producing and sending documents by mail, and free up resources for both GP practices and hospitals. Experience shows, however, that the office staff will not be redundant by the restructuring, but getting new jobs and other responsibilities.

The proliferation of messaging, particularly electronic referral and discharge summary, vary along in the different parts of Norway. The solutions used are national and using message standards developed by KITH. The solutions can be adopted by all hospitals and medical offices, where their records provider and communications provider has implemented the standards and solutions.

Users of electronic business services have made requests for further development of the service with several types of messages. A further development of the service must also be able to send attachments along with references and summaries, such as pictures, audio and text documents. This requires that suppliers and operators in the health network make use of the framework (ebXML). The change will mean that telemedicine solutions are integrated into the patient record systems that doctors use in their daily lives. It will facilitate the user interface and usability of the individual physician. This provides great potential for displacement of telemedicine services.

Another wanted service is to allow health care professionals to communicate directly with their patients regardless of where they are located. NST has for the project PasientLink developed technology that allows patients to communicate directly with their own doctor via electronic mail. This technology allows the patient to transmit to a receiver within the health network (GP) and receive information from the GP by electronic mail. More and more patients want to communicate electronically with their doctor. In the long run this will also need to be offered to patients who are constantly being followed up by a specialist. This service has been developed and put into operation. However, it is not in routine operation because it needs to be inserted in an organizational context.

### 3.2 How to get started

Many enthusiastic supporters of telemedicine and e-health solutions experience difficulties in moving from the initial project phase onto the implementation and operation phase. NST has suggested the following “get started list” to motivate the users:

- **Support team / super users**: Experiences among clinicians indicate that telemedicine solutions often involve technical errors or user errors. As a result, many clinicians have resisted using such solutions. To avoid such a development, “super users” of telemedicine systems and a support team that quickly respond to problem calls and alarms must be connected to the departments.

- **The responsibility for the equipment must be clearly identified**: Clinicians often report that they avoid using telemedicine solutions because of technological problems. Such inconvenience must be reduced to an absolute minimum.

- **Training – client participation – codetermination**: We can expect the entry level among clinicians to be low as long as the service has a volume that implies regularly use and identifiable profits for the patients, their relatives and the clinicians themselves.
requires that all clinicians get adequate training. The training must focus on the user’s needs. A more comprehensive training must be offered to the “super users”.

- **Up-to-date equipment**: It is very important that all equipment upgrades and modifications are notified in advance and that all users receive additional training, if needed. The good relationship between support personnel and clinicians is very important. Client participation when changes are considered is important. Net-based support functions should also be considered. Users groups / forums must be established, and clinicians must be able to participate in those. Codetermination in processes is important factor for a good work environment and motivation.

- **Customer-oriented**: Requests for inspection, copies of and access to medical data and documents from patients and their relatives are increasing. Their experience with IT systems varies a lot. This means that the possibility to get access to and copies of their medical data / patient data must be as easy as possible.

- **Continuous operation must be ensured**: When telemedicine equipment is purchased we must ensure that proper maintenance agreements are made, and that our requirements for continuous operation are made clear to contractors and industry (very high MTBF). Only solutions that have proved to be reliable should be chosen. Empirical knowledge has shown that it is the clinicians that must improvise and find emergency solutions. It is the clinicians that must “carry the can” in meetings with frustrated patients, relatives and health care personnel when the technology fails. Reduced operation time is de-motivating and frustrating and can “kill” good solutions.

- **Participations in development projects in the industry**: Especially at university hospitals, the interest for participation in research and development projects is huge. This type of activities is important motivation factors for many of the clinicians. The hospitals should enable cooperation between contractors/developers of telemedicine equipment groups of clinical specialists.

- **“Up-to-date” solutions**: A characteristic with IT systems is the process of continuous development and improvement. The length of life for such equipment is limited. A plan for continuous upgrade and replacement must be made. An example of this is that many telemedicine services are based on the use of videoconference equipment. This is expensive equipment with limited access. Within short time, pc-based VC equipment is expected to replace the studio-based approach. Today's plans must take into account the solutions of tomorrow.

- **Identifiable profits – tariffs (reimbursement)**: A large-scale operation of the most profitable areas will imply considerable investments for the hospitals. The reimbursement system must reward the hospitals that invest in the most prioritized areas. When a clinician’s daily routines are changed, they often ask “What is in this for me?” Telemedicine systems often result in less ambulatory work and increased opportunities for further education. This can strengthen professional and collegial networks. Such profits must be visualized. Use of telemedicine systems can be time consuming and require increased recourses from both general practitioners and specialists, while cost reduction only is reduced transportation costs. This must be reflected in the tariffs / reimbursement system.

- **Goal-oriented research**: Along with patient treatment and education, research is very important for the region / hospitals. We must ensure that research recourses are allocated to the fields that are most relevant for telemedicine research. Research grants from Helse Nord RHF should be coordinated with large-scale implantation of telemedicine services.

How to get started packages in the different fields have been developed for:
Fact sheets from the NST

Feb, 2014 - Teledialysis (In Norwegian) (Updated fact sheet)
Dec, 2013 - NST as partner for WHO (In Norwegian) (Updated fact sheet)
Oct, 2013 - Video conferencing as a collaborative tool (In Norwegian)
July, 2013 - Cooperation between NST and Northwest Russia (In Norwegian)
No. 1, 2011 - Risk of Information Security (In Norwegian)
No. 2, 2010 - Cooperation between the NST and Northwest Russia (In Norwegian)
No. 1, 2010 - Video Conferencing (VC) to the patient (In Norwegian)
   (In Norwegian)
No. 2, 2008 - Confidentiality and use of information technology in health care (In Norwegian)
No. 1, 2008 - Video conferencing as a collaborative tool (In Norwegian)
No. 6, 2007 - Equipment for video-based emergency medical conference
   (In Norwegian)
No. 5, 2007 - Mobile units and data security (In Norwegian)
No. 5, 2007 - Mobile units and data security (In English)
No. 4, 2007 - Equipment for teledialysis (In Norwegian)
No. 4, 2007 - Teledialysis (In English)
No. 3, 2007 - Electronic communications between health care and patient
   (In Norwegian)
No. 2, 2007 - Telemedicine and responsibility (In Norwegian)
No. 2, 2007 - Telemedicine and responsibility (In English)
No. 1, 2007 - Norwegians' use of the Internet for health purposes (In Norwegian)

Project sheets from NST

- Interact through a web-based patient record in wound treatment “Ulcer interaction”
  (2010) (In Norwegian)
- Interact through a web-based patient record in wound treatment “Ulcer interaction”
  (2010) (In English)
- Heart Link: Cardiovascular disease in Northwest Russia (In Norwegian)
- Clear-Brave-Proud: nurses facing commercial players (In Norwegian)
- Symptom-based disease surveillance in the Northern Health (In Norwegian)
- Competency Program in obesity, lifestyle and coping (In Norwegian)
- ICT-based skills development in municipalities (In Norwegian)
- Common electronic medication card (In Norwegian)
- Net-based guidance for enhancing the quality of wound care (In Norwegian)
- Ses@m Tromsø (In Norwegian)
- FUNNKe – Northern Norway as a telemedicine laboratory (In English)
- Eczema Counselling via the Internet
- Net-based guidance for improving ulcer care
- Tele-dermatology in North Norwegian medical offices
- Ses@m Tromsø - telemedicine in the nursing and care service

These brochures can be found on: www.telemed.no
NST also offers more comprehensive guidelines in the form of reports, e.g., the report “Videoconference - about infrastructure and organization” (“Videokonferanse – Om infrastruktur og organisering”) (Figure 45). In the introduction, Karoliussen (Karoliussen 2014) argues that:

“Purchasing videoconferencing equipment (VC) which can be used for meetings, collaboration and teaching, is for many an investment that may eventually save costs and time. In addition, you can access information and resources that would otherwise be inaccessible.

A prerequisite to get a good VC-room (studio) and a system that provides a good user experience requires proper installation and good maintenance. In addition, users of the studio must have been trained in use or have access to someone who can operate the system.

Health care institutions have used videoconferencing for many years, and many great facilities that are often used have been installed. NST wishes to inform about our experiences that we have gained over 10 years of use and organization of VC services in healthcare. Both technical and organizational aspects are discussed.” (Page 5)

Figure 45 The NST-report “Videoconference - about infrastructure and organization” offers detailed help installation of videoconference equipment (Karoliussen 2014)
4 Telemedicine services

This chapter presents some of the most important telemedicine services implemented in Northern Norway since 1987. The presentation is not complete, especially when it comes to the most recent telemedicine services. Many of the illustrations and service descriptions have not been updated in recent years or they are not used anymore. However, most of the telemedicine services are still relevant.

4.1 Telemedicine in emergency care

Due to long distances and severe weather conditions, transportation of emergency patients can be a big challenge, especially in wintertime. The three northernmost counties in Norway, Nordland, Troms and Finnmark, which cover 45% of the land areas in Norway and has less than 10% of the Norwegian population (470,000 people), had to their disposal 130 ambulances, 15 boats, 6 planes and 4 helicopters. The total travelling expenses for patients in these counties is NOK 1.4 billion per year (Figure 46 - Figure 48).

![Figure 46](image)

Figure 46  Helse Nord’s responsibility area for patient transportation (red circle) is enormous.

Emergency care is complicated in the high mountains and off shore. Telemedicine is an important part of emergency care in Northern Norway. An example of the distances in the north is the ambulance station on Stonglandseidet on the island Senja. The station is located about 300 meters from the doctor’s office. There are doctors in the office 2-3 days a week between 8-16. After that time, the ambulance has to drive to Silsand, which is approx. 45 km away. From Skrolsvik to UNN Tromsø, it takes about 3 hours and 15 minutes to drive 480 km.
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 47  Helicopters are heavily used in Northern Norway. (Photo: UNN)

Figure 48  Flight time from Tromsø (in minutes) with the ambulance helicopter.

4.1.1 Tele-emergency medicine in Northwest Russia

The first attempt at combining telemedicine and emergency medicine was through the NST’s long-standing cooperation with Arkhangelsk Oblast in Northwest Russia. At the request of health authorities, it was developed a mobile telemedicine unit that could be used in emergency medicine and screening in order to save time and specialist hospital and patients' travel costs. The project “telemedicine mobile unit” started in September 1998.
The device contained ECG equipment, an endoscope and a digital camera. The camera was originally intended for use in radiology, but can also be used for other medical examinations, such as images of skin, lesions and samples. Later the unit was expanded with the ultrasound machine, pulse oximeter and equipment for ECG measurements. Cameras and monitors are high definition quality. Already in the first period the equipment was used in over 1,000 investigations, of which 200 acute cases, the rest screening.

In Norway, teleradiology has been used as an important tool for assessing the need for emergency transportation or emergency counselling to patients admitted to local hospitals.

Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem</strong>: To provide telemedicine services in emergency care in Northwest Russia.</td>
</tr>
<tr>
<td><strong>Solution</strong>: It was developed a mobile telemedicine unit that could be used in emergency medicine and screening in order to save time and specialist hospital and patients' travel costs.</td>
</tr>
<tr>
<td><strong>Equipment</strong>: The device contained ECG equipment, an endoscope and a digital camera. The unit was expanded with an ultrasound machine, pulse oximeter and equipment for ECG measurements.</td>
</tr>
</tbody>
</table>

Lessons learned:

- In 1998, on average it was made 1.2 consultations per patient between the Regional Hospital of Arkhangelsk and the smaller hospitals in the area. Number of specialists who assisted the consultations of the Regional Hospital of Arkhangelsk ranged from one to five, with an average of 1.4 specialists at each consultation. Compares one of these figures with last year, these were respectively 2.2 and 2.6. This indicates that people who perform telemedical consultations have become more experienced, it is no longer necessary to take as many pictures per patient, and it is easier for specialists to diagnose on the basis of still images.

Further reading: (Sørensen, Rundhovde et al. 1999, Manankova and Sørensen 2001, Bye and Manankov 2007)

4.1.2 VAKe – Video-based Emergency Medical Interaction

In recent years there have been several successful research attempts to offer video conferencing solutions in emergency situations in order to provide expertise from the hospital’s acute unite. Smaller hospitals and health institutions often have limited emergency medical skills. In order to make emergency medical expertise available in emergency situations NST, together with the Acute Unit at University Hospital and Longyearbyen hospital, initiated a project called videoconferencing acute medical conference (VAKe).
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 49  The emergency room at Longyearbyen hospital. The picture is from an exercise (not a real patient). On the monitor, the outgoing video stream of the patient is to the right and the incoming video stream of the emergency team at UNN is to the left. (Photo: Oddvar Hagen)

Figure 50  The monitors at the emergency unit (AMK) at UNN. The upper monitor displays the video stream from the patient camera. The lower monitor shows the patient’s vital parameters and the picture from the outgoing video stream. (Photo: Oddvar Hagen)
It was developed and established a video link between the emergency treatment room at Longyearbyen Hospital to the Emergency Medical Communications Centre (AMK)\textsuperscript{53} at UNN. From here, UNN provides access to a wide range of medical specialists (Figure 49 - Figure 54).

\textsuperscript{53} Akuttmedisinsk kommunikasjonssentral
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 53 The Emergency Medical Communications Centre (AMK) at UNN. The AMK nurse receives a request for videoconference from Longyearbyen hospital. The AMK is manned 24-7. (Photo: Oddvar Hagen)

Figure 54 The picture shows the Emergency Medical Communications Centre (AMK) nurse at UNN receiving a video call from Longyearbyen hospital. (Photo: Oddvar Hagen)
Longyearbyen hospital has the following positions (Figure 55):\(^{54}\)

1. medical superintendent – GP
2. chief physicians (1 GP, 1 surgeon)
3. head of administration
4. dentist
5. unit nursing officer – anaesthesia
6. nurses (3 anaesthesia, 3 surgery, 1 midwife, 1 occupational health nurse)
7. physiotherapist
8. medical secretary
9. dental nurse
10. 0.5 secretary
11. 1.5 officer

The equipment on Svalbard is a control unit with a large display in which the primary key is “Call AMK UNN” (“RING UNN AMK”) (Figure 52). By pressing this the videoconferencing units are connected. The idea behind this design is that in emergency situations the equipment should be extremely easy to use. The acute ward at Svalbard hospital was, in addition to a camera on the wall, equipped with a ceiling mounted camera. This camera has motion and zoom functions that can be controlled from the University Hospital so that the experts at UNN can study the desired areas of the injured patient. All vital signs measurements from the patient such as ECG, pulse, oxygen saturation and temperature is automatically transferred to the University Hospital so that both sites have access to the same patient information. It has also been emphasized that good, sensible placed microphones are needed to provide good conditions for dialogue between the two locations regardless of where they are positioned in the room.

\(^{54}\) www.unn.no/longyear (Last accessed: 5.2.2013.)
The trials and testing of the equipment showed that access to images improved understanding of the situation, resulted in correct advice and thus had positive therapeutic consequences. The doctors said that it gave a better "clinical gaze", and thus more accurate treatment and that the virtual medical team strengthens the interaction.
Based on the results of Svalbard it was decided to extend the service to strengthen the emergency medical treatment elsewhere in Northern Norway (Figure 56 - Figure 58). Video-based Emergency Medicine conference in Finnmark county (Finnmark VAKe) establishes the video connection between the emergency rooms at hospitals / emergency services in four major locations in Finnmark county (Båtsfjord Municipality, Vadsø Municipality, Honningsvåg Municipality and the Municipality of Alta). These are connected to the county’s two hospitals (Hammerfest and Kirkenes), and here the AMK centres act as competence centres with access to emergency medical expertise.

In addition to the use of traditional video conferencing equipment, videoconference on mobile phones over 3G networks were tested. Preliminary results showed, however, that the technology was not sufficiently stable or did not offer acceptable quality for clinical use. The researchers expected, however, that this would change in the very near future.

For the specialists at UNN, who obviously have to evaluate the patient’s condition from remote, their ability to “recreate the patient” is crucial for the evaluation: What kind of data do you as a specialist need in order to give appropriate advice and/or make decision(s) about optimal treatment when you do not have the patient in front of you? A good approach is to establish good routines based on adequate data: audio, images, visual data, written data and trained health care personnel remotely who the specialist can instruct to do what he/she obviously cannot do with the patient.

The procedure for setting up a VAKe connection is as follows: When somebody calls the emergency number 113, the operator contacts the Emergency Medical Communications Centre (AMK) at UNN, which can set up a videoconference directly (Figure 59). From the AMK-centre, it is then set up a videoconference from the hospital specialists to the institution where the patient is located. In addition to the videoconference, other information is available from connected PC-based applications, such as X-rays and patient records, as well as instruments for vital data in real time, including ECG, pulse and blood pressure (BP). Survey instruments can also be linked in if needed.
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 59 Example of a team of health specialists at UNN examining a patient remotely from the Emergency unit (AMK). (Photo: Oddvar Hagen)

The typical setting with participants at Longyearbyen hospital and UNN in Tromsø includes (Table 2, Table 3, Figure 60):

<table>
<thead>
<tr>
<th><strong>Longyearbyen hospital</strong></th>
<th><strong>UNN</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>GP/Surgeon</td>
<td>AMK-doctor</td>
</tr>
<tr>
<td>Anaesthesia nurse</td>
<td>AMK-nurse</td>
</tr>
<tr>
<td>Surgical nurse</td>
<td>Surgeon</td>
</tr>
<tr>
<td></td>
<td>Anaesthesia specialist</td>
</tr>
<tr>
<td></td>
<td>Neuro surgeon</td>
</tr>
</tbody>
</table>

Table 2 List of equipment at UNN Emergency unit (AMK) (Hagen, Sjaaeng et al. 2006)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codex</td>
<td>Tandberg</td>
<td>6000 MXP</td>
<td>1</td>
</tr>
<tr>
<td>Ceiling mic</td>
<td>Tandberg</td>
<td>Audio Science</td>
<td>1</td>
</tr>
<tr>
<td>Headphones</td>
<td>AKG</td>
<td>HSD 200 SR/OC</td>
<td>2</td>
</tr>
<tr>
<td>Audio/video control unit</td>
<td>Crestron</td>
<td>Professional Media Processor MP2E</td>
<td>1</td>
</tr>
<tr>
<td>Touch Panel</td>
<td>Crestron</td>
<td>Wired 5,7 inch table top TouchPanel CT -1550</td>
<td>2</td>
</tr>
<tr>
<td>Mixer</td>
<td>Behringer</td>
<td>Eurorack UB802</td>
<td>1</td>
</tr>
<tr>
<td>Distribution amplifier</td>
<td>Extron</td>
<td>P/2 DA 2PLUS</td>
<td>1</td>
</tr>
<tr>
<td>TV</td>
<td>ATEC</td>
<td>LCD 37&quot; HD Ready</td>
<td>2</td>
</tr>
<tr>
<td>Camera</td>
<td>Sony</td>
<td>EVI D70 “robot camera”</td>
<td>1</td>
</tr>
<tr>
<td>TV</td>
<td>Hitachi</td>
<td>37PD5200</td>
<td>2</td>
</tr>
</tbody>
</table>
**Table 3  List of equipment at Longyearbyen hospital (Hagen, Sjaaeng et al. 2006)**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codex</td>
<td>Tandberg</td>
<td>990MXP</td>
<td>1</td>
</tr>
<tr>
<td>Ceiling mic</td>
<td>Tandberg</td>
<td>Audio Science</td>
<td>1</td>
</tr>
<tr>
<td>Headphones</td>
<td>AKG</td>
<td>HSD 200 SR/OC</td>
<td>2</td>
</tr>
<tr>
<td>Audio/video control unit</td>
<td>Crestron</td>
<td>Professional Media Processor MP2E</td>
<td>1</td>
</tr>
<tr>
<td>Touch Panel</td>
<td>Crestron</td>
<td>Wired 5,7 inch table top TouchPanel CT 1550</td>
<td>1</td>
</tr>
<tr>
<td>Camera</td>
<td>Sony</td>
<td>EVI D70 “robot camera”</td>
<td>1</td>
</tr>
<tr>
<td>TV (LCD 23”)</td>
<td>Hyundai</td>
<td>HLT2310</td>
<td>1</td>
</tr>
<tr>
<td>Sound mixer</td>
<td>Behringer</td>
<td>Eurorack UB802</td>
<td>1</td>
</tr>
<tr>
<td>Transformer</td>
<td>Noratel</td>
<td>IMED 300</td>
<td>1</td>
</tr>
</tbody>
</table>

**Figure 60  Block diagram of equipment for Longyearbyen hospital and how they are linked. (Figure 1 (“Tegning 1”) in (Hagen, Sjaaeng et al. 2006))**
Case: The polar bear attack 5th August 2011

VAKe has already proven to be an essential tool in emergency medicine. One example is the tragic attack by a polar bear on a youth camp on Spitsbergen with 13 youths from British Schools Exploring Society (BSES) Friday 5 August 2011 (Figure 61). Horatio Chapple, 17, was killed by the polar bear. Four others were severely injured. They got help through telemedicine. The four young men were sent by helicopter to Longyearbyen hospital with serious head and neck injuries (Figure 62). (Longyearbyen hospital is subject to UNN.)

Using live video chat with surgical specialists at University Hospital of North Norway, the youths were operated by doctors at the small hospital on the island. The cameras, which are related to the conference equipment, are placed around the bed the patient is treated in. In this way, the specialists in Tromsø could follow what the Svalbard doctors undertook.

“We made several different treatments here. Among other things, we had to sew together many of the very deep wounds before we could send the patients to Tromsø. In this way, also the Tromsø doctors were prepared,” said surgeon Finn Krohn to the Norwegian newspaper VG.

“Patients had extensive injuries. Only two of them were able to communicate with us. One of the injured had deep wounds in the right arm, while another had deep scratches on the back. They all had 10-15 cm long cuts in their head,” said surgeon Find Krohn to VG Nett.

The injured young men arrived at Longyearbyen hospital at 9:30 on Friday morning. At the hospital it was declared full emergency alarm, and all available health personnel in the area had been mobilized. A total of about 10 nurses, physicians and surgeons were present when the injured youths arrived. According to the local surgeon, Dr. Finn Krohn, the most visible and serious injuries were in the faces of the youngsters. Several of the injured would have to undergo several facial and jaw surgery, Krohn said to the newspaper VG.

The four young men received first aid at the scene, and received surgical treatment when they arrived in Longyearbyen hospital. The hospital serves on a daily basis as a medical centre, but is also the emergency hospital on Svalbard. Since the mainland is a 1.5 hours’ flight away, the doctors at the hospital on Svalbard had to perform simple operations on the injured to stabilize them. On Friday afternoon, the four young men were taken to Tromso with an ambulance plane for further treatment. Their conditions were described as stable, but the two expedition leaders had extensive injuries.

**Case: Severe accidental hypothermia at a local hospital**

The accident on Friday 21st November 2008 (Figure 63) was reported in the following way:

“One person remained trapped after a collision between a pickup and a lorry truck at 14:50 o’clock on Friday. There were two men in the passenger car, and both are sent to the hospital in Narvik. Information Officer at the University Hospital of North Norway, Tor Øydvin, says that there are two men in their 50ies who were injured in the traffic accident. Police informs that one man is from Nordland county and one from the county of Troms.”
Lessons learned from 25 years with telemedicine in Northern Norway

- Both men have extensive and serious injuries. The condition is unclear, says Øydvin.56

Message to AMK Tromsø from AMK-Harstad:

“Serious traffic accident in Narvik. Two persons critically injured. UNN-Narvik asks for VAKe! Bad weather locally, not possible to operate the University Hospital helicopter.”

In this case, the procedure is as follows:

- The local hospital receives patients and does primary examination. Then the camera is connected, and the damage assessed by several specialists at the University Hospital.
- Distribution of the patients agreed. In this case: one of them was transferred to the University Hospital.

Figure 63 From the newspaper Nordlys, 21 November 2008.

Headline: “Collided with a lorry truck”57

(Epilogue: The local newspaper Fremover58 reported 25 November 2008 that one of the men who were involved in the traffic accident died as a result of the serious injuries he had incurred.)

56 http://www.fremover.no/lokal_nyheter/article3938531.ece (Last accessed: 5.2.2013.)
57 http://www.nordlys.no/nyheter/article3938894.ece (Last accessed: 5.2.2013.)
Lessons learned

The VAKe system became immediately a success story after it was installed at Longyearbyen hospital. It very quickly turned out to be very useful to avoid unnecessary transportation by plane to the mainland or give support for stabilizing a patient. After the system became known among health care workers, other healthcare organizations on the mainland asked for the same service.

According to the project leader of VAKe, Oddvar Hagen, positive experiences with the VAKe system include:

- The technology worked well.
- Better support and workflow.
- “Closer” teamwork.
- It saves time, tasks solved in parallel.
- The nurses felt safer in situations with severely injured patients.
- Reduced stress, especially after the first use.
- Specialists at the University Hospital had a better understanding of the condition of the remotely located patient.
- Positive impact on patient care.
- Improved team function.

Negative experiences include:

- Monitoring and co-operation: If “they” help “us” - or “see us in the cards”?
- Sensitive initial phase, vulnerable to interference
- Disruptive communications.
- “Keen” specialists.
- The communication was not well structured.
- Not clear operational procedures.
- The need for the work routines and “rules”.
- Need for more exercise.

The specialists at UNN:

- The specialists argued that visual information gives a better platform for decision-making.
- The specialists were more confident by giving advices base on visual information.

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59 https://www.sykepleierforbundet.no/Content/273037/Videobasert%20akuttmedisinsk%20konferanse%20av%20Oddvar%20Hagen.pdf
(Last accessed: 5.2.2013.)
Lessons learned from 25 years with telemedicine in Northern Norway

- Eye contact made it easier to get acceptance for the suggested treatment procedures.

Lessons learned:

- Due to a telemedicine service, organizational changes have been made at the emergency centre: multi-disciplinary medical team is gathered for the emergency teleconference – and now also for general emergency cases! Here, technology led to the opportunity to perform a change.
- Hagen and the project group concluded in 2006 that monitoring allows patients faster treatment, avoiding unnecessary transports and hospital admissions. The result is that the local doctor spends more time with the patient, that the virtual team has a better workflow and enhanced team function, and that tasks can be solved in parallel.
- The disadvantage is that one can be more sensitive to disturbances in the initial phase, and the failure of the technical equipment can cause interference if it does not work properly.

Status:

- In routine use.
- Moderate, but increasing, frequency.
- Locations: Helse Nord, Helse Vest, Helse Midt, Spitsbergen (Longyearbyen), Antarctic (TROLL)

4.1.3 Prehospital thrombolysis

Telemedicine has been introduced in two other areas of acute medicine. One service, prehospital thrombolytic treatment of myocardial infarction, has been developed at the Emergency Medical Communications Centre (AMK) at UNN, whereas thrombolytic treatment in ischemic stroke has been developed at NST.

For acute myocardial infarction, there is a clear reduction in mortality with the use of thrombolytic therapy for patients with less than 12 hours of history. The principle of thrombolytic therapy is that the patient receives an intravenous drug that dissolves blood clots in the coronary artery so that blood flow in the artery is restored. At the same time the patient is given additional treatment with drugs that act on platelets (Aspirin) and coagulation (Heparin) to prevent re-occlusion. In some pioneering communities in Norway, local doctors have for many years given thrombolytic treatment at the doctor's office.

Through a broad commitment to training of paramedics and local doctors, early pre-hospital thrombolytic therapy have been offered in all municipalities in Troms County since 2000. This is achieved through close cooperation with local doctors and skilled paramedics, who have previously been given delegated authority to the advanced cardiac resuscitation, use of semi-automatic defibrillator and appropriate medications. There is evidence that certified paramedics can safely give thrombolytic treatment in consultation with the doctor, based on telephonic ECG and thorough medical history. It is important that ambulances are adequately staffed and equipped to avoid potential complications of acute myocardial infarction. This particularly applies to life-threatening arrhythmias.
In Troms County, they have acquired relatively inexpensive, easy to use, mobile device for 12-lead ECG with the option of telephone transmission to the terminals in the AMK-centres, where the doctor on duty is helping with ECG interpretation and decision about the indication for thrombolytic treatment. Local doctors decide the intervention on their own or through discussion with colleagues at the hospital. The decision to treat will always be the doctor’s choice, whereas certified ambulance personnel on the orders of a doctor can provide thrombolytic therapy, even if they are alone with the patient.

Stroke is the commonest cause of death from neurological disease, the third most common cause of death overall and the disease often leads to permanent loss of function in adults. Each year, about 15,000 people in Norway are affected by stroke, i.e., about 40 people each day.

Figure 64 A standard procedure has been developed.

In Norway, in 2006 only approx. 2% of all stroke patients received advanced emergency care in the form of intravenous thrombolysis, while up to 20% of patients thought to have an indication for such treatment. Telemedicine solutions have been suggested to improve this situation, both for the interpretation of CT and MRI scans and consultation with neurologists. It is therefore planned that stroke patients admitted to local hospitals have immediate taken CT of their head. The images are transmitted over the network to the neuron-radiology specialist (Stroke Unit) for assessing whether there is an incipient cerebral infarction or a stroke or other neurological disease. On the basis of the information about the clinical condition and observation by means of video transmission (consciousness level, paralysis, language disorders) and duration of symptoms, it is decided whether the patient should receive thrombolytic therapy or not (Figure 64).
Patients are followed up the subsequent 12 hours in a partnership between local hospitals and the Stroke Unit. Those patients showing a worsening of the disease, with increasing paralysis and loss of consciousness, and which may have incipient cerebral oedema, are controlled with a new CT and transferred to the Stroke Unit. Patients with threatening oedema development are closely monitored in the Stroke Unit and transferred if necessary with respect to craniotomy.

**Lessons learned**

<table>
<thead>
<tr>
<th>Problem – Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem:</strong> To provide prehospital thrombolytic treatment of myocardial infarction in the Nordland, Troms and Finnmark Counties.</td>
</tr>
<tr>
<td><strong>Solution:</strong> Use of inexpensive, easy to use, mobile device for 12-lead ECG with the option of telephone transmission to the terminals in the AMK-centres, where the doctor on duty helping with ECG interpretation and decision about the indication for thrombolytic treatment.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> 12-lead ECG, mobile communication.</td>
</tr>
</tbody>
</table>

Lessons learned:

- Telemedicine can increase the availability of thrombolysis treatment through faster diagnosis. In addition, treatment can be given decentralized.
- For difficult cases, cardiac units at the large hospitals can be contacted for advice through videoconference.

Health North expert group:

- The group believes the project and that there are benefits associated with that heart attack patients receive an early thrombolytic treatment:

  “We look forward to the results so far in the project is made up and published in international medical journals. It will be of interest to reveal any differences related to the model at Nordland Hospital (primary care physician is responsible for thrombolytic to provide treatment) and the corresponding treatment used in Troms and Finnmark (ambulance personnel are trained to provide thrombolytic treatment). Cost-benefit considerations will also be interesting.”

Status:

- In routine use.
- Locations: Helse Nord
Virtual specialist supports local doctor; Medical assistance at a distance

By Marit Kvarum and Erik Øvernes (2010)

A patient enters the hospital in the North Cape (Nordkapp) with severe burn injuries. Municipality doctor Helge Bjørø connects using telemedicine equipment to the emergency ward at Hammerfest Hospital, and within seconds he receives virtual specialist support. The patient has suffered an explosion and received burns on his neck. There is no suspicion of other injuries, but the patient is unconscious. “We have started cooling the burned area with a damp towel. So far no response from the patient, but it has not gotten worse,” informs Bjørø.

“If the patient has burns he will be sent to UNN,” answers resident in anaesthesia, Kim Mikkelsen from Hammerfest hospital. “Should a doctor travel with the patient?,” he further asks.

“It will take time to find a doctor who can travel with him,” answers Bjørø. “He should be sent by air without a doctor.”

Mikkelsen gives praise to the staff at North Cape, who he believes has done a good job in this test. Helse Finnmark tests the use of video conferencing and image transfers in connection with emergency situations between municipal health service and emergency ward at the hospital in Hammerfest. The virtual anaesthesiologist then provides advice on further treatment. “Do you have people to intubate?,” he asks. “Uncertain,” answers Bjørø, “Then you wait for it,” encourages the anaesthesiologist.

Helse Finnmark has tested telemedicine equipment for emergency medical patients with success. For municipality doctor Helge Bjørø at North Cape (Nordkapp) a “virtual presence specialist” is a milestone in patient care. “For us this is a milestone,” he says. “In this way we get technical support by a specialist who is virtually present. In addition, we used to spend an awful lot of time to require the necessary transport and enrol patients. Now we will call only AMK (Emergency Unit), which will arrange this for us. We can instead concentrate on the patient and that is what we really should do,” he says happily.

The anaesthesiologist at Hammerfest Hospital, Kim Mikkelsen is satisfied with the test. “North Cape municipality has experienced professionals,” he says. “After all, they may not benefit from this as doctors with far less experience. The latter is the more important. It is not ‘only just’ for young newly qualified doctors to come to a municipality without any support from the faculty”, says Kim. “In addition,” he continues, “all in the studio were silent when they were supposed to be silent, which is good. If the equipment is used correctly, this is entirely positive. Now we know much more about the patient early on and can plan accordingly. Earlier we experienced that the patient came through the door without any notice beforehand. The only thing we have to look at is that we do not spend so much time that it slows the transport, but it should not be a big problem,” he notes.

The use of telemedicine equipment improves the interaction between municipalities and hospitals. The goal is more holistic patient treatment with better quality. Now it also includes equipment for emergency medicine.
4.1.4 Pictures from ambulances

The second initiative involves the use of still pictures in ambulances. Ambulance personnel have taken pictures that have been transferred to the emergency unit at the hospital. Emergency personnel at the hospital will interpret the pictures. (One ambulance at UNN was equipped.)

The pictures were part of the oral report from the emergency field, and they can be useful for several groups:

- The manager at the hospital for the emergency field can use the pictures to get an overview of the emergency field, and estimate the resources needed.
- Surgery and anaesthesia personnel can use the pictures of material damages to estimate the power that has been involved and the possible damages this may give.
- Pictures of damages can be used by the surgical team to prepare potential operations.

The pictures were sent via GSM from the ambulance.

Lessons learned:

<table>
<thead>
<tr>
<th>Problem – Solution</th>
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</thead>
<tbody>
<tr>
<td><strong>Problem</strong>: To provide access to visual information from the emergency field.</td>
</tr>
<tr>
<td><strong>Solution</strong>: Ambulance personnel take digital pictures that are transferred by GSM phone to the emergency unit at UNN for further examination.</td>
</tr>
<tr>
<td><strong>Equipment</strong>: Digital camera and mobile phone.</td>
</tr>
</tbody>
</table>

Lessons learned:

- The ambulance personnel do not take picture because they see the service as very disturbing and of relatively little value.

Status:

- The original project is not in use. However, the ambulances at UNN are in 2015 equipped with communication tools in order to transfer vital sign from the ambulance to the emergency unit at UNN. As shown in the news article on the next page, Nordlandssykehuset in Bodø are in the forefront in Norway within this area.

Ambulance service in Nordlandssykehuset first in the country 63
By Line Braseth (31 October, 2014)

Ambulance service at Nordlandssykehuset signed an agreement with the companies AMIS AS and SAAB on the use of electronic medical records (EMR) on tablets. The tablet is fully integrated with AMK (the emergency unit) and emergency rooms, and thus is the country's first of its kind.

“The need for an integrated electronic medical record is applicable throughout the country, and some services have been waiting for several years. The current solution with paper records gives us both challenges when it comes journal management, and to extract business data afterwards. We also believe that it provides increased safety for the patient and has an unbroken chain of digital information that follows the patient from home or the scene and in the hospital / emergency room,” says Loke Gulliksen, ambulance chief at Nordlandssykehuset.

Same solution in operation in Sweden
Patient records shall be fully integrated with AMK and emergency rooms, which have not previously been possible to achieve. Thus, the ambulance service is the first in the country to benefit from this type of solution.

The Swedish group SAAB already have this solution in operation in Swedish ambulances today, but this is the first time the system is adapted to Norwegian healthcare.

“We in the ambulance service at Nordlandssykehuset have set ourselves ambitious goals and want to be one of the leading services in Norway. This can be challenging when you are a small department, therefore it is particularly important that we are proactive when it comes to innovations that improve patient safety and quality,” says Gulliksen.

Robust, user-friendly and proven
“There are three things that have been important for us in this work,” says Gulliksen. “The solution must be robust. This means that it must withstand the stresses it would be subjected to in daily use. It must withstand rough use and to work even if it falls down or is out in heavy rain.”

“In addition, it is important that the interface is user friendly. It should be intuitive and easy to use even under stressful situations. And finally, the system must be sufficiently tested so we are confident that the solution will work as it should. We have had a long dialogue with the companies that supply the system and feel confident that SAAB and AMIS together deliver quality-assured solution.

Tablets will be operational in January of ambulances in Bodø and Ørnes. The project will last for half a year, then we will decide whether it will be used throughout the ambulance service,” says Gulliksen.

63 URL to the original article (Last accessed: 2.6.2015):
http://www.nordlandssykehuset.no/aktuelt/ambulansetjenesten-i-nordlandssykehuset-forst-i-landet-article124160-3018.html
4.2 Telemedicine in oncology (radiant interaction)

4.2.1 STRÅLT

Radiation therapy has traditionally been exclusively given at highly specialized hospitals. In order to investigate the possibility of decentralizing this service the Research Council of Norway granted the project Radiation therapy and telemedicine (STRÅLT) in 2002. The aim of the project was to find solutions for use of telemedicine to give patients safe access to radiation therapy at a distance (Figure 69).

The Høykom report (Høykom / Section Number: 1211 / 240) from the project states that:

“The project beamed radiation and telemedicine is a telemedicine broadband solution for radiation therapy tested between the Norwegian Radium Hospital (DNR) and the University Hospital of North Norway (UNN). The solution includes both dose planning and simulations. The service is going to be used between satellite and the parent institution and the goal is to provide an improved health care for cancer patients and better monitoring of both patients and staff at the satellites.”

Export and import of dose schedules are done via DICOM Export in Helax TMS. This enables dose plan manipulation at both sites. In addition, dose plans can be produced on request for a patient based on the received CT images. The minimum bandwidth for the service is 512 Kbps in each direction. Videoconferencing is recommended by the fixation of the patient, close-ups and the meeting between doctor and patient at the remote site. Still images require less bandwidth and may be a good complement to the video when the detail is important.
Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem:</strong> To provide guidance from the Norwegian Radium Hospital (NRH) in remote treatment planning, supervision, second opinion and educational support in radiotherapy.</td>
</tr>
<tr>
<td><strong>Solution:</strong> Established videoconferencing between UNN and the Norwegian Radium Hospital.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Videoconference equipment and secure network.</td>
</tr>
</tbody>
</table>

Lessons learned:

- Broadband telemedicine between Norwegian Radium hospital in Oslo and UNN:
  - Videoconference, exchange of diagnostic pictures, radiation dose plans, radiation area, field-control pictures.
  - Increased quality of treatment.

Status:

- Not in use.

Further reading: *(Burkow, Norum et al. 2003)*

### 4.2.2 Tromsø - Bodø

Encouraged by the results from the STRÂLT project (see above) the two oncological departments at the hospitals in Bodø (Nordlandssykehuset) (Figure 70) and UNN in Tromsø joined forces to give birth to new services within cancer radiation therapy in Northern Norway. Radiation therapy has normally two main goals. One is to cure the patients (curative treatment), the other is to give the patients who are too sick to be cured pain relieve for the remaining time of these patients live (palliative treatment). Traditionally, all form for radiation therapy has only been given at UNN. In the new system the two oncological departments are linked together in the Norwegian Health net, the two departments’ PACS system function as one, and the doctors at the two sites work together as one team. The result for the patients is that those living in the Bodø area now can be refereed there for their CT and MRI scan. The images are seen and discussed between the two teams, the treatment and the delicate possess of dose planning is done in cooperation, and the those who are in need for palliative treatment get that in Bodø, close to where they are living. Those who are in position for curative treatment are already prepared for this upon arrival at UNN.

Since spring 2007, the Radiation Department at the hospital in Bodø served as “satellite” at UNN. Every day the Bodø satellite treats between 10 and 15 patients. Updated information about dose plans for further treatment is recorded here with new X-ray and CT images. In practice the documentation follows the patient, and if the patient must return to UNN's medical personnel in Tromsø they quickly get access to information about what is done in Bodø.

Other spin-offs of these new way of thinking is that the Department of relieving medicine at the University hospital of Mid Norway (St Olavs Hospital) has been given videoconference-based lectures to the nurses specialized in treatment of cancer patients in Northern Norway.
Furthermore, UNN uses videoconference in the discharge and follow up process of their patients to the primary health sector. The Norwegian Cancer Association is planning to use videoconference and web-based concepts for their nationwide information activities.

Lessons learned

**Problem – Solution**

*Problem:* To establish close cooperation between the two oncological departments at Nordlandssykehuset in Bodø and UNN in Tromsø.

*Solution:* Established VC connection between UNN and Nordlandssykehuset. The two oncological departments are linked together in the Norwegian Healthnet, the two departments’ PACS system function as one, and the doctors at the two sites work together as one team.

*Equipment:* VC equipment in Bodø and Tromsø connected the Norwegian Healthnet. Distributed PACS and EHR.

Lessons learned:

- Advanced cancer treatment for patients in Bodø can be improved by planning the treatment in Bodø (through the use of the CT in Bodø) before hospitalization in Tromsø. This saves time and travel costs.
- Patients living in the area of Bodø can be referred to Bodø for their CT and MRI scan. The images are seen and discussed between the two teams, the treatment and the delicate possess of dose planning is done in cooperation, and those who are in need for palliative treatment get that in Bodø, close to where they are living.
- Palliative radiation treatment for patient in Bodø are performed in Bodø, dose planning is done in Tromsø.
- Planning in Bodø: PET CT in Tromsø (Positron Emission Tomography).
- Technical solution: Distributed PACS, distributed EHR (available both in Tromsø and Bodø).

**Status:**

- In routine use.
- Locations: Helse Nord (between Bodø and Tromsø)
Excellent interaction
By Jan Fredrik Frantzen (3 January, 2008)

The Radiation Therapy Department in Bodø has since the spring of 2007 served as a “satellite” at the University Hospital of North Norway (UNN) in Tromsø. They provide palliative care and the information Bodø and Tromsø now can share through the health network provides a better life for both patients and staff. All information on radiation therapy is now being placed on the server in Tromsø. When patients are transferred from UNN, the Radiation Therapy Department in Bodø can access the information that is added about the treatment these patients have received in Tromsø. It allows that physicians, physicists and radiation therapists in Bodø can catch up quickly on the situation and plan further treatment for the patient. The result is a more comprehensive course of treatment, providing both better treatment and greater safety for patients. “Now we log on the server in Tromsø and do a quick check on what kind of treatment the patient has received. This makes our job much easier, and we can avoid damage from too much radiation,” says Ari Rasmussen at the Radiation Therapy Department at Nordland Hospital. It is important to document how much radiation a patient has previously received in each area of the body. Too much radiation can cause damage of varying degrees of severity in different organs, and may for example result in renal failure.

Every day the Bodø satellite treats between 10 and 15 patients. New information about dose plans for further treatments are recorded here with the new X-ray and CT images. This way, the documentation follows the patient, and if the patient must return to Tromsø, UNN’s medical personnel get quick access to information about what has been done in Bodø. “Patients have anywhere from a few weeks to several years left to live, but common to most of them is that the final phase also can bring great pain. Radiation is very effective for relieving the pain. We try to give them a better quality of life the time they have left. When we enter new information into the system, we make it encrypted through the health network, and all activity in the system is logged. We also have limited access only, so no one gets out information about something other than the actual radiation treatment for the patient.”

It thus makes the work day to the staff at the Radiation Therapy Department in Bodø easier – but most importantly, patients can get the same treatment in Bodø which they would have received at UNN. For patients it means a lot that they can get treatment much closer to home the time they have left. This solution was originally developed and tested in 2002 and early 2003 between the University Hospital of North Norway (UNN) and the Norwegian Radium Hospital in Oslo. In this project, UNN served as a “satellite”. Nordland Hospital in Bodø has now taken over this role. The Norwegian Centre for Telemedicine was the project manager. The goal was to provide better services to cancer patients and better monitoring of patients and staff.

Figure 71  Electronic interaction provide better treatment and less pain for oncology patients. Here they are planning new radiation doses for patients. Are Rasmussen (right) at the Radiation Therapy Department at Nordland Hospital in Bodø. (Photo: Jan Fredrik Frantzen)

64 This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/straalende-samhandling.4446638-97537.html (Last accessed: 5.2.2013.)
4.2.3 Palliative care in the North

Since 2000, the Infirmary Project Finnmark (“Sykestueprosjekt Finnmark”) and the Oncology Department at UNN have been partners in the project “Palliative care in the North” (“Lindring i Nord”). The project goals have been:

- Competence building: Educate staff at smaller hospital and infirmaries in palliative care (e.g., as illustrated in Figure 73).
- Network: Establish a professional competence network for palliative care.
- Contribute in the creation of units / beds for palliative care / Palliative Care team.
- Professional development and research.

![Figure 72](image)

*Figure 72  Each week, the palliative team at the Oncology department at UNN meet with smaller hospitals and infirmaries through videoconference. (Photo: UNN)*

The palliative team at the oncology department at UNN meets with smaller hospitals and infirmaries in Finnmark through the use of videoconference (Figure 72). The team has regular meetings with Alta, Nordkapp and Vadsø, and more infrequent meetings with Lakselv and Karasjok.

![Figure 73](image)

*Figure 73  The project “Palliative care / demulcent in the North” has published its own handbook about palliative care (“Håndbok i lindrende behandling”).*
The use of videoconferences started in 2008. The use of VCs between the palliative teams have been very successful (Donnem, Ervik et al. 2011).

Status:

- In routine use (weekly).
- Locations: Helse Nord (From UNN to smaller hospitals and infirmaries in Finnmark).

### 4.3 Telemedicine for patients with kidney disease (dialysis)

The teledialysis project in Northern Norway started in September 2000 and continued until January 2002. Due to positive results from the project period it has continued as a routine service since then (Figure 74). The Research Council of Norway, the Høykom programme and the participating institutions funded the project.

![A patient receiving teledialysis. (Photo: NST)](image)

In 2002, eighteen of nineteen counties in Norway had a central renal unit and some had additional unit(s) (satellites) running in close contact with the central unit. There was only one transplant centre, the Rikshospitalet-Radiumhospitalet Trust in Oslo (Today: Oslo University Hospital). Pretransplant work-up, as well as post-transplant follow-up beyond 3 months, was handled by the county hospitals.

Dialysis in Norway is mainly provided as haemodialysis in hospitals (centre dialysis). This type of haemodialysis “binds” patients three times a week for 5 hours to the hospital in addition to the travel time needed. With the long distances in Norway, it is appropriate to decentralize dialysis treatment as much as possible. This can be achieved either as “satellite dialysis” pro-
provided by smaller hospitals or nursing homes or by home dialysis (either haemodialysis or peritoneal dialysis). In order to meet the increasing demands of treatment, UNN wanted to supply as much as possible of the dialysis treatment in a decentralised manner.

UNN has the medical and administrative responsibility for patients undergoing dialysis in the neighbouring county of Finnmark. Finnmark is the largest county in Norway and the one with the most scattered population (1.5 person / km²). UNN is responsible for three satellites in Finnmark where patients are undergoing haemodialysis. Dialysis patients at these satellites did not have the same follow-up as the patients at UNN. In addition, the nurses were more isolated in that no nephrologists worked at the satellites; the nephrologists were all located at UNN.
Based on this the teledialysis project was started, and included the main dialysis unit at UNN in Tromsø (Figure 75) and two satellite units, one in Hammerfest (Figure 78) (548 km by road from Tromsø) and the second in Alta (Figure 76, Figure 77) (408 km by road from Tromsø). The aim of the project was to improve the quality of patient care by providing patients and nurses at the satellite units with the same quality of follow-up care and support as that received by patients and health care staff at UNN. With the help of telemedicine, it was sought to create a common workplace by integrating staff at the satellite locations into UNN's everyday routines. To achieve this, the nurses at the satellite locations had to be integrated into the daily routines at the nephrology department at UNN. The project wanted to improve the quality of patient care by doing patient rounds in Alta and Hammerfest from UNN over a real time video link.

Until the project started, all communication between health staff at the satellites and UNN took place via telephone, paper documents were sent via traditional mail, and the nephrologists visited the satellite locations every fourth week. The patients from Alta and Hammerfest also had to travel to UNN every third or fourth month for follow-up.
The Norwegian Healthnet established a 2 Mbit/s ATM network between all three sites. For security reasons they used a Virtual Private Network (VPN) connection for all data transmission except videoconferencing (VC). Different VC solutions were evaluated. Equipment was chosen based on technical requirement specifications such as: knowledge and experience analysis, support for both Internet Protocol (IP) and Integrated Service Digital Network (ISDN), built-in Multisite Conference Unit (MCU) menu and operating manual in Norwegian and the possibility for connecting biomedical equipment and external camera to the VC equipment. In the system selected, also the expressed wish from the health care staff for a portable system, and a rack for this purpose (codec, camera and monitor) was met (Figure 79).

Figure 79  Mobile videoconference equipment. (Photo: NST)

Figure 80  Videoconference during a dialysis treatment. (Photo: NST)
The VC equipment used is not qualified as biomedical equipment. Traditional VC equipment together with / connected through Medical isolating transformers (in accordance to Medical Directory Device / EN 606011) allows the use of VC in patients’ room (Figure 80).

*Figure 81* Dialysis machine and ultrasound equipment. (Photo: NST)

*Figure 82* The specialist at UNN can follow the dialysis in Alta. (Photo: NST)
VC is, in the project period and today, used in the following areas:

- The nurses have day-to-day contact from Monday to Saturday. Here, current problems are discussed every day in a 15 minute session to each satellite.
- Doctor and nurse have rounds every 14 days, alternating between Alta and Hammerfest. The rounds include review of all the patients and patient rounds. Ultrasound apparatus is used if required (Figure 81, Figure 82).
- At UNN they have in-house training once every 14 days. The satellites participate in the in-house training through videoconferencing.

The system is also used for emergency problems if needed.

When the equipment is located in rooms in which treatment of patients takes place, not everything can be communicated during the transmissions. For discussions about patients in preparation for rounds, the equipment should preferably be placed in a separate room. The telephone can be used when one does not want others to hear the conversation, or cannot set up the VC link.

In addition to VC, transmission of heart auscultation as well as lung and fistula murmurs was part of the telemedicine system. An electronic stethoscope was connected to the VC system. But, due to technical problems, the quality of the transmitted heart or lung sound was not good enough for medical purposes. On the other hand, it is possible to connect the stethoscope to a PC and transmit the sound to the doctor using a secure email solution. The electronic stethoscope was used on only three occasions in the project period (Figure 83).
The ultrasound apparatus was used within five occasions. Four of these were for assisting nurses at the satellite units when they experienced difficulties in establishing venous access. Once a cardiovascular surgeon was consulted and a pseudo aneurysm in the graft was disclosed. If local use of an ultrasound apparatus is found necessary, the nurses need guiding from a specialist who explains how it is to be used and how the images are to be interpreted.

Ultrasound support was desired for providing guidance for inserting needles in deep blood vessels, and for training new nurses on how to insert needles. The equipment was also intended for diagnosis of pathological conditions in blood vessels. Another application outside the telemedical context is to display “difficult” blood vessels.

Dialysis machine software is an online therapy data management system. PCs with software were installed at all sites to monitor the haemodialysis machines and to achieve a common electronic patient record system. The software offered the following capabilities from a remote location:

- Direct downloading of dialysis parameters such as arterial,
- Venous and transmembrane pressure,
- Conductivity,
- Temperature,
- Ultrafiltration rate,
- Data on blood volume as well as storage of laboratory test results, nurses’ reports,
- Medication taken,
- Blood pressure and
- Weight.

Figure 84  The satellite stations are integrated into the daily routine at UNN.
Lessons learned from 25 years with telemedicine in Northern Norway

For data security reasons and to enable simultaneous access to other hospital electronic sources such as digital radiographs and the main patient record systems, the server with the dialysis software was installed within the UNN’s network with a VPN to the satellite units. This gave the nephrologists simultaneous access to other information sources provided by the hospital (digital X-rays, the patient’s main electronic record). In addition, all the necessities of data security could be achieved. For UNN, the technology has improved the reliability of the advice given by its staff. For the satellites, the faster response and higher information quality add to the reliability of the care they provide.

The technological solutions together with new service delivery routines have strengthened cooperation between UNN and the satellite units. Patients benefit from greater continuity in check-ups, follow up and treatment, as well as the opportunity to talk to UNN health professionals directly. The technology has improved the reliability of the advice given by its staff. In particular, the audio-visual contact both with the health staff before the rounds and with the patients during the rounds has contributed to this improvement. Both health staff and patients report this. A number of acute problems can be solved via telemedicine, and this could avoid the need for several emergency admissions. In addition, admissions for check-ups are no longer necessary. Follow-up now takes place in almost the same way as for patients at UNN.

For the satellite stations, it appears to be easier to fit VC into day-to-day routines. The software can also be used to allow nurses to do other things in the office while they monitor the machines via the PC screen. This means that they avoid having to do rounds of the machines for monitoring, which in turn means that they avoid waking patients (Figure 84).

Annual costs included investments in teledialysis, broadband and time costs for specialists and nurses participating in the service. Both doctors and nurses must set aside time for teledialysis. Time is needed for the transmissions themselves as well as to prepare and to follow up work. The office service also needs to spend extra time for updating the electronic patient record. Access to technical staff when needed is also important.

Costs are saved because patients no longer need to travel to UNN four times a year for regular check-ups. Now the necessary tests and procedures were performed at the satellite units. Travel costs and costs of overnight stays at the hospital are avoided. Costs are also saved for emergency admissions, five in the project period from May to December 2001. In addition, the specialist travels less frequently to Alta and Hammerfest, every six weeks instead of every four weeks.

The patients were positive to this service, and the staffs were satisfied with the experience of using teledialysis applications. They were most satisfied with the VC equipment and the electronic patient record. Some of the staff at UNN thought that the electronic record was as useful as the VC, because the record enabled computer mediated communication. Ultrasound apparatus and the stethoscope were barely used, due to sound problems and the lack of medical problems.

Organization of teledialysis at the responsible institution may be individual from hospital to hospital, depending on how many doctors and nurses are available, where the equipment is located, etc. Before start-up, it is recommended that plans and routines be drawn up for scheduling the connection and the content of the transmissions. For example, a weekly plan in which all activities and all responsible staff are plotted. The doctor and nurse responsible must be designated in the roster for the department.
VC demands fixed schedules, as all the parties involved need to be available at the same time: the patient, the nurses, and the specialist if applicable. There will be communication between the parties involved throughout the process. In teledialysis, it is also possible to use VC outside the scheduled timetable when this is needed.

At the hospital, a separate room should be set aside for the equipment, as it takes up a certain amount of space, and this also makes it available to more users. The setting should be “uncluttered”, that is, with walls and curtains in soft and solid colours. Strong patterns in the background or the participants’ clothing may be a distracting factor. It is wise to speak calmly and at an even rate. Sudden movement can create a disturbance and interference in the picture.

For patients, single rooms are desirable so that they can talk to the doctor alone, or together with local health care staff. The optimal frequency for VC should be assessed (may not be needed every day). To ensure continuity, the same doctor should be responsible for contact with the satellites over a continuous period (for example, one month).

The limitations of the system lie in the possibilities for diagnosing of complex clinical conditions, in which advanced diagnostic aids such as contrast X-rays are needed, or where the technical quality of the telemedicine equipment does not make it possible to differentiate between various potential diagnoses (for example, with auscultation of the lungs: pulmonary congestion or pneumonia). So far, we have no indications that patients avoid taking up sensitive details via telemedicine. All patients have the opportunity to discuss such issues after the ordinary dialysis period, but have not taken advantage of this opportunity.

When teledialysis is well established between sites it is very important that all health staff members involved know who has the responsibility for the equipment and the network. Even so, it is recommended to identify a “super user” at each site in addition to this. It is also important to ensure access to technical personnel such as biomedical, information technology and telecommunication staff.

Some basic recommendations:

- Before start-up it is recommended that plans and routines be drawn up for scheduling the connection and the content of the transmissions.
- Establish a service that is simple as possible, both technically and in relation to costs (depending on what you want to achieve).
- Ensure that the network is fast enough and as reliable in operation as possible
- Take security considerations into account.
- Provide access to a common electronic patient journal that is up to date (should include laboratory data, X-ray result and possibly images).
- Establish audio-visual communication such as videoconference.
- Ensure access to technical support personnel, such as biomedical, information technology and telecommunication staff (for service and support when the system does not work).

The following were identified as unnecessary:

- Online monitoring software of the haemodialysis machines.
- Electronic stethoscope (due to the quality of the transmitted audio).
- Ultrasound
Online monitoring software was not used much in the project. The main reasons were that nurses at the satellite centre were fully capable to perform dialysis treatment. Further monitoring seemed unnecessary. One has to keep in mind that online monitoring creates an enormous amount of data that has to be taken care of. Electronic stethoscope was barely used due to technical sound problems and the ultrasound apparatus was not used often due to lack of medical problems. The service is currently in operation several places in Norway (Table 4).

<table>
<thead>
<tr>
<th>Satellites</th>
<th>Start-up</th>
<th>Recipient</th>
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<tbody>
<tr>
<td>Alta Medical Centre</td>
<td>2001</td>
<td>University Hospital of North Norway, Tromsø</td>
</tr>
<tr>
<td>Hammerfest Hospital</td>
<td>2001</td>
<td>University Hospital of North Norway, Tromsø</td>
</tr>
<tr>
<td>Kirkenes Hospital</td>
<td>2007</td>
<td>University Hospital of North Norway, Tromsø</td>
</tr>
<tr>
<td>Østfold Hospital, Askim</td>
<td>2006</td>
<td>Østfold Hospital, Fredrikstad</td>
</tr>
<tr>
<td>DMS Valdres (regional medical centre)</td>
<td>2004</td>
<td>Innlandet Hospital Trust, Lillehammer</td>
</tr>
<tr>
<td>DMS Nord Gudbrandsdal (regional medical centre)</td>
<td>2002</td>
<td>Innlandet Hospital Trust, Lillehammer</td>
</tr>
<tr>
<td>Brønnøysund legesenter (GP practice)</td>
<td>2007</td>
<td>Nordland Hospital Trust, Bodø</td>
</tr>
</tbody>
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Benefits and disadvantages with haemodialysis at the hospital includes:

Benefits

- Done by health personnel
- Regular contact with the hospital
- Fixed schedule (at least 3 x 4 hours per week)
- No equipment at home

Disadvantages

- Travelling
- Faster loss of residual function
- Permanent blood access
- Fluid and food restrictions
- Tied to the hospital's opening hours

The Renal Department at UNN started in 2011 a test project with one peritoneal dialysis patient (Arild, Rygh et al. 2012):

“The patient was recruited at the hospital and had just started with peritoneal dialysis. The patient had previously received in-hospital haemodialysis at UNN. The patient lived in a private apartment in a residential care centre and was in care by the municipal nursing services. Collaboration with the nursing service was therefore initiated, and the project team gained useful experience in working with the municipal health- and care services.”
The installation of the video conferencing equipment in the patient’s home was a complicated process, and there were several delays before the installation was completed. As the training of the community nurses was about to start, the patient’s condition deteriorated and he died in hospital.

To succeed in implementing a new telemedicine service, there must be a strong focus on how the service should be organized. As the patient was receiving home care by the nursing service it is also important to establish procedures for communication and interaction between the patient and the home nursing service, as well as between the nursing service and the Dialysis Unit at the hospital.” (Page 4)

Figure 85 In recent years, several new dialysis satellites have been opened. The web pages above present the new dialysis satellite on Finnsnes in Lenvik municipality, approximately 160 kilometres from Tromsø.

In an article on Lenvik municipality’s web page65 (Figure 85), we can read how Olivia Olsen’s life (Figure 86) has changed when she got access to dialysis treatment in her neighbourhood:

“Oliva Olsen from Kårvikhamn has been dependent on dialysis during the last five years. It has been many hours by car or boat to Tromsø and back.

–For us dialysis patients, this is a miracle. Our daily life has change. Everything becomes much easier, and we can spend more time at home, she says while the dialysis machine is working in the back.

(...) 

Several of these patients have been driving more than 1200 km per week to get to the dialysis at UNN. This is now a thing of the past.” (Original in Norwegian)

Arild et al. (Arild, Johansen et al. 2014) argue that:

“In the first collaboration project ("Network of the North", 2000 to 2002) we found that the technical solutions together with new routines enhanced cooperation relations between UNN and satellite stations in Alta and Hammerfest. The result for the patients was more continuity around the control and treatment, as well as the opportunity to talk directly with health professionals at UNN.

Positive experiences after project completion made UNN wanted to pursue further development of the service.

Videoconferencing can be used to:

- Advice and guidance on issues such as dialysis access, weight, fluid moves or other medical issues.
- The business doctor and dialysis nurse for review of dialysis curve and blood tests.
- Acute problems such as cannulation of dialysis access.
- Joint in-service education for the set plan.”
For videoconferencing to dialysis satellite, Arild et al. (ibid.) state that this service:

- “Allows presence and gives confidence to the nurses who work alone on satellites.
- Helps to strengthen the provision of specialist expertise to patients and staff at each dialysis station.
- Strengthens the expertise of those working on dialysis satellites.
- Provides better basis for practical guidance than telephone calls.
- Helps Community on patients.
- Creating a common kidney medical network and closer contact with colleagues on satellites.
- Can be used outside of the scheduled timetable if necessary.”

In the project NyTTeHjem (New Home) (2011-2012) videoconference was tested by two dialysis patients. According to Arild et al. (ibid):

“The project was implemented in cooperation with Tromsø municipality where the patient lived in a assisted living home and had assisted peritoneal dialysis with night machine. Videoconferencing equipment and networks were installed and the health personnel were trained in the use of videoconferencing.

There was great enthusiasm among the patient and community health services under the project. We got a lot of valuable experience about the practical challenges of equipment, establishment of secure network access and cooperation between municipal and specialist health services. The service was unfortunately not adopted by medical reasons.”

Experiences from the use of videoconferencing supporting home patients were positive. Arild et al. report that:

“Elderly patients who live far away or isolated benefit of videoconferencing because they avoid a tiring journey to the hospital. This also applies to young patients who can avoid absence from teaching and work.

Videoconferencing equipment operated with a single remote control is easy to use even for elderly patients. Good image quality made, for example, assessing the catheter end possible.

Patients experienced that with videoconferencing it was easy to get contact with the specialist. Both patients and healthcare professionals in the municipality experienced it as safe to use. Videoconferencing is especially useful when starting treatment at home when the patient / staff are inexperienced and need support for handling the machine. Videoconferencing gave us good opportunity to supervision and control of machine setup. Troubleshooting and problem solving is easier to implement with videoconferencing than by phone when there is the potential to see the dialysis machine. We find that videoconferencing is a more suitable form of contact than the phone.

Establishment of service as obtaining network access and installation of videoconferencing equipment at home took a long time. This is a challenge for the service to be able to function smoothly in the future.
The drawback with traditional videoconferencing equipment is that it is huge and it must be in the same room as the dialysis machine. We want in the future to spend more practical solutions that take up less space in your home and are easy to take with you, such as tablets. Tablets are not tested earlier because they have very simple camera function. There is no possibility to zoom in on what you want to view and you have a steady hand for shooting. Tablet also has some security challenges that must be addressed. There are several who are now trying out the tablet home for the chronically ill. We will look at the lessons that they make themselves. Videoconferencing also has a positive impact on the system level of the hospital. Patient progress is easier and less costly when the patient does not meet physically in the hospital.”

According to Arild et al. (ibid.), benefits of videoconferencing to home dialysis patients include:

- “Can be used for outpatient control.
- Can be used for training health personnel in the municipalities.
- Provides more confidence for the patient.
- Good tool for troubleshooting and debugging night machine.
- Easy to use with remote control also for elderly patients.
- Strengthens dialysis expertise in municipalities.
- Make it possible to avoid admissions.
- Provides reduced costs.”

An important issue relate to dialysis at home is the legal issues of this service. Arild et al. (ibid) argue that:

“A prerequisite to establishing good and sustainable solutions in the long term is that legal and security implications are pointed out and discussed so that the safety issues surrounding service is safeguarded. That was the background for the project "Legal and safety issues" (Arild, Christiansen et al. 2013). Patients’ legal protection and rights under the health legislation must be safeguarded when using videoconferencing support.

The main conclusion was that videoconferencing support prudent could be offered to patients who take home dialysis. The risk assessment that was made has general validity for video communications where dedicated videoconferencing devices used at the patient. PC-based videoconferencing solutions may involve a slightly different risk profile.”
“How are you today, Stein Wiggo?” asks the doctor at the University Hospital of North Norway (UNN)\textsuperscript{66}

By Jan Fredrik Frantzen

Nephrology (kidney) specialist Dr. Markus Rumpsfeld in Tromsø is on his weekly doctor’s round to his patient Stein Wiggo Olsen in Hammerfest, almost 550 km north of Tromsø. The doctor’s round takes place through telemedicine and broadband.

The patient is connected to a dialysis machine at Hammerfest hospital. Broadband technology in a closed network (the Norwegian Healthnet) enables the kidney specialist to perform his doctor’s visit without having the patient in the same room. The doctor uses an ordinary TV with a big camera eye on top and has chosen “Satelittstasjon Hammerfest” with his remote control. Simultaneously, the team of nurses in Hammerfest, consisting of specially trained nurses, have connected their system. In this way, the doctor and patient can have a video and audio link and talk directly to each other.

Stein Wiggo Olsen is one of 14 patients in Finnmark who receive dialysis supported through telemedicine, also denoted as “satellite dialysis”. “Since we do not have a nephrology specialist at the hospital in Hammerfest, it feels safe that the nurses very quickly through satellite connection can contact a specialist in Tromsø if something should happen to me,” Olsen says. He has earlier travelled several times per week to Tromsø for consultations with a nephrology specialist and knows exactly what that implies.

“I become very tired and exhausted after a dialysis therapy. It is a great relief to avoid the air travel and all the waiting at the airport. Now I can go straight home to my sofa or bed after the therapy,” he explains. Each treatment of renal failure by dialysis takes 5 hours. In addition, it takes some time to connect and disconnect Stein Wiggo to the dialysis machine. Almost 100 litre of blood circulates through the machine during these five hours. The results of all tests and measurements are recorded in the patient’s EHR and are available to the specialists in Tromsø. In this way, the doctors are always a jour with the dialysis treatments and the patient’s condition.

Should complications occur in a patient at one of the satellite stations (local hospitals or medical centres), the specialists in Tromsø can connect to the system and get access to vital data like ultrasound and heart sound. Nephrology specialist Dr. Markus Rumpsfeld sees the value of letting the health care personnel in rural areas get a improved and closed follow-up through the use of telemedicine. He believes this is important in order to prevent professional isolation of highly specialized personnel outside the hospitals. Professionals in Norway believe dialysis based on telemedicine will be widely used in the years to come.

Improved therapy for cardiovascular diseases combined with increasing duration of life implies the more people became old enough to experience kidney failure that requires dialysis treatment. In addition, the need for dialysis treatment increases due to increased occurrence of obesity and diabetes. The big hospitals cannot treat everybody. The solution is teledialysis (telemedicine).

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\textsuperscript{66} This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/teledialyse.453205-81407.html (Last accessed: 5.2.2013.)
Lessons learned

Problem – Solution

Problem: To improve the quality of patient care in dialysis treatment by providing patients and nurses at the remote centers with the same quality of follow-up care and support as that received by patients and health staff at UNN.

Solution: With the help of telemedicine, a common workplace was created by integrating satellite staff into UNN’s everyday routines. Daily communication with the satellites is established using IP-based VC.

Equipment: VC equipment, ultrasound equipment, digital stethoscope, dialysis software consisting of: 1) A database archive which stores data from the dialysis as well as computer data, and 2) A program which keeps track of the current status of the dialysis machines and which patients are connected.

Lessons learned:

- UNN experienced improved reliability of advice given. The dialysis staff is integrated as a team through the telemedicine setting.
- Alta and Hammerfest experienced faster response, higher information quality, and improved safety.
- Patients experienced improved continuity in check-ups and treatment. They get direct contact with UNN staff (instead of through the nurse).
- Costs are saved because patients no longer need to travel to UNN for regular check-ups. Specialist travels less frequently to Alta and Hammerfest.
- Average travel distance for a rural patient to UNN is 132 km
- In average, a “distriktsdialysepasient” “costs” > NOK 600 000 year in travel costs.

Figure 88 NST has made a simple fact sheet on how to get started with teledialysis.
The Helse Nord Expert Group:

- Helse Nord expert group argues that teledialysis is well established in Troms and Finnmark County, but not developed in Nordland County.
- The group concluded that teledialysis should be established as a large-scale service even though the volume is low.
- The first satellites were established in Hammerfest and Alta. Later a satellite was established in Kirkenes. The latter at a significantly reduced cost compared to the two first satellites.
- The project has been very well received among the patients who to a larger extent are able to receive treatment and follow-up close to their homes.
- The cost of establishing telemedicine for satellite dialysis units is ca. NOK 120,000. This is considered to be a small cost compared to the benefit, given the high reimbursement fees per dialysis treatment.

Status:

- In routine use.
- Moderate, but increasing, number of patients.
- Locations: Helse Nord, Helse Sør-Øst, Helse Midt
- Used at 24 hospitals and 34 satellites.

NST has published a simple fact sheet for those who want to do teledialysis (Figure 88).


4.4 Telemedicine in dermatological diseases

Teleconsultation within the field of dermatology was one of the very first activities started in Tromsø. Together with the Norwegian Telecom Research Group, enthusiasts at the Dermatological Department at RiTø, among them dr. Edvard Falk, dr. Dagfinn Moseng and dr. Svein Erik Stenvold started videoconference (VC) transmissions between UNN and Kirkenes hospital. This was in 1989. Later, in 1996, Hammerfest Hospital also became part of this activity (Figure 89, Figure 90).

The motivation in the beginning was research activity, to see “if it was possible”. Encouraged by the preliminary results, the researchers started to think in the direction of using this way of communication between the health care provider and the patients to provide dermatological services to underserved areas in Northern Norway.
Lessons learned from 25 years with telemedicine in Northern Norway

Prior to this service, the Dermatological Department had put into action a very good program of ambulatory service where the doctors and nurses travelled to the remote locations six times a year to see the patients from other parts of Northern Norway. Waiting lists were long and patients needing immediate consultations had to travel all the way to Tromsø. This was, and still is, a service that functions very well. The introduction of teledermatology led to that both patients, and health care personnel were saved for travelling time. Since the introduction of weekly teleconsultations between the outpatient dermatology unit at Kirkenes Hospital and the Dermatology Department at UNN, there have been no waiting lists in Eastern Finnmark and the need for emergency journeys to Tromsø has been reduced significantly.
At the remote site, the different GPs use the VC equipment situated in the hospital. The GP brings with her/him 10-12 patients. These are examined over the 3 hours to follow once to twice a week. At the UNN site the dermatologist is sitting in the VC studio at the Dermatological Department (Figure 93). In this way the participants can see and hear each other simultaneously. The GP uses a close-up camera and records the affected areas on the specialist’s request. The anamnesis is reviewed and diagnosis and treatment are discussed and determined where possible. The consultation can sometimes cause that the patient must travel to the Department of Dermatology at the hospital.

Figure 91 Today’s teledermatological equipment. (Photo: NST)

Figure 92 Teledermatology. Advice on diagnosis of moles, follow-up of light treatment, etc. The figure shows Doris, a system for secure transference of images. This solution represents the second-generation teledermatology. The first one was based on videoconference. (Photo: NST)
In addition, a phototherapy unit operated by a nurse has been established at the hospitals in Kirkenes and Hammerfest. This enables the hospital to treat the patients locally with support from UNN via videoconference. Before a phototherapy unit was installed locally these patients had to travel to Tromsø, stay in a hotel for 14 days, meet for their 15 minutes of a phototherapy at the UNN and then go back to the hotel again. Now when these patients are taken care of locally, they only have an absent from their work of 20 minutes a day. The patients follow up are examined with the aid of videoconferences.

738 patients were diagnosed in 1997. In 1999, nearly 800 patients were examined via videoconferencing between UNN and Kirkenes and Hammerfest.

Teledermatology 1988-2002:

  - Teleconsultation once a week with 10-12 patients.
- 1996: Regular service between UNN in Tromsø and Hammerfest hospital.
- 1999: 381 patients examined via videoconference between Kirkenes and UNN. The number for Hammerfest was ca. 400 patients.
- 2002: “Telemedisinske takster” (reimbursement) for videoconference-consultations introduced for dermatology.
4.4.1 Opportunities and constraints

Many studies show that there is a high diagnostic agreement when comparing results from conventional dermatology and telemedicine dermatology (Moseng 2000). In one study, 59 patients were examined using still images and video of two different dermatologists. There was full or partial agreement on the diagnosis, including differential diagnosis in 93% of patients. Of the four patients where there was disagreement, had two non-objective changes and had no diagnosis in one of the skin doctors. Full or partial agreement on the main diagnosis between the specialist and the doctor in the studio was available in 74% of patients.

Suitable problems are the common skin diseases that can be safely diagnosed via telemedicine. Here, treatment is implemented and more specialized treatment offered. Monitoring of implemented treatment is suitable for most eczematous disorders. The same applies for regular monitoring due to the use of specific medications as methotrexate, cyclosporine and retinoid. After control of patients operated for squamous cell carcinomas or basocellular, and at follow-up of the bullous disorders, erythroderma, etc. are also suitable.

For the less appropriate problems must be considered suspect cancer disorders and skin lesions, diseases of the scalp as it may be difficult to make good pictures because of the hair prevents access to the skin. Disorders in / around the genitals can be difficult because of lighting conditions and embarrassment. And for the elderly and hearing impaired, videoconferencing can be difficult.

The service must be organized with regard to record keeping, documentation and post. The primary doctor refers the patient to a specialist consultation in the usual way. Before, this was done by letter, now electronic notes are more and more used. The specialist considers who should be consulted via videoconference and who must travel to the hospital. Dermatologists have a responsibility to document their findings in the patient record in the same way as a traditional specialist consultation. After the videoconference consultation, discharge summary sent to the referring physician after normal routine. Follow-up and monitoring of the patient agreed at the conclusion of each video consultation.

Figure 94 Low-end teledermatology includes the use of standard digital cameras.
(Photo: NST)
Lessons learned from 25 years with telemedicine in Northern Norway

For video conferencing in dermatology, ordinary of the shelf equipment and an access to minimum 384 Kbit/s bandwidth can be used. The codec must be based on H320 standard. Alternatively, the broadband technology with the VPN service (IP-based videoconferencing) is used. And as bandwidth increases as the demand and falling prices of equipment becomes more and more common to HD monitors and cameras with ever-higher resolution. This provides increasingly better quality pictures and sound for this type of service.

Necessary equipment for close-ups of the skin include:

- Pan / Tilt / Zoom with autofocus and the ability for remote control.
- Mounting the camera on a mechanical arm for this kind of broadcasting appropriate.
- Dermatoscope and PC.

![Figure 95 It is 20 years difference between these two cameras used in dermatology. It is indicated both in size, weight and image quality. (Photo: Jan Fredrik Frantzen) 67](image)

In 1989 in Finnmark County started a four-year project, whose goal was to find out how new technology could be used to improve health services for those living in our largest and most impassable county. Could VC reduce the need to travel? Is it possible in practice to provide specialist help from a distance? The questions were in line.

Meetings, training from Tromsø and even interviews for vacant positions now run regularly by videoconference. In 2008, about 600 VC sessions were performed. Doctors and nurses from Kirkenes are still contacting specialists at the University Hospital of Tromsø through video conference, and once a week meet dermatologist and GP with the patient on the video lines of the health network to diagnose skin disorders and initiate treatment.

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67 http://www.telemed.no/kirkenes-telemedisinens-morgenfugler.4621093.html (Last accessed: 5.2.2013.)
Long distance dermatologists

By Stine Skorpen (22 June, 2005)

With modern telemedicine, dermatologists Gro Mørk and Per Helsing sit at the hospital and assess patients with psoriasis at Hallingdal sjukestugu. The pilot project shows how specialists using telemedicine may help in treatment in rural Norway. It was Dr. Geir Strømmen at Hallingdal sjukestugu who came to the Department of Dermatology at Rikshospitalet with a proposal the dermatologists could not say no to. Telemedicine could help people from Hallingdal out of a sad predicament.

Hallingdal sjukestugu received last fall light treatment equipment as a gift from the Psoriasis Association of Buskerud. Treatment with light (UVB) is one of the measures used to keep the skin disease psoriasis in control, and this would be a welcome offering to the many people with psoriasis in Hallingdal. The only problem was that patients could not begin treatment without a preliminary examination by a dermatologist. Patients must also be checked by a dermatologist during the course of the eight-week treatment program.

Hallingdal sjukestugu failed to obtain a dermatologist, and the treatment was in danger until Strømmen contacted Rikshospitalet. The solution was to introduce telemedicine collaboration with Rikshospitalet. “The pilot project should first and foremost determine whether telemedicine, i.e., examination through the TV screen, can really replace parts of the personal survey a specialist has to do,” explain senior doctors Gro Mørk and Per Helsing at the National Hospital’s Department of Dermatology. Around 20 patients have participated in the pilot project. Doctors at Rikshospitalet have first assessed the patients’ psoriasis via the TV screen. Subsequently, the patients travelled to Rikshospitalet for regular examination, so that doctors could control the impression they got over the screen to reality.

So far, the project shows that the telemedicine survey gives good and accurate results. “It implies that patients in the future will not need to travel to a specialist for follow-up and control. Only the initial investigation should be done in the usual manner. The follow-up during the course of the treatment period can be done by telemedicine,” says Mørk and Helsingborg.

After several months of testing, Dr. Geir Strømmen is confident that this works. He believes many other district hospitals can imagine a similar offer. The results of the pilot project means that Hallingdal sjukestugu with help from the hospital can finally open for regular light treatment of psoriasis patients.

Mørk and Helsingborg also attended on screen when the Psoriasis Association of Buskerud recently invited to a briefing meeting on light treatment. Physician Gro Mørk believes the experience of the project may be important for health services in Norway. “With the help of modern telemedicine one can much easier than before include specialists in patient treatment in rural Norway,” she says.

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68 This article was originally written by Stine Skorpen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/hudleger-paa-langt-hold.254393-80449.html (Last accessed: 5.2.2013.)
Sissel Richardsen has atopic eczema. And she certainly seems it is easier to drive for ten minutes to Sonjatun for treatment, rather than to use a half-day to travel between Nordreisa and Tromsø. Between October 2007 and March 2008 she received treatment at Sonjatun for her eczema outbreak, which came with full force last summer. Then she began to respond to both paper and nickel, and she developed large rash on both hands and feet. “It is terrible to struggle with things like that at my age. It was certainly difficult to do the job as store manager at Coop Market. There I have to encounter both money and paper,” she explains.

After several rounds at the University Hospital of North Norway (UNN) in the summer of 2007, she was offered to continue the treatment at Sonjatun, just ten minutes’ drive from her home in Sørkjosen. “If I take the bus to Tromsø, I have to set off at seven in the morning. I will not be home again before half past seven in the evening. Then the whole day is gone,” she says.

The light treatment she received for the hands and feet in Nordreisa made her much better, although she still has not completely got rid of the outbreak. It is so aggressive that she still needs to go to Tromsø for a different and more advanced treatment. But Richardsen is pleased to have received light treatment near her home. It is not fun to spend the whole day to receive a treatment that takes a maximum of five minutes. “I think it is absolutely fabulous here. We are so well treated by the nurses. And it’s only 10 minutes from home. It is certainly much better than to sit half the day on the bus, and we met the dermatologists both through videoconference and when they visit us from Tromsø,” she concludes.

Figure 97 Together with Torunn Hansen, nurse Solveig Tonder (right) offer dermatology patients in North Troms light treatment for hands, feet or entire body. Sissel Richardsen from Sørkjosen appreciates it, and she does not think it is such a bad idea to get some extra colour in the dark period. (Photo: Jan Fredrik Frantzen)

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This article was originally written by Jan Fredik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/sparer-et-halvt-doegn.4497221-4259.html (Last accessed: 5.2.2013.)
Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
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</thead>
<tbody>
<tr>
<td><strong>Problem:</strong> To provide dermatology services in Troms and Finnmark Counties.</td>
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<tr>
<td><strong>Solution:</strong> Videoconference equipment at both places.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> A video camera is attached to a codec and the signals are transmitted via ISDN. The codecs are H320 standard and the service uses 384 Kbit/s.</td>
</tr>
</tbody>
</table>

Lessons learned:

- Initial skepticism (palpation and smell mandatory) made recruitment of specialists difficult. However, simple pilots proved that the services were both possible and beneficial (in the framework of the limited technology).
- General practitioners who are using this service are in general satisfied with the service, and they have gained new knowledge in the field. This new knowledge have enabled them to do a better screening of patients that need to be referred to the hospital. In this way, both patients and accompanying persons need to travel less frequently.
- Equipment can be used in other settings, e.g., wound treatment (homecare), psoriasis and other chronic diseases.
- Another lesson, which goes for most of the telemedicine services that have been established, is that cost saving depends on volume. The cost-effectiveness of telemedicine services and electronic message 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 traveling to a specialist hospital (Johnsen, Breivik et al. 2006).
- The use of this service is decreasing. Possible explanations are increased level of competence in primary care and decreased enthusiasm. In addition, a dermatologist has been employed in Karasjok. He is also ambulating to Vadsø. HN expert group recommend VC-based teledermatology for large-scale operations.
- Another lesson, which goes for most of the telemedicine services that have been established, is that cost saving depends on volume (Figure 98). The cost-effectiveness of telemedicine services and electronic message 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 traveling to a specialist hospital (Johnsen, Breivik et al. 2006).

The Helse Nord Expert Group:

- The VC-based teledermatology solution has given considerably improved dermatology competence in primary care. However, the solution is resource demanding and the GP becomes often a “secretary” to the specialist. Thus, the use of other groups of supporting personnel should be considered.
- The use of this service is decreasing. Possible explanations are increased level of competence in primary care and decreased enthusiasm. In addition, a dermatologist has been employed in Karasjok. He is also ambulating to Vadsø.
- HN expert group recommend VC-based teledermatology for large-scale operations.
Lessons learned from 25 years with telemedicine in Northern Norway

- An evaluation of this service in 2005 concluded that the service was cumbersome and not very useful as long as the service was not implemented in the EPR.
- The service may also potentially “bypass” the primary care level since the patient/relative submits the pictures directly to the specialists.
- The recommended, though, the service as a large-scale service. But they recommend that the images are included in the EPR in order to become systematically available.

![Break-even point for determining the cost-effectiveness of telemedicine](image)

**Figure 98 Cost saving in telemedicine projects depends on volume (Johnsen, Breivik et al. 2006).**

Status:
- In routine use.
- Moderate number of patients.
- Locations: Helse Nord, Helse Sør-Øst, Helse Midt (Valdres, Otta, Setesdal, Kristiansand)

### 4.4.2 Still images in dermatology

As a result of work done by developing a remote dermatological service by videoconference, the researchers developed a prototype for still images for dermatological cases where the skin diseases are photographed and sent as an attachment to an email from the GP to the specialist in dermatological diseases, i.e., teledermatology offered by means of still image referral.

The prototype system, first developed by Telenor researchers, was called VIDA. This was later improved by NST researchers, called DORIS, and became ultimately the basis of a Spinoff company. This viable company was called Well Diagnostics and developed several telemedicine off-line SW solutions to be used in competition with a rising global growth in this kind of SW producers.

From the very first trials it is recalled that technical problems between the SW and the net let to the situation that every time images from one consultation should be transferred between the GP situated in Alta, some 400 km north of Tromsø, a researcher from Tromsø had to take

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70 Well Diagnostics was later acquired by DIPS ASA.
the plane to Alta and then bring the harddisk in his travelling bag back to the hospital. But soon this kind of technical trouble was solved and still images started to flow from the GPs to the dermatologists in Tromsø.

Figure 99 Skin diseases are photographed and send as an attachment to an email from the GP to the specialist in dermatological diseases.

For still image referral the pictures followed by a written referral from the general practitioner to the specialist. Pictures can be taken, submitted, and evaluated at different times. This asynchrony is a big advantages compared to videoconferencing because it is much easier to adapt to the busy days of the clinicians. However the patient has to wait for the response from the specialists. Evaluation studies have shown that less clinical information is available than with videoconference. Thus, more patients are referred to special clinics and the cost of investment is significantly lower.

Today, a commercial product called Well Communicator is used (Figure 99). This is a message-based communication program specifically designed to carry health-related EDI messages securely between different units in the health sector. You can also attach digital photos to your messages. The messages sent are based on the ebXML standard. For the user the program worked as a mail client with inbox, outbox and archive and are used for communication from hospital to home care and institutions for receiving “labsvar” (i.e., answer from the laboratory), discharge summaries, outpatient notes and discharge notes from the nurses. In addition, users can send ulcer referrals and receive guidance for the treatment of ulcers.

The system maintains the security required by only making it possible to send messages to pre-approved recipients, and all recipients had to be explicit registrated in the program, with his/her encryption key. All messages are encrypted before being sent, to prevent that unauthorized persons could read the messages that are transmitted.

In 2003, 84 of ca. 200 GP offices in Northern Norway had the necessary equipment to send such messages. In the 10 first months of 2003, only approximately 290 such referrals were submitted to UNN or Nordlandssykehuset, which was a disappointing low usage of the sys-

71 2015: DIPS Communicator.
Lessons learned from 25 years with telemedicine in Northern Norway

tem. The most important reason for this is that the services are not reimbursed. In spite of several economical analyses have shown that the profitability to telemedicine services by off line services (NORUT) the Norwegian authorities have be reluctant to this kind of economical incentives. The second most important reason for not being much used is, according to the GPs, that the SW for referrals is not integrated into the EPR. This will hopefully be dealt with in the EPR version to come.

Internationally, the most successful implementation of this off line dermatological services is, the ANTH program in Alaska\textsuperscript{72}. And it is not surprising that the services there (and in Hawaii) are reimbursed by the government.\textsuperscript{73}

\textit{Lessons learned}

\begin{tabular}{|l|l|}
\hline
\textbf{Problem – Solution} &  \\
\textbf{Problem:} To provide store-and-forward dermatology services in Troms and Finnmark County. &  \\
\textbf{Solution:} To develop a prototype for still images for dermatological cases where the skin diseases are photographed and send as an attachment to an email from the GP to the specialist in dermatological diseases. &  \\
\textbf{Equipment:} Digital camera, Well Communicator (software for sending images). &  \\
\hline
\end{tabular}

Lessons learned:

\begin{itemize}
  \item Similar experiences as for VC-based teledermatology, except for more frequent referrals to UNN with the store-and-forward systems compared to the VC-based solution.
\end{itemize}

Status:

\begin{itemize}
  \item In routine use.
  \item Moderate number of patients.
  \item Locations: Helse Nord (a few GPs’ offices)
\end{itemize}

\textbf{4.4.3 Internet-based eczema guidance}

In connection with still images in dermatology another direction of telemedicine was suggested. For teledermatology, the hospitals and the GPs have not been successful in getting high volume on this service. However, the situation is much better when it come to the use in dermatological services directly between patients at home and nurses at the hospital, not to talk about direct contact in this field between nursing homes and the hospital and home visiting nurses for the elderly and nurses at the hospital. The solutions described in the following part are both to be understood as guidance activities more than an electronic visit.

\textsuperscript{72} http://www.anhtctoday.org/ (Last accessed: 5.2.2013.)

\textsuperscript{73} For a complete description of requirements for teledermatology please visit the American Telemedicine Association’s website: http://www.atmeda.org/files/public/Standards/QuickGuide_Teledermatology_SF%2BLive.pdf (Last accessed: 5.2.2013.)
In 2002, NST and the paediatric ward at UNN conducted a pre-project with counselling service via e-mail to children with atopic eczema and their families. By using hand-held cameras, parents to kids with eczema submitted pictures of their kids’ eczema in order to receive guidance from specially trained nurses at UNN (Figure 100, Figure 101). The pre-project showed that such an offer is technically possible and the parents were satisfied with advice concerning treatment adapted to each individual child and thought the children's health improved. There were no limitations in how often or how many messages the families could send. The technical solution met the demands of computer safety in the protection of privacy legislation.

The Eczema school shall be a supplement to consultation and traditional counselling. Studies have shown that teaching and supervising parents have a positive therapeutic effect.

The parents have to answer 4 open-ended questions (Figure 102):

1. In case the eczema has changed after last guidance, do you know why?
2. Have you received new experience with eczema treatment that you wish to share with the guide?
3. How do you think further treatment should be performed?
4. In what fields do you want further guiding?

The supervisor evaluates and compares the information with the pictures. On this basis, the supervisor gives further guiding and treatment. In difficult cases, the supervisor asks for second opinion from the experts at the hospital.

Based on these encouraging results the “Eczema school on net”\(^\text{74}\) was founded (Figure 103). It is cooperation between Department of dermatology, Centre for learning and mastering, the Paediatric clinic and NST. The purpose of eczema school online is to meet the need for advice and guidance on eczema treatment without specialist health services directly engaged. The goal is among others to establish a picture archive with pictures from different phases of eczema companioned by written information and video clips of procedures and practical treatment. The Eczema school shall be a supplement to consultation and traditional counselling. Studies have shown that teaching and supervising parents have a positive therapeutic effect.

\(^{74}\) http://www.eksemkolen.no/ (Last accessed: 5.2.2013.)
Control with a click
By Jan Fredik Frantzen (February 2007)

By sending questions and digital pictures to dermatologist Thomas Schopf at the University Hospital of North Norway (UNN), Bodil Stormo in Gratangen can get advice when her son Vebjørn (8) is afflicted with troublesome eczema outbreaks.

About one in four Norwegian children suffer from atopic eczema. The Stormo family in Gratangen has been especially hard hit. All of the six children have had eczema of varying severity.

The two youngest children have been the worst affected. Atopic eczema can be a great burden for both children and adults. The treatment is complicated, and the distance to the nearest dermatologist is often great.

“We live in a small place, with a high turnover of doctors. As a rule, GPs have little experience in this type of eczema, and it is often necessary to visit a specialist.”

“Our nearest dermatologist is in Tromsø, a return trip of about 600 km. Over the years we have done that trip many times, and it is tiring for a small child – tiring for the whole family,” says Bodil Stormo.

But life became much easier for the Gratangen family five years ago, when they were included in a project run by the Norwegian Centre for Telemedicine in Tromsø together with the Department of Dermatology and the Department of Paediatrics at UNN.

The parents, Bodil and Fred-Arne, were equipped with a digital camera and were given access to a secure Web site where they could upload pictures of the children's eczema outbreaks along with questions about treatment. At the other end, a specialist at UNN replied to the enquiries.

“When the eczema flares up, as parents we have many questions. Often, you feel at a loss, and often you have to wait a long time for treatment. With this system, we could quickly get a reply about what we should do, which cream we should use, etc. For us, this project was incredibly good,” says Bodil Stormo. To illustrate the complexity: parents of children with atopic eczema often alternate between 10-12 different creams, ointments, and oils, which must be applied during the different phases of the eczema outbreaks.

75 http://test.telemed.custompublish.com/kontroll-med-et-klikk.447515-48994.html (Last accessed: 5.2.2013.) (Excerpt from the article “Control with a click” published in Norwegian in the daily newspaper Nordlys on Monday 19 February 2007. Reproduced with the permission of journalist Thor Harald Henriksen. The photograph has been used with the permission of the Stormo family.) The original article from the newspaper Nordlys was edited by Jan Fredrik Frantzen, NST, and later translated into English by the authors.
Anki Gerhardsen is the mother of a girl with a severe eczema. As a resident in Lofoten, and with long distances to hospitals and dermatologists, life without telemedicine would be demanding.

Gerhardsen had once to travel in a storm to Bodø with her then three-year-old daughter – a journey that altogether took 15 hours, thanks to the Norwegian Labour and Welfare Service’s (NAV) creative travel system (where you can fly to the consultation, but must take a boat back home, even if the wind blows up to the storm, and even if the patient is three years old).

The two got 15 minutes and some prescriptions of the doctor. “And I had so much I wanted to tell and ask. I had so many reflections on the disease and our situation I would like to share with someone,” she says.

By chance she was eventually invited to participate in a project where the eczema patients and their families received counselling on the Internet and communicate electronically with specialists. In addition, they met the dermatologist face to face. Thus, Gerhardsen got the opportunity she wanted to share ideas and issues around the existence of an eczema-family.

“I can write as much and as long as I want and I can send pictures of eczema and get a quick assessment. And the answer I get is written, so I can read it several times, and take the time needed to digest the answer. Also, I can send follow-up questions. It’s like having your very own house doctor. And not only that – wherever we go in the world, we always have the doctor with us!” she concludes.

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76 This article was originally written by Jan Fredik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/-som-aa-ha-en-egen-huslege.4608508.html (Web page not available.)
A new study shows that web consultations with eczema patients take less time for dermatologists than patients’ visits to the doctor’s office.

Itching, stinging pain, and sleepless nights. For many families with small children who develop atopic eczema, this is an everyday situation. On top of that, waiting times may be long and they may be far away from the dermatologist when they need help.

“For these families, there is no question that it is easier to fill in a web form, send a message to the dermatologist – and receive a reply the same day about how they should treat the eczema outbreak. But up to now, few studies have been conducted on how web consultations affect the dermatologist’s working day,” says dermatologist Thomas Roger Schopf. Together with paediatrician Roald Bolle at the University Hospital of North Norway, he has explored this issue with good results. It turns out that it takes less time for doctors to respond to enquiries in this way than for an ordinary examination.

Analysis of the material from the study showed that in 60% of the cases it took less than five minutes to answer the parents’ question, while 32% of the enquiries took between five and ten minutes of the workday. Only 8% of the enquiries took more than ten minutes to answer. In comparison, an ordinary consultation takes about 20 minutes. “Previous studies have shown that patients are satisfied with this type of consultation, and that the treatment they get is just as good. Our study now shows that doctors also save time with a web solution like this,” says Schopf. The study also shows that he needed more time to answer messages where the parents had included photographs of the eczema outbreak as well as describing it on a web form and in free text. But he and the co-authors of the article have not conducted a systematic analysis of exactly how much longer it took. “On the other hand, a photo gives the dermatologist much more and better information than he or she would get from text alone. The prerequisite is that the picture is sharp enough to use, that it is taken under good lighting conditions, and that the colours in the picture are correct,” adds Schopf. The seasons also have a considerable impact on the amount of time taken. In the winter months, which in the project are defined as October to March, the incidence of eczema is higher and the outbreaks are more severe. This in turn leads to more complicated guidance and takes more time.

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This article was originally written by Jan Fredik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/web-consultation-saves-time-for-doctors.4774509.html (Last accessed: 5.2.2013.)
Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
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<tr>
<td><strong>Problem:</strong> To provide examination of eczema without moving the patient to UNN.</td>
</tr>
<tr>
<td><strong>Solution:</strong> The parents use standard digital camera to take pictures of their child’s eczema. With specialized software, the pictures and comments from the parents are sent to the specialists at UNN.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Digital camera, Well Communicator (software for sending images).</td>
</tr>
</tbody>
</table>

Lessons learned:

- Eczema counselling can successfully be done with simple equipment.
- The kids and their parents do not need to travel to UNN (Tromsø).
- Parents are taught how to evaluate and treat the eczema, which gradually reduces the need to consult a specialist.

The Helse Nord Expert Group:

- An evaluation of this service in 2005 concluded that the service “bypass” the primary care level since the parents submit the pictures and questions directly to the specialists at UNN.
- They recommended, though, that the service should continue as a small-scale service for those children/parents that already had been in contact with the paediatric clinic, and where such electronic communication can prevent resource-demanding travels to polyclinic check-ups or re-hospitalizations.

Status:

- Not in routine use.
- Small number of patients involved in the study.
- Locations: Helse Nord

4.4.4 The Polyclinic for ulcers

As many as 3-5% of the population above 65 years old have problems with wounds that do not heal (ulcers). Sometimes, the wounds return several times, and the home care service neither has the capacity nor the knowledge to treat the ulcers in an adequate way.

“Many people get wounds that can take a long time to heal. The wounds reduce their quality of life because they smell and are painful,” says assistant doctor Nathalie Dufour at hudavdelinga (Dermatology department) at Universitetssykehuset Nord-Norge (UNN).78

Ulcers are a huge cost for the society. Dufour and the specialist nurse Ada Steen tell (in an interview published on telemed.no) that ulcer patients are one of the forgotten patient groups. The situation was the same in Sweden and Denmark until they studied the costs of this patient group. “In Sweden, they estimated that the (yearly) cost of bandages alone represented one

78 http://www.telemed.no/gir-bedre-livskvalitet.434505-80451.html (Last accessed: 5.2.2013.)
billion Swedish kroner (SEK). In addition comes salary and travel expenses for the health care personnel,” says Dufour. Even though we have not performed a similar study in Norway, calculation has indicated a cost of nearly half a billion NOK for bandages to ulcers.79

Improved treatment through Internet-based guidance (telemedicine) can reduce these costs through faster healing and less need for treatment. Most important is that this will reduce patients’ pain and increase their quality of living. “We have a good day at work when we receive a picture of a wound that has improved since last week based on our guidance to the home care nurses before the wound developed to much,” say Steen and Dufour.80

Telenor R&D along with Alta Municipality and NORUT Social Science Research started a research project within nursing and care services in the municipality of Alta in 2000. Patients who participated in the study had chronic wounds that normally involve many visits to the doctor. In the experiment they tried out how it worked to send pictures of chronic wounds as attachments to email (Figure 108, Figure 109). The experiment was evaluated as positive. This lead to the creation of a virtual ulcer polyclinic (“sårpoliklinikk”) at UNN in conjunction with the SES@M project in 2004-2006. Nurses in the care services received guidance on wound management directly from the ulcer polyclinic. The nurses took digital photographs of chronic wounds, filled out an ulcer form sent through the Norwegian Healthnet to the ulcer polyclinic. The clinic supervised the nurses on the basis of the referral.

79 http://www.telemed.no/gir-bedre-livskvalitet.434505-80451.html (Last accessed: 5.2.2013.)
80 http://www.telemed.no/gir-bedre-livskvalitet.434505-80451.html (Last accessed: 5.2.2013.)
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 108 When nurses have undergone training they take pictures of the wounds that are suitable for supervision. (Photo: Jan Fredrik Frantzen)

Figure 109 The Doris system for submission of text and images.
In 2007, a new organization of the service was introduced. Ulcer patients were recruited from the dermatology clinic’s waiting list. This means that vulnerable patients are undergoing clinical evaluation at the clinic before the Internet-based guiding to the nurses’ start. Most patients meet with the nurse who has primary responsibility for monitoring and treatment in nursing and care services. During the consultation they get guidance on wound care and possible compression therapy before the online tutorial starts. The Internet-based guidance can last up to a year. (On average, vulnerable patients had wound for 2.5 years before the guiding starts).

The results showed that patients experienced a greater degree of security through the use of images because both patients and caregivers could easily monitor the prevalence. The images can be compared from week to week, and thus contribute to a common understanding of the prevalence. In addition, patients were satisfied to know that nurses can send wound images via e-mail to a physician for medical assessment.

At the Department of Dermatology, nurse Ada Steen is the main supervisor (Figure 111). The dermatologist Dr. Nathalie Dufour supports her (Figure 112). The patients or their relatives or health care personnel sent her pictures with comments on demand. They patients have also borrowed a camera themselves when needed. A main conclusion from the experiments was that image documentation for assessment could help to strengthen the interdisciplinary collaboration around patients’ care.

The evaluation shows that the concept of participation in physical consultation and follow-up via the Internet provides the greatest learning effect. The nurses were eventually able to attend treatment locally they could not attend earlier, thereby preventing hospitalization for patients. Guiding over time has had a positive effect on wound healing or have been important to pre-
vent amputation.

Figure 111  Nurse Ada Steen is the primary web-supervisor at the dermatology department. (Photo: Jan Fredrik Frantzen)

Figure 112  Dermatologist Nathalie Dufour and head nurse Ada Steen at Department of Dermatology, UNN. (Photo: Jan Fredrik Frantzen)
In 2010-11, a process was initiated to establish a permanent solution for the Internet-based ulcer polyclinic (Figure 107). Based on an extensive search for the best solution for the dermatology department, the Danish solution Pleje.net was chosen (Figure 113 - Figure 115). The system is used by several Danish hospitals. In Norway, it is used by Stavanger University hospital, Helse Fonna - Stord Sjukehus and UNN. Several dermatology departments in Norway are playing with the idea of establishing a similar service.

The Danish solution Pleje.net is a web-based ulcer record system consisting of a database, an application to store and communicate images and text between different actors taking part in the treatment of a patient and a tool to analyse ulcers. The system can be accessed from both a computer connected to the Internet and from mobile phones. One benefit of the system is that all the relevant ulcer data are stored in one database. Health professionals involved in the treatment of a patient with chronic ulcers can collaborate via the system. The data can be available both for nurses and doctors in the local community, and nurses and doctors in specialist health services, as well as patients themselves. Specialists and nurses from the specialist health care can monitor the ulcer of the patient through images and text based explanations communicated via Pleje.net by nurses from the primary health care who visits the patient at home after the patient has been diagnosed and given a treatment plan at the hospital. Furthermore, the specialists and nurses from the specialist health care can assist and give advice to the home care nurses (or general practitioners) through the same system.

In Denmark, the users of Pleje.net got access to the service from a web browser by providing a user name and a password. They could also access the service from mobile phones without providing any authentication credentials. As long as the phone number was registered in the user’s profile in the system they would get automatic access to the data of their own patients in the system. All users had to be registered in the system in advance.

In Norway, up to 1st January 2015 only those who were employees of the organization that owned an IT-system or service in the health care sector were allowed to access the system or service. This meant that if a hospital provided a service or a system, only the employees of this hospital could legally access the system. General practitioners or home care nurses should not be given access.

Pleje.net processes patient data, which are defined as sensitive personal data by the Data Protection Directive 95/46/EC and thus, by the Norwegian Privacy Data Act. Such data shall be protected with the highest security level as specified by the Health Directorate, when accessed via the Internet or mobile units. In Norway a two-phase authentication solution was required for authentication when accessing the data in such a web based ulcer record via external networks.

This meant that the Danish solution did not comply with Norwegian legislation. The Danish solution had a common database for all actors taking part in the treatment and it was accessible via mobile phones without strong authentication or from computers on the Internet by only providing username and password.

The Danish solution had to be adapted in order to comply with the Norwegian legal requirements before it could be taken into use by Norwegian health care institutions. The Dermatology Department at UNN asked NST to help them improve the Pleje.net solution to make it compliant with the national legal requirements. NST worked together with the provider Dansk Telemedicine to enhance the solution with a two-phase authentication solution. In addition, it
was necessary to split up the shared database so that each institution taking part in the treatment of the patient’s ulcer had a separate database. Then, each participating institution could act as a responsible data controller for their own system for documentation of the ulcer treatment. The data in one institution’s ulcer record database, including the images and text-based inquiries and answers between the home care nurses and the specialist health care personnel, could be copied to the cooperating institutions’ databases on demand. The modified Norwegian version of the system is called Pleie.net. All participating partners’ databases are run at the same server park, and the data are replicated between the different databases on demand.

For access to Pleie.net from a computer a two-factor authentication is required; including username/password and a one-time password sent via SMS from the Pleie.net service to the phone number registered in the user profile. When the service is accessed from a mobile phone, both user name/password and a one-time link is used, or an app with sufficient security integrated.

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![Login](image)

**Figure 113** In 2015, the Dermatology department at UNN uses Pleie.net to document the diagnosis and treatment of ulcers and to give advice to the home care nurses treating the patient at home. ([www.pleie.net](http://www.pleie.net)) (Last accessed: 14.7.2015.)

The Internet-based record offers several special designed functions to support treatment of ulcers, included images, size measurements, etc. (Figure 115).
Pleie.net offers an advanced but simple to use wound record system.

Figure 114

The status at the end of 2011 for Pleie.net at the Dermatology department at UNN was that:

- Patients take care of their wounds themselves.
- Three patients have home care nurses who take care of their wounds. The nurses take care of the communication with the dermatology department as well.
- One of the patients has medical anxiety and does not come to the hospital. He communicates with the Dermatology department solely through the Internet. All the others have had a preliminary investigation at the dermatology department.
- A dermatologist follows his patients’ communication on pleie.net

Figure 115

The wounds may be examined and measured. A graph shows the development of the size of the wound.

No general practitioners (GPs) have so far been involved in the communication with the dermatology department, despite of several attempts to get the GPs in the loop.
Lessons learned from 25 years with telemedicine in Northern Norway

Ulcer guidance over the Internet: Get rid of the pain through telemedicine

By Jan Fredik Frantzen

After 1.5 years with severe pain Ms. Karly Sandmo can breathe a sigh of relief. Her ulcers are healed, and she can finally move around as she wants after 18 months with foot stillness. The last few years have been heavy for Ms. Karly Sandmo from Valnes, an hour’s drive outside the city of Bodo. In three years she has had three chronic wounds on her leg, and the last wound was especially tiring. Up to three times a day homecare nurses visited her to changed bandages on the wound. “It hurt all the time and can not really be described in words. I could barely sit in my home with the foot on a chair, and the pain was so intense that I almost lived on painkillers,” she says.

The GP had to admit his lack of knowledge about care of chronic wounds. Karly was referred to the Nordland Hospital in Bodo, where she in autumn 2006 was offered transplantation of healthy skin from other parts of her body. But, if possible, she wanted to avoid the operation. From the hospital, they also provided guidance about another way to treat the wounds. Unfortunately, the wound would not be healed. When it seemed to be healed, it was suddenly worse. It was depressing, she said.

The spring of 2007 was a turning point: “One of my colleagues had attended a conference and learned that it was set up expertise in wound management in Tromsø and Oslo. I took direct contact with the Department of Dermatology, University Hospital of Tromsø, for help,” says Marlis Almbakk, a homecare nurse in Saltstraumen.

Having been to guidance in Tromsø in April 2007, things began to happen. Karly and Marlis said they were very confident in the expertise of the Department of Dermatology. There, they got the camera that they could use at home in Saltstraumen. When they returned, the two nurses Marlis and Siv Eivik began to use the website mindoktor.no to send digital images of wounds to the Department of Dermatology in Tromsø once a week. In this way the nurse Ada Steen and doctor Nathalie Dufour of the University Hospital could follow the development of the wound and give advice on how it should be cared for.

This became the salvation. The wound was getting better, and 20 November last year it was finally completely healed. Karly has marked this in her calendar, and now she looks forward to Christmas and brighter times. “It’s almost so I do not dare to say it aloud, but the wound is actually healed,” she smiles warmly and says that she is already looking forward to summer trips in the forests around Valnes.

Now the home care nurse Marlis visit her only twice a week and make sure everything is as it should. She feels that she has learned a lot about the care of wounds that may benefit other patients as well. “We have become better and more confident in our treatment of chronic wounds. Now we dare to explore new ways to find out which treatment that eventually works best,” said Marlis.

This article was originally written by Jan Fredik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/kvitt-smertene-med-telemedisin.4444741.html (Last accessed: 5.2.2013.)
Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
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<tr>
<td><strong>Problem:</strong> To provide examination of ulcers without moving the patient out of their nursing homes.</td>
</tr>
<tr>
<td><strong>Solution:</strong> Software for sending images, digital camera.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Digital camera / smartphone, access to Internet.</td>
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</table>

Lessons learned:

The experiences with the ulcer team have been positive. The team has contributed to:

- Improved ulcer evaluation
- Fewer referrals (Figure 118)
- Faster intervention
- Precise feedback
- Individual guidance
- Improved follow-up
- Better documentation

The combination of photo- and text data leads to more exact evaluation. The communication with photo attachments optimises the information quality. The photo and text data make also immediate intervention possible if the status of the ulcer changed. This net-based guidance concept provides the opportunity for the ulcer team to guide the nurses on the basis of their level of knowledge. A result has been transference of competence from specialists at the hospital to the nurses at the nursing home.

Patients have been able to receive help for their ulcers without being transported to the hospital. Many patients live far away from the hospital and it will not be possible for them to come to weekly consultations. Net-based guidance improved follow-up for long distance patients. The follow-up is taken place between 3-12 months’ intervals.

![Figure 118 The telemedical ulcer polyclinic has led to fewer referrals to the hospital.](image)

Results for the home care nurses have been very positive. The clinic has resulted in: Improved skills, Uniform evaluation, Increased self-confidence, and Better continuity of care.
Status:

- In routine use.
- Very small, but slowly increasing, number of patients.
- Locations: Helse Nord

4.5 Telemedicine in pathology

Telepathology was one of the very first services put into successfully routine use in Northern Norway (Figure 120, Figure 121). What came into production was a service where an online, real-time frozen specimen services was offered to operating surgeons at remote hospitals without a pathological department of their own.

Many surgical operations require immediately access to pathology services. In this service, a pathologist analyses a frozen-section specimen during an operation. Based on the pathologist’s answer (malignant, malignant and no signs of any remainder pathological tissue, or benignant) the surgeon can continue the activity in the operating theatre. Before this telemedicine service was introduced, if presence from a pathologist was expected during an oper-
ation, patients had to be transported to Tromsø where such expertise was available. Or, even worse, depending on the final analysis from the pathologist, the patient had to be re-operated.

![Figure 120](image1.jpg) The telepathology studios in Tromsø (left) and Kirkenes (right). (Photo: NST)

![Figure 121](image2.jpg) Pathology department in Tromsø. (Photo: NST)

Telepathology at UNN was performed with the use of videoconference equipment. Clinical pathological conferences were held to surgeons in other hospitals in the region to discuss cases that have been referred from the remote hospital to UNN. In this way valuable knowledge from the university surroundings was shared with colleagues at smaller hospital for the best both for the patients and the doctors.

Timeline for the development within telepathology at UNN:

- **1990**: The first tests of telepathology services started in Norway at Regionsykehuset i Tromsø (today: UNN).
- **1990-**: Many hospitals, among others in Helse Sør and Helse Midt-Norge, have established similar services.
- **1994**: Det Norske Radiumhospital started telepathology tests in 1994. At first, these test service was set up between Radiumhospitalet and Aust-Agder sentralsjukehus.
- **1997**: Digital system installed at both hospitals and telepathology became a regular service.
• **2000** - In Helse Sør, a network of cooperating hospitals comprising nine Norwegian and nine international hospitals was gradually established.

• **2000** - Diagnoses established by telepathology became a normal part of the workday for pathologists at Radiumhospitalet.

• **2000** - In Helse Midt-Norge, equipment for telepathology was installed at eight hospitals.

• **2000** - In Helse Nord, telepathology is a regular service between Universitetssykehuset Nord-Norge and Kirkenes and Harstad.

• **2007**: Telepathology is after almost 20 years of active use still a routine activity in three health regions.

• **2014**: Telepathology is not in regular use. Since the smaller hospitals do not perform operations on female breast or pancreas anymore, telepathology is no longer needed for these high-volume procedures. (These operations are done at UNN only.)

Figure 122 Example of tissue-samples sent by secure email.

Figure 123 The telepathological workstation. (Photo: NST)
Lessons learned

<table>
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<tr>
<th>Problem – Solution</th>
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<tbody>
<tr>
<td><strong>Problem:</strong> To provide specialist services in pathology in Troms and Finnmark County.</td>
</tr>
<tr>
<td><strong>Solution:</strong> Development of videoconference equipment, a telemedicine workstation (at the pathology department at UNN) and remote controlled cameras for producing adequate images that were transferred to the pathologist at UNN (Figure 123). One of the inventions was a smart mouse for control of the remote microscope.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Use videoconference equipment, telemedicine workstation (at UNN) and remotely operated microscopes.</td>
</tr>
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</table>

Lessons learned:

- Result from this service was that the hospitals submitted images instead of tissue (Figure 122).
- Could provide pathology service at smaller hospital.
- Small hospitals improved their link to specialists at UNN.

Status:

- Cooperation between specialists.
- Not in (routine) use due to changes in surgical practice.

4.5.1 Frozen-section specimen service

In order to expand the surgical procedures to rural hospitals, pathologists at UNN introduced a frozen-section specimen service, i.e., microscopy images of frozen-section samples transferred, through the net, from the Kirkenes hospital to UNN. The service was developed at Telenor R&D in cooperation with the pathologists in Tromsø.

**Figure 124 Telemedicine workstation and remote operated microscope. (Photo: NST)**

During an operation, tissue samples from a suspicious, removed tumour is frozen to minus 40 degrees C, cut into microscopically thin slices by means of a cutting diamond and then put on
a glass plate (frozen-section specimen). This plate is then put under a microscope to be viewed by the pathologist.

![Image of frozen-section tissue sample](image1)

*Figure 125 A picture of a frozen-section tissue sample is taken in the operation theatre. (Photo: NST)*

The research group made a videoconference equipment station consisting of two screens (incoming and outgoing pictures). In addition, the station was equipped with a macro camera at the remote site (Figure 124). A microscope was also built into the station at the remote site. This microscope was completely controlled from the pathologist in Tromsø since the new devolved “super mouse” had the ability to change between the different oculars at the microscope, to focus and to move the frozen specimen around under the microscope in order to examine the whole plate.

![Image of macro camera and microscope](image2)

*Figure 126 The picture of the tissue sample submitted to the pathologist in Tromsø. (Photo: NST)*

The procedure started with the surgeon placing the removed tumour under the macro camera, as illustrated in Figure 126. Pictures of this tumour were then seen in real time by the pathologist in Tromsø, and based on this transferred information the pathologist could guide the surgeon to which part of the tumour it was most likely to find the suspect tissue (Figure 125). From this part the technician, who has been taught the technical procedure to make the frozen specimen, took over and created the frozen specimen, which he then put on under the
microscope at the remote hospital (Figure 127, Figure 128). Based on the judgement from the pathologist the surgeon then concluded the operation.

*Figure 127 The tissue sample after it has been cut in accordance with the pathologist’s instruction. (Photo: NST)*

*Figure 128 An enlarged picture of the tissue sample. (Photo: NST)*

The first tests started in April 1990. The quality of the frozen samples was evaluated as good. The group behind this innovation was in 1999 awarded with the Telenor’s Research Award (Figure 132). The prototype for freezing samples was later commercialized by NovaKom AS. The telepathologic workstation Telepat 2000 is now being produced by AM Elektro A/S (Figure 129 - Figure 131). For more information, see (Hartviksen and Rinde 1993).

This project became a low quantity, but very high quality service with great impact for the patients in question. Over the years the importance of this service in Northern Norway has decreased due to the fact that cancer surgery has been centralised to a very few hospitals in the region.
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 129 The telepathologic workstation Telepat 2000.

Figure 130 Example from the A200 software package.

Figure 131 Example of use of A200. The pictures are from A/M Electro’s web.
Lessons learned

Problem – Solution

**Problem:** To provide pathology services during an operation at the hospitals in Hammerfest and Kirkenes.

**Solution:** Development of frozen section service based on videoconference equipment and remote controlled cameras for producing adequate images of tissues during an operation. The pictures were transferred to the pathologist at UNN, who also controlled the microscope from UNN.

**Equipment:** Use videoconference equipment, remotely operated microscopes.

Lessons learned:

- Small hospitals got access to pathology service during an operation.
- Many patients did not need to be re-operated, because the examination could complete in one operation. Before this service was introduced, the remote hospital received the answers from the pathology department after 1-2 weeks. For some patients, that implied re-operation.

**Status:**

- Not in (routine) use.
- Location: Helse Nord

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**Figure 132** The Telepathology Group got the 1999 Telenor Research Award for their work with the telemedicine service in pathology.
4.5.2 The PatNet

Together with professionals, NST has developed a web-based collaborative application for pathologists in Norway (www.patologi.net[^2]). The network contains an information kiosk, documents (quality assurance, organizational information), news, a discussion forum, case archive and a colleague consultation service. PatNet had more than 300 registered members in 2000. The Norwegian Association for Pathologists was maintaining the site until 2003 (Figure 133 - Figure 135).

[^2]: Not in operation since 2003.

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Figure 133 PatNet - Intranet for pathologists. (Photo: NST)

Figure 134 Second opinions is a key function of PatNet. (Photo: NST)
According to the year 2003 annual report from the Norwegian Society of Pathology, PatNet was closed in 2003.83

“Regular operation of PatNet ended early this year.

Quote from last year's annual report: “To ensure specialist network’s future existence, it may be appropriate to try and establish PatNet as a foundation. PatNet editors will, in consultation with the Board of Directors of DNP, invite the concerned health authorities to an inaugural meeting.” This has not been performed.

The Board has now decided to establish their own home pages of the Norwegian Medical Association’s Pathologist Association via their website. Such websites will cover the information needs of members, but will not have functionality such as case records and consultation.

Any continuation of PatNet will depend on the initiatives to come. The idea of specialist networks across health authorities should be interesting to try out.”

Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem: To provide specialist network in pathology in Norway.</td>
</tr>
<tr>
<td>Solution: Development of a dedicated web site for Norwegian pathologists.</td>
</tr>
<tr>
<td>Equipment: Dedicated web site for PatNet.</td>
</tr>
</tbody>
</table>

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Lessons learned:

- Experiences from PatNet indicate that the network has limited benefit and very varying use.
- The use did not reach the critical mass of contributors in order to be a useful forum. This is a general problem for these kind of services.

Status:

- Not in use.

4.5.3 International cooperation in pathology

In 1992, a new pathologic consultation service was introduced at UNN, in which of pictures from electron microscopy for diagnosing within neuropathology were sent to The Mayo-clinic in the US (Figure 136). Images were digitized in Tromsø and transferred to the Mayo-clinic in the US, where they were diagnosed based on the pictures and enclosed patient case history. The background for this service was cooperation between UNN and the Mayo-clinic that had been started earlier on. In this way a world-class hospital is supporting the diagnostic quality on the northernmost university clinic in the world.

![Figure 136 “Diagnosis via satellite”](image_url)

Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem:</strong> To provide pathology services in specialized field by consulting expert groups abroad.</td>
</tr>
<tr>
<td><strong>Solution:</strong> Transfer pictures and patient case history to the best specialist for diagnosing. The service was a test service that was discontinued.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Microscope, digitalization unit (scanner), access to net services.</td>
</tr>
</tbody>
</table>
Lessons learned:

- Network services can be used to contact the best medical groups in the world.
- Infrequent use and reduced need of the service gradually lead to that the service was not used anymore.

Status:

- Not in use.


4.6 Telemedicine in otorhinolaryngology (ENT)

For many years, the Department of Otorhinolaryngology (ENT) had conducted a very good program of ambulatory service where the doctors travelled to four remote locations six times a year to see the patients from other parts of Finnmark County. Waiting lists were long and patients needing immediate consultations had to travel all the way to Tromsø. This was, and still is, a service that functions very well.

The introduction of teleotolaryngology was motivated by the idea that this would lead to reduced waiting lists and travelling time both to patients and health care personnel. In 1992, telemedicine services in otorhinolaryngology were established between the specialists at UNN and one GP (Dr. Daniel Haga) at Alta Health Care Centre. Alta is situated at a distance of more than 400 kilometres to the specialists in Tromsø. The design was to train the GP in doing endoscopical ENT examination at UNN and then go back home to do the same procedures on his own patients in Alta controlled by the ENT specialist via videoconference equipment.

Figure 137 One of the early services was in otorhinolaryngology. (Photo: NST)

During a videoconference, the patient, the GP and the specialist are present simultaneously and can communicate in real-time. A nasal/ear endoscopy is performed during consultation. The endoscope is connected to a video camera that allows the images to be transmitted to the
otorhinolaryngologist (Figure 137, left picture). The equipment is set up so that the GP and the patient (Figure 137, middle picture) can see the same images as the specialist. If necessary, the patient is referred to the specialist for further examination (Figure 137, right picture).

The training of the GP was planned so that he should train at the ENT outpatients department with 20 selected patients a day for 5 days. The in-house staff were enthusiastic to this, but sceptical voices were also heard: “A GP will never learn how to handle this kind of sophisticated instrument in such a short period of time”. The GP went home after two days, having nothing more to learn about this instrumentation. Again some of the in-house doctors were enthusiastic, while others were worried: “Is he going to take away work?” Our reason for dealing with these remarks here is that we think they very well demonstrate the diversity of apprehensions when it comes to implementation of new IT solutions in the health care system.

![Figure 138 An otorhinolaryngology case submitted as still images.](image)

### 4.6.1 ENT solution with videoconferencing

At the remote site, the GPs used the VC equipment situated at Alta Health Care Centre. Connected to videoconference was a full-blown endoscopic ENT examination tool consisting of scopes for the ears, the nose and the larynx and appurtenant light source. In addition, the GP had access to a handheld tympanogram (to measure the pressure in the middle ear).

The GP brought with him 10 patients to each session, and these were examined over 3 hours every second week. At the UNN site the ENT specialist was sitting in the hospitals (very first) VC studio. In this way they could see and hear each other simultaneously. The medical history was reviewed and diagnosis and treatment discussed and determined that it was possible. The consultation ended sometimes in the patient having to travel to the ENT department at the hospital.
Not all states within ENT suitable for remote diagnosis. Below is a list of the areas videoconferencing within the skin can be used (Moseng 2000).

Suitable issues for teleotorhinolaryngology:

- The most common ear diseases can be safely diagnosed via telemedicine.
- Treatment courses can be taken and more specialized treatment offered.
- Monitoring of implemented treatments is also suitable.
- Polyps in the nose is seen most often okay.
- Video images provide a good overview and images from the larynx. And the vocal mobility is matching.

Less appropriate issues for teleotorhinolaryngology:

- Cancer suspicious illnesses where necessary palpation of the neck is required.
- Nasal congestion can be difficult to diagnose because the video image does not always give good dynamics.
- Swollen mucous membranes may also prevent access to underlying disorder.

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Figure 139 A patient in Hammerfest is examined. The pictures are sent directly to the ENT specialist at UNN via encrypted e-mail. (Photo: Per Christian Lindberg, NST)  

The primary doctor referred the patient to a specialist consultation in the usual way. This happened, then, by letter. The specialist considered who would be examined via videoconference and who had to travel to the hospital. The ENT doctor was responsible for documenting their

findings in the patient record in the same way as for a traditional specialist consultation. After the videoconference consultation, discharge summary was sent to the referring physician in accordance with the normal routine.

Follow-up and monitoring of the patient was agreed at the conclusion of each video consultation. After working together in this way for one year, the GP estimated that more than half of the patients he used to refer to the ENT specialist, the GP now was able to handle himself without having to ask for the specialists’ advice.

In spite of this the service is no longer in practical use. The GP has moved to another part of the country and the ENT specialist has changed position (and is one of the authors of this book). So what the two enthusiastic start-up doctors forgot was to institutionalize this service. So when the two only participants started to do something else there was nobody else to carry on the work!

Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem:</strong> To provide specialist services in otorhinolaryngology in Troms and Finnmark County.</td>
</tr>
<tr>
<td><strong>Solution:</strong> Teleconsultations are offered twice a month with seven or eight patients each time. Each teleconsultation session lasts between two and a half and three hours. In addition, UNN specialists travel from to Alta three times a year.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Videoconference equipment, digital still, video camera connected to PC with frame grabber card (H.320), end scope connected to a PC, camera control, light source, ISDN connection (364 kbps) access to the Norwegian Health net, Software to transmit encrypted e-mail.</td>
</tr>
</tbody>
</table>

Lessons learned:

- Initial scepticism (palpation and smell mandatory) made recruitment of specialists difficult. However, simple pilots proved beneficial services possible in the framework of the limited technology. The equipment is still in use.
- Initial scepticism towards having a GP operating the endoscope.
- This telemedicine services had difficulties in showing cost saving, almost independent of volume due to the high cost of the endoscopic equipment on that time. Today, however, several vendors have developed ENT equipment for videoconference conference specially designed for GPs and nurses, with a very good functionality and to an affordable price.
- Growing number of cases in a first phase (several years), but then gradually drop in the number of cases due to knowledge transfer from specialist to GPs.
- This method of consultation may be used in the clinic with the same degree of reproducibility as in a conventional consultation situation. This enables us to give patients in remote locations better service at a lower cost.
- Best suited for health centres and large GP offices.
- Service can be used to distribute workload between hospitals.
- The most successful project of large scale ENT implementation today you will find in Alaska. It is a part of the ANAC project.
Helse Nord Expert Group:

- The Helse Nord expert group recommended that the ENT solution should be implemented as part of the DIPS EHR.
- The service based on VC has been available since 1992, but it has a very low volume.
- The still image service as part of electronic referral was an early service in telemedicine. This service was vigorous as long as the “fiery souls” in Alta and Tromsø were part of it. Today the service has a low and decreasing volume. This can be an effect of the reimbursement system. In addition, many specialists in private practice want direct contact with their patients.
- Today, Helse Nord will not recommend this service for large-scale operation.
- A service with net-based adjustment of hearing aid has been tested in the Trøndelag County. The conclusion was that this service was not cost-effective. The analysis presupposes investment in VC equipment.
- In the future, a pilot study and evaluation of such a service without including expensive VC equipment should be made.

Status:

- Minimal use of VC.
- Small number of patients.
- Patients examined through electronic messages (Figure 138, Figure 139).
- Location: Helse Nord


4.7 Telemedicine in ophthalmology

Diabetes is a chronic disease with increasing incidence in Norway as well as in the world in general. In 2010, there were more than 300 million people worldwide who have diabetes (Melmed, Polonsky et al. 2012). This number is expected to almost double within 2030 (Wild, Roglic et al. 2004). It is primarily older people who have type 2 diabetes, while more and more young people get type 1.

Diabetes is one of the greatest threats to sight in the western world. To reduce morbidity and mortality caused by diabetes the Saint Vincent Declaration recommends increased efforts to prevent disease complications (Diabetic Medicine 1990). One of the complications is diabetic retinopathy, which at worst can lead to blindness. The Saint Vincent Declaration advocates reducing that by at least a third in the course of a five-year period.

Regular examination of eye grounds is an action that could lead to early detection of progression of diabetic retinopathy at a stage where treatment can yield good results (Clark, Grey et al. 1994, Evans 1996). Half of diabetes patients have changes in eye grounds and are thus at risk of impaired vision / to be blind. In Norway, less than 20 patients lose their vision each year due to diabetes (Eggesvik 1995).
In Norway, there are also too few ophthalmologists and they are not distributed equally throughout the country. To remedy this situation came the idea to start with telemedicine eye ground control (“øyebunnskontroll”) to Alta.

Alta has approximately 16,000 inhabitants (in 2003) and a diabetes population of 350, of which 250 are suitable for telemedicine consultation (Rotvold, Knarvik et al. 2003). In autumn 1991, Alta municipality established a diabetes team that mainly consisted of two nurses
Hartvigsen and Pedersen

and a municipality doctor as medical director. The team offers diabetes management to all diabetic patients in Alta municipality.

Figure 142 The ophthalmologist at UNN study the pictures from Alta. (Photo: NST)

Alta has no regular ophthalmologist. Until 1995, most eye examinations were performed by ambulatory ophthalmologists from the University Hospital who spent one week in Alta each month. Eye grounds were in the first period examined by ophthalmoscope, eventually with fundus camera (a camera that is specifically designed for shooting behind the eye) (Figure 140). The findings were often documented with slides. Then the waiting time was up to a year for newly referred people with diabetes. This led many of the primary physicians to refer their patients to private practice ophthalmologists in Tromsø and Lakselv.

For the telemedical setup in Alta we used a commercially available fundus camera for ophthalmological imaging. It had facilities for both digital imaging and 35 mm colour slide acquisition (this was to test the medical quality of the pictures before we deployed the solution). The camera had a field of view of at least 50 degrees. It could be connected to video cameras, where the static resolution of the images was limited by the PAL video standard (768x576 pixels and 24 bits resolution). The fundus camera could also be connected to a digital monochrome camera with a resolution of 1317x1035 pixels (Figure 144). We did not use videoconference transmission of fundus images. A software package for image acquisition and analysis were integrated into the system together with a prototype, developed by NST, for request and report system. The equipment was placed in Alta in April 1999.

The nurses of the diabetic team in Alta were trained by the specialists to do the image acquisition, and in this way images of the fundus were taken from patients located at the remote site, attached to an commercial available pc-based system for management of eye ground images (Figure 141). These images were integrated with an e-mail based module and then send to the specialists at UNN for evaluation (Figure 142, Figure 143).

Each consultation takes a total of 45 minutes. This includes 20-30 minutes waiting for the
effects of eye drops that expand the pupils. Diabetes nurses shooting (takes 10-15 minutes),
quality assurance and saves fundus images continuously. A medical checklist and associated
studies are reviewed for each patient. After the last consultation, all fundus images with refere-
ral form were sent by e-mail to the eye specialists (ophthalmologists) at UNN.

The eye specialists have the pictures available on their PCs and can diagnose the patient when
they have time. The result is sent to the patient by ordinary letter with a copy to the primary
physician. It takes on average 14 days after the patient has been examined for the person re-
cieves the results by mail. Today this response time is reduced.

It is probably understandable that the integration of all these systems, together with access to
transmission network, with its lack of capacity almost 10 years ago, was a challenge. Add to
this picture that this way of working also had to develop new ways of organizing the work
between the different players both at the highly specialized hospital side and at the remote
health care centre. However, the equipment performed its job.

It is believed that at least 250 of the 350 diabetics in Alta municipality are appropriate for tel-
emedicine eye ground control. The rest of the group (about 100 patients) are considered un-
suitable because they have other eye diseases so they must seek ambulatory ophthalmologist.

The telemedicine eye ground control is also more efficiently because you have access to the
results immediately and do not haveto wait for processing of images such as the ordinary fun-
dus images. The diagnosis is also faster when the specialists expect that they can screen for
five to eight patients at the same time as it is used on a patient in a conventional face-to-face
consultation. More efficient use of resources can thus lead to more can be offered eye ground
control without increasing the number of ophthalmologists.

Figure 143 Organization of teleophthalmology (in 2000).
The specialists expressed positive experiences with the new method. They look positively on that diabetes nurses perform eye ground control (decentralization of the service). From the specialist's point of view there are several advantages of a telemedical examination. They get freed working hours of several reasons: They save travels to Alta, they can diagnose more patients with this method than with the conventional, and they have the ability to choose the time for consultations. However, the diagnostic basis changed. The specialists have no oppor-
tunity for follow-up questions to the patients without summoning the person again. At the same time the specialists express that the pictorial documentation of eye grounds is a good historical basis for comparison and provid better control of diabetics’ medical history (Figure 146). For diabetics, especially those who get diabetes at a young age and who will live with the disease for many years, regular and easily accessible controls will be an unqualified benefit.

Medical-technical investigations the specialist and the NST staff carried out, also show that the visual quality of the black and white images are satisfactory. Duplications were avoided since they rarely needed to take pictures again. In addition, changes in eye grounds could be detected early. The specialists also believe that the teleophthalmology service added very valuable “visual information” since the referral contains both consultation and image (see also (Taylor 1996)). (The conventional method includes writing to explain the appearance of eye grounds, provides digital storage of eye ground images and objective documentation.)

![Figure 146 Referral to ophthalmologist at UNN.](image)

Patients are generally satisfied with this way to be investigated. This is based primarily on trust in technology, health care and health care system as a whole (Rotvold, Knarvik et al.)
The patients also appeared to be satisfied with not having to travel to Tromsø, in that diabetes nurses that they know well care them for. Diabetes Nurses state that they can now provide a more holistic care for people with diabetes. They also seem to have a better overview of patients' attendance and have the opportunity to follow up patients who fail to control. Diabetes nurses welcome the expertise rising through new work.

In an analysis of user satisfaction, it is pointed out that trust is crucial for the cooperation between health professionals, especially when the tasks and responsibilities have changed from a conventional to a telemedicine examination. When “clinical expertise” is different from the cooperative in the case of the diabetes nurses and eye specialists, it must be compensated with such consistency and predictability (Rotvold, Knarvik et al. 2003). When the specialists at UNN diagnose the digital images, they are dependent on good image quality, that the images are taken properly and that relevant patient information is attached. Specialists point out in this context the importance of knowing the examining and photographing patients. In addition, face-to-face meetings between healthcare groups are of great importance. Common understanding of the relevance of knowledge is vital - not common knowledge (Rotvold, Knarvik et al. 2003).

Based on the results of an economic evaluation of the pilot project in Alta, which is described in the article “An Economic Analysis of Screening for Diabetic Retinopathy”, Bjørvig et al. (Bjørvig, Johansen et al. 2002) found a break-even point at 110 patients annually. Cost effectiveness may be improved further by replacing the diagnosing ophthalmologists with less costly ophthalmic nurses or other health care personnel.

In spite of all these positive results we got for this telemedicine service, as for many of the other telemedicine services, we experienced that to maintain the service in routine environments is extremely difficult.
In many countries, there is a lack of ophthalmologists. We believe that tele-screening of patients with diabetes may be advantageous in such settings as images may be taken by less skilled health care personnel or photographers, perhaps in mobile screening units, and then transmitted electronically to ophthalmologists, ophthalmologic nurses or ophthalmologic service centres.

Figure 147 shows an example of a comparison of a colour image and a redfree image taken from a diabetes patient. The colour images are scanned from a slide (Kodak Ektachrome 100+) using Polaroids SprintScan 35. Resolution is 2025 dpi, which results in an image on about 9.5 MB. The red free monochrome picture is taken from OCULab and has a resolution of 1024 x 1024 pixels, which results in a image on about 1 MB.

Telemedicine and the use of digital images has the potential to improve outcome of diabetes treatment – and reduce risk of blindness, due to benefits like:

- High quality images, and the possibility of image manipulation for improved detection and analysis.
- Immediate results - no film processing.
- The specialist is able to establish diagnoses based on digital retina images, for 5 to 10 patients in the same time used for 1 ordinary specialist-to-patient consultation.
- Better utilization of resources, should enable much higher screening rates.
- Digital technology enables better storage and retrieval facilities, and telemedicine enables easy and fast communication with other centre possible.

Additionally, from a socio-economic perspective, less time and money is spent on travel by patients; which results in better patient compliance in participating in follow-up procedures.

Figure 148 The images illustrates how a B/W image can be manipulated. The dark image has very poor contrast (left). The same image after the contrast has been manipulated (right). It is now easier to see the red spots. (Photo: NST)
Also, replacing the specialist with a technician or nurse on patient side will result in lower manpower cost. Another important aspect is the transfer of skill between specialist service and the primary health care services. Most important, however, is that a decentralised specialist medical service will provide better health care services – also for the diabetes patient.

**Lessons learned**

<table>
<thead>
<tr>
<th>Problem – Solution</th>
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<tbody>
<tr>
<td><strong>Problem:</strong> To provide ophthalmology services in Nordland, Troms and Finnmark County.</td>
</tr>
<tr>
<td><strong>Solution:</strong> A fundus camera linked to a digital camera and electronic transfer of digital still images to an ophthalmologist at UNN for further examination and diagnosing. The camera in Alta municipality is operated by specially trained nurses.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Fundus camera and access to the Norwegian healthnet. The communication platform today is Well Communicator.</td>
</tr>
</tbody>
</table>

Lessons learned:

- Both patients and health care personnel express greater satisfaction in the use of telemedicine instead of more traditional solutions.
- Study: 76% (32) of the involved patients were satisfied with the local availability of eye ground screening using telemedicine because they did not have to travel, gained access to specialist services, and since the service was offered in familiar surroundings.
- Increased quality and efficiency of diabetes treatment. (Reduced risk of blindness)
- The pictures were taken by nurses, and not by doctors (i.e., ophthalmologists). Even though similar services in other countries had been taken care of by technicians, it had not been put into practice in Norway to let other groups than doctors do these kinds of operations. (It was only accepted because this was a telemedicine service.)
- A telemedicine application can have an impact on general medical practice. Ophthalmologists at UNN stayed with grey scale! This is an example where the doctors where challenged by introduction of new technology. Before this, they had been used to interpret colour pictures.
- The advantage of monochromatic pictures is not surprising for people with a background in (computer) graphics. Processing and adjustment of contrast, etc., is very complex in colour, but can be almost intuitively simple to do with grey scale (Figure 148).

The Helse Nord Expert Group:

- The Helse Nord expert group argues that this a very promising service, and that they are optimistic as regard the forthcoming project evaluation. A recommendation of potential large-scale evaluation will be made based on this evaluation.
- The activity between Alta and UNN is increasing; from 130 examinations in 2004 to 230 in 2005.
- The researchers at Ophthalmology Department (“Øyeavdelingen”) at UNN plan to use photographers instead of diabetes nurses to operate the fundus camera in the “Tromsø-6-health examination”. In this way, they hope to increase the efficiency and make the
Lessons learned from 25 years with telemedicine in Northern Norway

service less dependent on health care resources. If this turns out to be successful, an ambulatory photographer solution will be considered.

Status:

• In routine use.
• Moderate, but increasing, number of patients.
• Locations: Helse Nord


4.8 Telemedicine in psychiatry

Telepsychiatry encompasses professional supervision, education and clinical cooperation as well as actual clinical practice. Telepsychiatry can be described as the use of information and communications technology (ICT) in mental health care.

Videoconferencing (VC) is used regularly in Troms and Finnmark Counties both in direct patient consultation and for personnel training. In a study of the use of VC for patient-directed cooperation between the specialist health care unit and four municipalities, the following positive experiences with the VC were found:

• Improved contact between different levels, improved information exchange.
• Some acute hospitalizations avoided because of VC contact patient – psychiatrist.
• Increased availability of evaluations of discharged patients (every 3rd months).
• Decreased feeling of professional isolation in the municipality.

Videoconferencing or other means of two-way audio-visual communication have been used in mental health care for more than 30 years. However, until recent years, the use has been restricted to small-scale trial projects, due to high costs and infrastructural limitations.

Reduced costs and improved technical solutions have increased both interest in and use of telepsychiatry. Loud-speaking telephony, videophone, phone conferencing, videoconferencing and electronic intra- and Internet communication can overcome geographic distance between patient and therapist as well as promote cross disciplinary interaction, networking and skills development.

It is difficult to provide a comprehensive overview of the total range of application of telepsychiatry. What is known is that the level of use is increasing, and that an increasing number of mental health care workers consider telepsychiatry a useful collaborative tool between various levels and service areas of the mental health care system.

Telepsychiatry includes:

• Professional supervision of health care workers.
• Education (cross disciplinary or for specific professions).
• Research
• Networking between various institutions and levels in the health care system.
• Various forms of clinical collaboration.
• Clinical practice.

Figure 149 Newspaper headline: “Psychologist wants Internet for free”. Psychologist Deede Gammon at NST argues at psychiatric patients must have free access to Internet service.

Technical preconditions for telepsychiatry vary between different regions in Norway. A number of institutions throughout the country regularly use videoconferencing in mental health care. These include:

• Hospitals (somatic hospitals, Nordland county mental hospital, various departments at the University Hospital of North Norway).
• Most mental health centres.
• Some local authorities and medical offices.
• Universities and colleges.

Telepsychiatry share some central concerns with telemedicine in general: Quality, efficiency, user satisfaction, cost/benefit and availability. Still, psychiatry has special requirements regarding communication as a basis for human relations and interaction in clinical practice.
Therapy by m@il\textsuperscript{15}

NRK (Published 10 March, 2003)

She was driving along a road with high frequency of accidents when memories of the past suddenly came to her. Siri Marte Hollekim (26) had a dramatic car accident behind her, and nine years later it became difficult to cope with everyday life. She contacted the psychologist Tormod Rimehaug via e-mail, and suddenly they were in a dialogue that helped her further.

Hollekim’s personal story was presented in the TV program “Therapy by m@il” in NRK in 2003. “Therapy by m@il” is about to write down your deepest frustrations and your anxiety. And to send it away to someone who listens. This is therapy that works, if it is handled with care and expertise.

“I wrote at night,” says Siri Marte, “for it was then that I would tell how I really felt.” She places great weight on her own control in this process. It was she who would describe her own feelings. And she would decide when it suited her to tell about them. “This is a new trend,” says Dedee Gammon. “Many of the young people are concerned about self-help.” She believes that the Internet allows for a different kind of contact and many new opportunities in mental health care. And she says we can expect more of this in the future.

Deede Gammon works at the National Centre for Telemedicine in Tromsø. She does research on our use of interactive media in the health context and thinks that the history of mail exchange between Siri Marte and Tormod is interesting. “Written communication in the dissemination of our innermost thoughts and feelings are not new,” she says. “Just think of the glowing love letters that are exchanged from time immemorial. Today, e-mail and mobile messages included a new place in our everyday lives. The network gives us the opportunity for rapid feedback, but also creates new expectations.”

We are all concerned about safety when we talk about our secrets. What neither Siri Marte nor Tormod thought of, was that the mail system we use is not safe enough for patient care or confidentiality. But it is only a matter of time before there are solutions that are safe enough and we can use the net when we need help.

There are many websites that are engaged in health counselling. But this program is about a two-way communication, to get personal help from a psychologist. There is no doubt that the contact between them had many positive aspects, even if they have not met face to face. Many believe that the new technology will revolutionize the health care system, when the only safety is good enough. “The network gives us the mental health care a great opportunity to reach out to young people who otherwise never would have contacted us,” says Tormod Rimehaug. “For me it was a fantastic way,” says Siri Marte Hollekim. “The only thing I could think of.”

\textsuperscript{15} This article was originally published by the Norwegian Broadcasting Corporation (NRK), and later translated into English by the authors. URL to the original: http://fil.nrk.no/programmer/tv-arkiv/faktor/1.6391201 (Last accessed: 5.2.2013.)
4.8.1 Morild

NST has together with Sørlandet sykehus developed a net-based service for children to parents with mental disorders (Figure 153 and Figure 154). Agnes Rabbe, consultant and webmaster at Sørlandet sykehus, said in an interview that: “It is a unique opportunity because young people can meet like-minded in the same situation and get help and comfort each other. The chat room is available 24 hours a day year round and we have received many appreciative feedback from young people who need it.”

Figure 153 Morild is a web-based system for kids with a parent with mental disorder.

Figure 154 In 2014, Morild web-site was re-design and updated. The screen (left) contains a number of Q&A related to several fields, e.g., mental illness (“Psykis sykdom”), parents in prison (“Foreldre i fengsel”), physical illness (“Fysisk sykdom”), physical and psychological violence (“Fysisk og psykisk vold”), eating disorders (“Spiseforstyrrelser”), sexual abuse (“Seksuelle overgrep”), alcohol and drug addiction (“Alkohol- og rusavhengighet”), divorce (“Skilsmisse”), bullying (“Mobbing”), death in the family (“Dødsfall i familien”).

The instruction to “Your history” (“Din historie”) is as follow.87

“You who write about events, thoughts and feelings, tell your story as you remember it and the way you choose to tell it. The way you tell your story contribute to shape your life and your ability to influence your reality. Therefore, we will also hear stories about coping when things go well and about issues that become smaller or disappear.

Anyone who writes a story is anonymous. We cannot see the address of the person who sent a story to us. Nor can we arrange contacts between submitters. The answer service on the Morild page welcomes questions. The Morild page contains nearly 1000 questions and answers. The chat room is an offer for those who want to share their own experiences and get tips and advice from others.”

Sociologist Marianne Trondsen at NST has followed the users of the room for two years and has interviewed several of them as part of his doctorate (Figure 155). “It means a lot for young people to speak with others in the same situation and find that they are not alone with their thoughts and difficult challenges. Several said that this is the first time they have dared to speak to someone about these things,” says Marianne Trondsen.

Figure 155  Sociologist Marianne Trondsen at the Norwegian Centre for Telemedicine has developed Morild as part of her PhD project. (Photo: Jan Fredik Frantzen)

Status:

- In routine use.
- Large number of users.
- Location: Administrated by Sørlandet sykehus. Availability: Norway

“Using the Internet makes it easier for children and young people to open up and talk about their parents' mental illness,” say Ellen Walnum and Jorunn Gjedrem from the answering service on the website Morild.

“Studies show that as many as 90,000 Norwegian children have parents who are struggling with mental disorders. The problem for many young people is that they will not open up about their parents' problems. They often feel that their problems are not taken seriously and that they become throw balls in the whole system, both in the specialist health services and the municipal health service. The young people are struggling with shame, guilt and great responsibility. And often they have no one to talk to about this,” say Walnum and Gjedrem.

In Sørlandet sykehus they work to help these children through an anonymous answering service on the Internet, where kids can submit their questions and thoughts. Within a week, they will get response from both professionals and people who have personal experience with mental illness. Experience is good from the two years Morild answering service has been in operation. “Many of these kids had never said anything about their problems, if they had not been able to speak anonymously to us on the Internet,” says Ellen Walnum from the answering service. She grew up with a mother who was mentally ill and are sure that this had been a good service for her, if it had exist when she grew up. “On the other hand, we have many who submit multiple entries, and the kids get access to an open, anonymous place online where they can express what they wonder, without having to reveal themselves face-to-face with the school nurse or psychologist.” She says.

Jorunn Gjedrem works in the child welfare services in the municipality of Kristiansand. She says that it can be difficult to answer. “Because the service is anonymous, we do not know who is submitting the question. We have only the text to use as the background to our answer. Sometimes, also, we only got one message and then we hear no more from them,” she says. On the website, young people between 15 and 18 can also enrol in a closed chat. There, they can have contact with other young people who struggle with parents with mental health problems and they can give each other tips and advice in daily life.
4.8.2 Slutta.no - Smoke-free on the Net

The site www.slutta.no is offered to those who want to be smokeless (Figure 158). The course is web-based, free of charge and tailored to your needs. Approximately one of four Norwegians are smokers. An increasing number of smokers are using the Internet to become smokeless and prolong their life. On the site www.slutta.no they can enter the program when they are ready. The service is available 24/7, regardless of where they live. Slutta.no was released in August 2006 and is currently operated on by the Health Directorate in conjunction with “røyketelefonen”. At the end of 2008 slutta.no resulted in nearly two million smoke free days for users of the service.

In addition to information about how to become smokeless, the site provides several tests, diary, guestbook and discussion forum where the users can share their experiences and get support from others in the same situation. Moreover, they can receive general information about smoking and how to stop smoking and get personal guidance, depending on the tests they take when they first time logged on. Norwegian Centre for Telemedicine, in cooperation with the Cancer Society and the Ministry of Health and Social Affairs, developed and evaluated the online smokeless program “Opptur” (“Journey up”), which is based on the Norwegian Cancer Society’s project “Røykfri bedrift” (“Smokefree business”). Silje Camilla Wangberg at NST did the work as part of her doctoral research.

Status:

- In routine use.
- Large number of patients.
- Location: Norway
4.8.3 DeVaVi

DeVaVi, decentralized on-duty call cooperation through the use of videoconferencing (“Desentralisert Vaktsamarbeid ved bruk av Videokonferanse”), has extended the acute psychiatric services at the Centre for Mental Health in South Troms (SPHST), Centre for Mental Health in Middle Troms (SPHMT) and the Centre for Mental Health in Ofoten (SPHO) in the South Division of the Public Psychiatric Clinic (Figure 160).

The on-duty call system has 24-7 on-call service covered by mobile teams and psychiatrist on-call at the on day unit, and senior doctors on-call who are employed and located in different parts of the hospital. The senior doctors can participate in direct patient consultations via video calls, in collaboration with mobile teams and day units (Figure 159).

The purpose of DeVaVi is to ensure that medical specialists are available for day units and mobile teams so that patients can get the best possible treatment as close to home as possible. It has for years been the major challenges in securing specialist coverage at the District Psychiatric Centres (DPS).

In recent years, a number of studies on the use of telemedicine in psychiatry have been performed (Hyler, Gangure et al. 2005). Videoconferencing is used extensively in meetings and to improve interaction between professionals. Videoconferencing is also used a lot in direct patient care, but no one has established on-call duty in psychiatry by the use of videoconferencing. In studies where video conferencing is compared with direct face-to-face consultations, it is found equal to the quality of investigations and equal satisfaction among patients and professionals (Hyler, Gangure et al. 2005).

In February 2010, UNN established a project team that worked hard to prepare the organization for the forthcoming change. Equipment for more than NOK 1.2 million was purchased and installed. Three large video studios were located in the day units in Narvik, Harstad and Silsand. Six small studios were installed in the homes of the senior doctors.
DeVaVi emergency service was started 5 September 2011. This is a 24-7 on call service operated by Ambulant Psychiatric Team and telephone operators at day units. A website with further information was also established.92

Through DaVaVi, on-call psychiatric service has been established using video conferencing at the three Centres for Mental Health. In this way, the day units and mobile teams have specialist access around the clock. Specialists can be employed and located at different places. At the end of 2011, the specialists were located in Harstad (1), Silsand (1), Narvik (1) and Tromsø (2).

Figure 160  DaVaVi has its own website.

Though DeVaVi, UNN expects to establish acute psychiatric services at the Centre for Mental Health level with outpatient services and the opportunity to admit patients to the local day unit. In this way, transport of patients to Tromsø can be avoided when they can be offered adequate care locally.

Status:

- In routine use.
- Small number of users.
- Locations: Helse Nord

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92 http://www.helsekompetanse.no/devavi  (Last accessed: 5.2.2013.)
Lessons learned:

- The use of VC in psychiatry has been very successful. Due to long distances VC has been necessary for avoiding professional isolation and very efficiently connecting professionals and to follow up on discharged patients.
- The biggest users are the clinics. The success factor is that VC has become a natural part of the work to doctors, psychiatrists, psychologists, nurses, etc.
- Most institutions in psychiatric health care have VC equipment. VC is used to professional and administrative meetings, information exchange, supervision and teaching and to some extent to patient treatment. In Finnmark County, supervision of municipalities is mainly done via VC. VC is described as an important tool in daily work, resulting in less travel and more efficient time consumption.

The Helse Nord Expert Group:

- The Helse Nord advisory group is aware that video conferencing is widely used in psychiatry, including in England.
- The Helse Nord Expert Group concluded that VC in psychiatry is well suited for large-scale implementation. Their conclusion was based on the following projects:
  - Use of interactive media as a tool for aftercare for drug addicts. The project is in an early phase (2005). HN had noted that 1/8 of the health care workers reported that the close connection to the telemedicine solution was incriminating.
  - Network for patient-directed telepsychiatry. (In an early phase.)
  - Mental health and mastering on the Internet. This project created a forum for psychiatric patients. However, this project is outside the HN groups mandate.

Status:

- In routine use.
- Moderate number of patients.
- Locations: Helse Nord, Sykehuset Innlandet

4.9 Telemedicine in radiology

Teleradiology has been a routine service for many years (Figure 161). This has been a pioneering activity, where the radiologists very early started to use and transfer digital images. The development was driven by enthusiasts at the radiology department at UNN, among them Dr. Jan Størmer, who very early saw the potential of this service (Figure 162). In fact, Dr. Størmer himself developed the first database solution. The X-Ray Department at UNN (former RiTø) is linked to all hospitals in the Northern Norway Health Care Region for teleradiological consultations. UNN is used for as a reference for second opinions. In the beginning, the traditional x-ray images were digitized and transferred to UNN in digital form (Figure 163). The radiologists at UNN examined the images on the screen (Figure 164), and reported their diagnoses.

Dr. Størmer and his department had to convince / push the different vendors of radiology systems to support (parts of) the DICOM standard. This was necessary in order to enable communication between different systems and institutions (interoperability).
In September 1992, teleradiology was established between Troms Millitære Sykehus (TMS) and UNN (Figure 165). X-ray pictures were scanned at TMS and transferred to the radiology department at UNN (Figure 166). Before the teleradiologic service was established, radiologists at UNN visited TMS one day a week. After the teleradiology service had been installed, TMS got immediate examination of their images. In 1995, the service became all-digital.
Troms Military Hospital (TMS) uses the teleradiology service offered by UNN more than any other hospital in the region. The hospital has no radiologist and for the most part does not accept patients in need of emergency assistance. During 1997, x-rays of 7,857 patients at TMS and 107 patients at other institutions were assessed by means of teleradiology.

The small hospitals in Norway have normally none radiologist present. For these hospitals, teleradiology is particularly useful. It is not uncommon that a distant radiologist runs entire hospital departments while just one radiographer is physically present.
In an interview with Dr. Jan Størmer he said: “It is difficult to recruit qualified personnel in those areas, so it is good to have teleradiology,” On the other hand, teleradiology is not a panacea. “Radiology is not only about reading images, it is also interventional, it needs experienced professionals, and sometimes it’s just about touching or talking to the patient. It can be degrading for the medical community to see teleradiology as the only solution here,” Størmer insists.

In some situations, face-to-face contact between the patient and the radiologist who interprets the images is necessary. However, according to Størmer, this group are small: “Only in 10% of the cases, I need to talk to and eventually further examine the patient physically when I am in doubt about the clinical indication or diagnostic conclusion.”

Teleradiology in Northern Norway could be divided into three phases:

First generation (1997-1999): “Analogue” teleradiology:

The first generation of teleradiological services focused on long distance printing of x-ray images between the hospitals in Tromsø, Hammerfest and Kirkenes (Figure 168).


In the second generation, digitalization of teleradiology was addressed. The first digital telearadiology connection was between the hospital in Tromsø and Setermoen. From the start in September 1992 the teleradiology service was partly digitized. By the end of 1995 the service was fully digitized. Approximately 6.500 examinations took place each year. This was among the first fully digitized radiology departments, and for many years, this was a showcase for Agfa, which had provided the PACS (Figure 169).

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Lessons learned from 25 years with telemedicine in Northern Norway

Figure 168 In the first generation teleradiology, processed film were used. (Photo: UNN)

Figure 169 Dr. Størmer is examining digital x-rays. (Photo: UNN)

Third generation (1997-2000): Teleradiology in Health Region V:
The third phase of teleradiology included radiology between hospitals with radiologists (Figure 170). The radiology department had implemented web-based referrals (Figure 171). The radiology journal was web-based, too, which allowed remote access (Figure 172 - Figure 176).
Figure 170 The Radiology department at UNN anno 2000. Note that the webpage presents the number of patients 2nd May 2000.

Figure 171 Web-based referral to the Radiology department at UNN. (Around year 2000.)
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 172  Web-based radiology journal at UNN. (Around year 2000.)

Figure 173  Examples of data from the web-based radiology journal at UNN. (Around year 2000.)

Figure 174 Examples of data from the web-based radiology journal at UNN. (Around year 2000.)
Figure 175 Examples of data from the web-based radiology journal at UNN. (Around year 2000.)

Lessons learned from 25 years with telemedicine in Northern Norway

Case study: Teleradiology to Sonjatun
By Jan Fredrik Frantzen (14 August, 2008)

What gets a radiographer from the University Hospital to move to Nordreisa to work at a regional medical centre? “I get much better contact with the patients,” says Gro Dagmar Mobakk. Since 2006, radiographers from the University Hospital of North Norway worked for a week at a time in rotation at Sonjatun. They have operated the new X-ray machine that is connected to the hospital so that patients in the northern part of Troms County could avoid the long trip to Tromsø to take simple radiographs.

Gro-Dagmar Mobakk worked several weeks at Sonjatun the summer of 2007. This she liked so well that she and her husband moved from Tromsø to try a full year in Northern part of Troms County. This she doesn’t regret. “There is a much smaller environment here at the health center, compared with the hospital in Tromsø. It makes the workday more quiet, and I have more responsibility,” she says.

At the hospital in Tromsø she often did six to eight X-ray examinations per hour, while she at Sonjatun has anything between two and 16 patients visited in the course of a day. But then she also gets more time for each individual and better contact with them. She also makes a much larger part of the job now. Instead of just taking the pictures she now are accepting patients when they enter Sonjatun, records all the relevant patient information, sets up the X-ray machine, takes the pictures and sends them to Tromsø. Then she arranges the payment while the patient waits for a response from the specialist, who is at work at the hospital in Tromsø. “I feel like I learn a lot about the medical treatment. For example, I have close contact with the other professional groups here, both doctors, nurses and secretaries. Thus, I have also learned to assist in casting of fractures. In Tromsø I took pictures in a row, and that was it.”

A little minute after Mobakk has pressed the send button the X-ray images are stored into the electronic patient record system in Tromsø. There the radiologist reviews the images before Mobakk gets a reply back if the patient must be sent by road to Tromsø.

There is a distance of 230 kilometres, or 137 km plus two ferries, between Nordreisa and Tromsø. The view along the way is impeccable, but the trip is long. It’s better to wait half an hour for a response from Tromsø. “The only thing that might be negative about working here is that I only can take normal skeletal images to detect fractures, pneumonia, or the cause of joint pain. Academically I lose a bit of progress here. But overall, I think I win a lot. I get a much closer relation to both patients and treatment,” she smiles.

Figure 177 Calmer working, better contact with patients and more responsibility. Radiography Gro Dagmar Mobakk is pleased to work full time on Sonjatun. (Photo: Jan Fredrik Frantzen)

94 This article was originally written by Jan Fredik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/index.php?id=4497312&showtipform=1&cat=97537 (Last accessed: 5.2.2013.)

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Lessons learned

<table>
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<tr>
<th>Problem – Solution</th>
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<tbody>
<tr>
<td><strong>Problem:</strong> To provide radiology services in Nordland, Troms and Finnmark County.</td>
</tr>
<tr>
<td><strong>Solution:</strong> Digitized x-ray images transferred to UNN via ISDN lines. (In the beginning).</td>
</tr>
<tr>
<td><strong>Equipment:</strong> In-house developed database for administration of digitized x-ray pictures (RIS), digitalisation unit (scanner) at remote hospitals, access to ISDN services.</td>
</tr>
</tbody>
</table>

Lessons learned:

- Radiologist at UNN available 24 hours a day.
- Struggle with vendors to comply with interoperability standards. Challenge of making hospitals purchase such equipment. In house development of part of PACS.
- “Radiology is the single service in which the qualitative benefits of digitalization are beyond any doubt.”
- “It is fully possible to send images to radiologists for review, so that the patient does not have to travel.” (Johnsen, Breivik et al. 2006)
- Vendors of PACS / RIS did not follow the DICOM standard. The radiology department had to put a lot of effort into securing interoperability.
- Study: 90% of 2280 interviewed patients were very satisfied with the fact that the service offers radiology locally and that the waiting time is minimal.
- Effect of teleradiology: reduced need for meetings. Reduced response time from x-ray dept.
- 2004: Teleradiology in neurosurgery: Unnecessary travel avoided in 34% of cases (Johnsen, Breivik et al. 2006).

Helse Nord Expert Group:

- The Helse Nord expert group argues that teleradiology is one of the success stories in telemedicine. It is used both for emergency and elective purposes, and has become increasingly important in regional clinical cooperation. It has also been the foundation for telemedicine services in other areas, such as neuron surgery, traumatology, orthopedic, general surgery, vascular surgery, heart surgery and oncology.
- The reason for this success is among others:
  - Professional consensus and enthusiasm among the relatively few radiologist with an long period of service in the region.
  - “Win/Win” between central (UNN and NLSH Bodø) and peripheral (local hospitals and primary care) actors.
  - Willingness among the actors to challenge the current law that puts the requirement of right to privacy up against the requirements of good patient treatment, quality, availability and reduced radiotherapy.
  - Prioritizing of professional profit and optimal adjustment of patient logistics instead of focus on financial profit. (In departments- and hospital accounts, teleradiology has not turned out as a winner. It has, though, been a success for the society, but this is more difficult to prove.) None of the involved health professionals that have contributed with a huge effort on their own have had special financial incentives as their driving force.
Lessons learned from 25 years with telemedicine in Northern Norway

- ICT support to operational and development costs in the clinic. (Norsk Helsenett is developed based on the radiology network that was established from UNN.) The company RisCo A.S, established in 1999, but has an history from 1987 as part of RiTo’s radiology department, has consciously been developed in close cooperation between clinicians, staff members and IT personnel in order to develop tailored radiology solutions that support an efficient use of limited resources.
- Optimal integration between public and private radiology in Helse Nord.

- Teleradiology is suited for large-scale operation, and the established model is a good model for other clinical areas.

Economical analysis:

- An economic analysis of the teleradiology service provided by a university hospital to a local hospital without radiologists was carried out. The average workload at the local hospital was 6000 patients (8000 examinations) per year.
- In these circumstances teleradiology cost NOK 108 per patient, in comparison with NOK 178 per patient for the visiting radiologist service that had previously been provided. The total cost of the teleradiology service amounted to NOK 646,900 per year; in comparison the visiting radiologist service cost NOK 1,069,000 per year.
- Calculations showed that for teleradiology to be cheaper, the workload had to exceed 1576 patients per year.
- A sensitivity analysis showed that assuming a shorter equipment lifetime, for instance four years rather than six years, made the threshold value 2320 patients per year instead of 1576.

Neurosurgical department, UNN:

- Neurosurgical department (nevrokirurgisk avdeling) at UNN has established a telemedicine service where x-ray pictures are evaluated with the help of a teleradiological solution together with information provided through telephone.
- A study has shown that this service was useful in 93% of the cases. As a result of this consultation, unnecessary transportation was avoided in 34% of the cases, local treatment was changed in 42% of the cases, and 13% of the patients were moved to the emergency ward.
- The study concludes that this neurosurgical teleconsultation coordinates and optimizes the treatment. Both patients with head injuries, intracranial tumours and cerebral infarction (stroke) / cerebral haemorrhage were discussed. The service should be further developed as a regional neuron surgical service.

Status:

- In routine use.
- Large number of patients.
- Locations: Helse Nord, the whole country

4.10 Telemedicine in maternity control

In the years 1930-1970, the number of delivery units in Norway increased from 11 to about 200. In the 1990s, as the number of maternity units almost halved, the closure of small maternity clinics and small maternity units in hospitals. The reduction in supply is mainly due to shortage of gynaecologists and reduction in birth rates. There are just over 60,000 births in Norway each year. Most of these (98%) occur in hospitals. The others occur in the home, delivery rooms, or in transit.  

Nurseries in the country are organized as part of community health services and medical responsibility lies with primary physicians. Each GP has little experience in obstetrics, so it is legal with mandatory midwifery services in the municipalities. Several municipalities are struggling, however, to recruit and retain midwives.

In connection with pregnancy and birth control ultrasound examination and CTG are used. In Norway, all pregnant women are offered ultrasound examination around the 18th week of their pregnancy. CTG is an abbreviation for cardiotocography, which is an apparatus, which detects the fetal heart activity and the mother's uterine contractions (-toco-) during pregnancy. Portable CTG machines can communicate from health clinics, home of pregnant women and from ambulances to a midwife/doctor who then gives advice back for further follow-up and treatment.

Figure 178 Patient and midwife in Lofoten. The gynaecologist is located in Bodø. Only the pictures are moved to Bodø. (Photo: NST)

In 2002, a project called “Born with broadband”, where performed in Nordland County (Figure 178). The goal was to study whether telemedicine could improve the quality of pregnancy checks at a small hospital by setting up a system for electronic transmission and storage of CTG readings (cardiotocogram) and ultrasound images between two hospitals (Nordland Hospital Dept. Lofoten and Nordland Hospital) (Figure 179). It was also tried using video conferencing between hospitals for internal education and exchange between the pregnant woman and a gynaecologist. The aim of the project was also to see if it was possible to reduce the number of pregnant women who had to travel to Bodø for the ultrasound examination.

Women's Clinic at Nordland Hospital is Nordland County's largest maternity ward with about 1100 deliveries per year. Lofoten Hospital is a local hospital for 4 municipalities with a total of approx. 24000 inhabitants. Midwives have antenatal clinic, and ultrasound outpatient clinic, and the local midwifery service in the 4 municipalities. There are approximately 300 pregnant women in this area per year of which about 200 give birth at Lofoten hospital and about 100 are transferred to the Women's Clinic at Nordland Hospital.

Ultrasound and still images were transmitted from Lofoten to Bodø using videoconferencing equipment. The ultrasound device is connected to the videoconferencing equipment. The quality of the transfers was very satisfactory and the transmission of ultrasound images via videoconferencing over IP was used in the diagnosis. The transfer took place at least 768 Kbps, but it is recommended to use the maximum transmission speed (3 Mbps), if this is possible.

Videoconferencing equipment did not meet the requirements for medical equipment and therefore were not automatically approved for use in the medical context. It was therefore an isolating transformer with videoconferencing equipment. This is done to fulfill the requirement of maximum leakage currents from the equipment used for diagnosis and treatment of patients.
A digital video recorder was used for recording ultrasound transmissions if it was not possible for a gynaecologist to be present at an ultrasound transmission. The routines that were developed for the implementation of ultrasound from Lofoten to Bodø was:

- Lofoten arranged appointment with a gynaecologist in Bodø and made a reservation for the video conferencing equipment at Lofoten hospital.
- Videoconferencing equipment is used with ultrasound equipment for consultation and the transmission of ultrasound signals.
- Midwife and the patient was present in the Lofoten Islands, a gynaecologist was present in Bodø.
- Midwife performed ultrasound examination.
- Picture of ultrasonic device and/or examination room with the patient and midwife were sent to Bodø.

There was evidence that the telemedicine ultrasound transmission; both medically and technically offered sufficient quality to the gynaecologist in Bodø to evaluate the images. It was therefore possible to use videoconferencing equipment for this purpose. However, the solution with ultrasound transmission was little used. The reason is that the need for assistance with ultrasound transmission was only needed during pregnancy where one detects an abnormality in the fetus, pregnancy, where there are multiple fetuses, or other causes that require closer monitoring of the pregnant. These patients must still be referred to a health institution with higher medical expertise so that the goal of avoided travel was not reached. The number of pregnant women (300) in Lofoten is also low and the number is decreasing. Statistics will be 2-3% of these pregnancies to be abnormal and may need a follow-up with ultrasound. This gives approx. 10 pregnant women per year, which also provides a low volume of ultrasound beams.

In the project about 15 ultrasound transmissions were completed including those that have been included in teaching/training. In 5 of these there were real need for follow-up, and none of them saved a trip.

**Lessons learned**

<table>
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<tr>
<th>Problem – Solution</th>
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<tbody>
<tr>
<td><strong>Problem</strong>: To let patients and midwives in Lofoten get in contact with the gynaecologist in Bodø through videoconferencing equipment. The goal was to identify risk patients that have to give birth in Bodø or that need further examination in Bodø.</td>
</tr>
<tr>
<td><strong>Solution</strong>: Established videoconferencing between Lofoten and Bodø. Ultrasound pictures were transferred from Lofoten to Bodø where they were examined by gynaecologists.</td>
</tr>
<tr>
<td><strong>Equipment</strong>: Videoconference equipment, ultrasound equipment.</td>
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</table>

Lessons learned:

- Before: If the health personnel in Lofoten wanted assistant from colleagues at Nordlandssykehuset in Bodø, pregnant women had to travel to Bodø for another ultrasound examination.
- After: The specialist in Bodø evaluates the transmitted pictures from Lofoten hospital
while the patient is present there.

- Experience from the test period: small volume of patients for which telemedicine services are preferred. This makes the threshold quite high to use the equipment.
- Discussions with the gynaecologist to plan the delivery or follow up talks after the delivery are difficult to perform through VC since the clinicians feel they lose the possibility to detect the body language of the patient and to ensure optimal communication.

Status:

- Not in use.

### 4.10.1 Electronic transmission and storage of CTG

Electronic transmission and storage of CTG was considered to have greater benefit. CTG transfers provided an opportunity for the midwife in the Lofoten Islands to get a second opinion from a midwife or gynaecologist in Bodø (Figure 180). Both midwives and pregnant women in Lofoten felt that this gave an increased sense of security. It was this service that was most used and that users thought it was most needed.

![Figure 180 CTG = cardiotocogram. Transmitted from Lofoten to Bodø.](image)
Furthermore, the project concluded that the use of videoconferencing in maternity care has the potential for becoming a permanent service. This is because more of the consultations in the choice of delivery method, and after traumatic deliveries, can be done through videoconferencing instead of traveling to Bodø.

The economic evaluation showed that this service was not economically profitable. The total annual cost was NOK 458,000. Required number of avoided travel for telemedicine to be a cost-effective alternative is 208 per year. Cost benefit calculation will change when it is possible to reuse video conferencing equipment at hospitals and wellness centres, for example for dialysis, cancer, ultrasound of the heart/vessels, etc. This can create an effective health care to the population in rural areas.

This service was therefore discontinued as a routine service. However, the same service has been launched in a partnership between the district doctor at Otta in Gudbrandsdalen in Southern Norway and gynaecologist at Inland Hospital of Lillehammer. It works fine as a service in the regular routine and is considered very good for both of the participating medical actors and of the pregnant women who receive this offer.

Lessons learned

<table>
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<tr>
<th>Problem – Solution</th>
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<tbody>
<tr>
<td><strong>Problem:</strong> To diagnose heart murmur in newborn babies by sending the heart sound electronically to the specialists.</td>
</tr>
<tr>
<td><strong>Solution:</strong> Established system for sending digitized heart sound to specialists.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Electronic stethoscope, standard PC, network connection to the Norwegian HealthNet, e-mail software DORIS to transmit encrypted e-mail.</td>
</tr>
</tbody>
</table>

Lessons learned:

- Before: CTG-registration was printed on paper and faxed to Bodø for examination.
- After: CTG is transmitted electronically to Bodø. Improved quality of data. Flexibility in analysis.

Status:

- In routine use.
- Moderate number of patients.
- Location: Helse Nord
Lessons learned from 25 years with telemedicine in Northern Norway

DMS - telemedicine in everyday life: A safer environment
By Jan Fredrik Frantzen (24 July, 2008)

The Maternity Ward at Sonjatun in Nordreisa has been connected electronically with the Women's Clinic at the University Hospital of North Norway (UNN) since 2007. “It gives us an easier life,” says midwife Hanne Kristine Johansen.

From January 2007, the midwives have had access to the patient record system DIPS at UNN, and it gives them great advantages. Everyday life has become easier, and they save a lot of work.

“It provides a professional security both for us and for those pregnant women who come here. Furthermore, we are regularly follow-up by the doctors at the hospital,” explains Johansen.

The new digital life gives several advantages such as quick access to answers to laboratory tests from the hospital and the ability to log on and listen to the doctor’s dictation in Tromsø, although it is not yet written into the journal. “We also send referrals electronically and can read about the consultations in Tromsø. We can also scan the CTG records of birth contractions and fetal heart rate right into the electronic health record. The results we obtain can be reviewed by the obstetrician in Tromsø if we are uncertain,” she continues. Thus they do not have to worry about any delays to obtain the following information in the records of Tromsø. And it is appropriate when the pregnancy is on the way back home to North Troms and will be further follow-up on Sonjatun. It makes the midwives better prepared for the challenges that await them until delivery.

If there is a possibility for a complicated birth, we must send the pregnant woman to Tromsø. In such case, we have already updated the EPR. Then the Maternity Ward at the hospital got access to all the information about what we've done so far. “It is more like a shift change than transferring her to another part of the health care system,” Johansen smiling in the end.

Figure 181 Have plenty of space and on-line connection to the obstetrician in Tromsø. Midwife Hanne Kristine Johansen feels safer in her job after maternity ward at Sonjatun was connected with the Women’s Clinic in Tromsø through the health network. (Photo: Jan Fredrik Frantzen)

96 This article was originally written by Jan Fredik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/en-tryggere-hverdag.4497242-97537.html (Last accessed: 5.2.2013.)
4.10.2 Telemedicine in neonatal medicine

The cardiac project at NST developed a solution on how to do electronic registration of heart sounds in children with secondary murmurs of the heart. Heart sounds were then sent electronically from a local doctor to a specialist for assessment (Figure 182 - Figure 184).

Figure 182 A paediatrician checking a received fetus heart sound. (Photo: NST)

Murmurs can be caused by structural defects in the heart or they can occur physiologically in a normal heart. Structural heart disease is found in approx. 8 of 1000 new-borns. Physiological murmurs are found in very many children, and they are a common cause of referral to a paediatrician / paediatric ward. An experienced doctor will almost certainly be able to distinguish an innocent murmur from a murmur caused by heart failure without applying additional investigations like ECG, X-ray examination or echocardiography.

Figure 183 Cardiosound referral.
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 184 The heart sound can also be displayed as a graph.

Because the diagnosis of heart murmurs, first and foremost based on simple clinical examination of auscultation of the heart, it was interesting to find out if this can be done using telemedicine transmission of heart sounds. It was used a commercially available electronic stethoscope from Meditron (Figure 185). The stethoscope was connected to the sound card in a PC and recording could be made directly available in software.

Figure 185 Electronic stethoscope (www.meditron.no)

The results of this project was presented in (Dahl, Hasvold et al. 2002). The authors presented the results from a study were heart sound and a short textual description from 97 children were sent as an attachment to e-mails to remote auscultation (telemedicine) of heart murmurs in children. The aim of the study was to assess the clinical quality of this method. Of the 97
cases of heart sounds, 47 came from patients with no murmur (n = 47), 20 with innocent murmurs (n = 20), and 20 with pathological murmurs (n = 20). The heart sound were recorded using a sensor based stethoscope and e-mailed to a remote computer. The sounds were repeated, giving 100 cases that were randomly distributed on a compact disc. Four cardiologists assessed and categorised the cases as having “no murmur”, “innocent murmur”, or “pathological murmur”, recorded the assessment time per case, their degree of certainty, and whether they recommended referral.

The results show that on average, 2.1 minutes were spent on each case. The mean sensitivity and specificity were 89.7% and 98.2% respectively, and the inter-observer and intra-observer variabilities were low (kappa 0.81 and 0.87), respectively. A total of 93.4% of cases with a pathological murmur and 12.6% of cases with an innocent murmur were recommended for referral. The authors concluded that “telemedical referral of patients with heart murmurs for remote assessment by a cardiologist is safe and saves time. Skilled auscultation is adequate to detect patients with innocent murmurs” (Dahl, Hasvold et al. 2002).

![Figure 186 NST fact sheet: How to get started with heart sound. (In Norwegian)](image)

**Lessons learned**

<table>
<thead>
<tr>
<th><strong>Problem – Solution</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem</strong>: To screen children with a secondary murmur in their hearth. In this way, only the children with organic heart diseases need to see a specialist.</td>
</tr>
<tr>
<td><strong>Solution</strong>: Established a system for sending digitized heart sound to specialists.</td>
</tr>
<tr>
<td><strong>Equipment</strong>: Electronic stethoscope, standard PC, network connection to the Norwegian HealthNet, e-mail software DORIS to transmit encrypted e-mail.</td>
</tr>
</tbody>
</table>
Lessons learned:

- Study: Of 151 theoretical cases of secondary murmur, 12.6% were unnecessarily recommended for referral, whilst 87.4% were correctly advised that referral was not necessary.
- Equipment and instruments needed for telemedicine should be used in routine for local practice as well, especially if telemedicine is seldom applied.
- Example of an additional service.

Status:

- Infrequent use.
- Small number of patients.
- Locations: Helse Nord


4.11 Home monitoring of defibrillator

CareLink is an Internet-based system to help patients and physicians to monitor chronic heart disease where defibrillators (ICD) is implanted in a patient. The system allows the physician to receive and analyze patient data on cardiac condition via the Internet. The system can be programmed so that the data from the patient can be sent automatically at the specified time and date. Eighty patients divided into the three northernmost counties use CareLink (home monitoring) at home. Altogether, UNN Tromsø receives 230 transfers per year. The patient’s control can be done from anywhere. An overview of telecardiology and remote monitoring of pacemakers and ICDs used in Norway can be found in (Færestrand 2010).

One of the patients who are using the home monitor is Trym Ivar Bergsmo. In 2007, Bergsmo got an Internet-based home monitor that quickly could transfer the data from his home to the cardiologist at UNN (Figure 187). The home monitor connects easily to his implanted defibrillator (AED). Through a telephone line data is sent to a server where the cardiologist can bring them to his PC or mobile phone and check if everything is as it should be with the patient. In this way, Trym Ivar Bergsmo does not have to travel to UNN for regular routine checks.

Lessons learned

Problem – Solution

Problem: To reduce the number of travels to the hospitals for patients wearing pacemakers and ICDs.
Solution: Use home monitor equipment for control of pacemakers and ICDs.
Equipment: CareLink, network connection.
Lessons learned:

- Patients using CareLink at home need fewer visits to the hospital.

Status:

- In routine use.
- Small number of patients.
- Location: Norway

Figure 187 Trym Ivar Bergsmo is lying on the floor in his living room in Harstad transferring data from his implantable defibrillator via a home monitor and a phone line to the cardiologist in Tromsø.97 (Photo: Øivind Arvola)

Further reading: (Færestrand 2010)

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97 This example is from an article in Pingvinen in 2009, No. 6, Vol. 6 (“Ufrivillig bundet til UNN”, page 8-9) written by Hilde Pettersen, NST, and later translated into English by the authors. URL to the original (Last accessed: 28.5.2013.): http://www.unn.no/getfile.php/UNN-Internett/OmUNN/Pingu/PDF-arkiv/Arkiv09/Pingvinen_aug_2009.pdf
Lessons learned from 25 years with telemedicine in Northern Norway

Defibrillator control on the Web: More frequent inspection but saves time and money
By Jan Fredrik Frantzen (19 August, 2009)

By using a home monitor less patients with defibrillators need to come to the University Hospital for control. It can take place in their own homes.

Before, patients had to come to the clinic a few times a year for inspection. But by using the CareLink, a home monitor, the patients can easily perform the check up themselves. Thus they do not have to travel to the University Hospital in Tromsø as often as before. The reading from the control gets to the doctors and nurses in Tromsø through the Internet, even though the patient may well be in Kirkenes (900 kilometres northeast). It this way, they can control if the AED has sufficient battery, the wires are in order, and last but not least if there is un-rhythmic heartbeat, or if there have been some complications in which the AED has had to step in with a shock.

“Patients with defibrillators need to frequently check them to make sure everything is as it should. This is essential technology. More than 50% receive life-saving help of the AED. And it is critical that it works. Therefore, they must be checked frequently,” explains senior doctor at the Department of Cardiology, Paul Tande, who has worked with the implantation and follow-up of cardiac patients since 1998. With the home monitor, they can also be checked more frequently than before.

“Now they get extra monitoring because they are checked every four months. And if they feel there is something wrong they can just call us and then we perform a second reading. Previously they would have had to jump on a plane to come here in such cases. Now they get the answer right away,” says nurse Lena Schjødt Andreassen.

Not only saves this time for patients since it avoid the long journey, but doctors also save much time in their workday with this system. “When I have a free moment, I see the readings. I spend perhaps ten minutes on a control of a patient. If he/she had to come here we would use from one half to one hour on the same control,” says Tande.

Cost saving for the University Hospital is also important. Currently there are 80 patients divided into three counties that have such monitors at home and do not have to travel to Tromsø. “For patients, this means that they get a sense of security. They can be checked at any time if they feel any unpleasantness. And many are pleased to avoid the long journey,” says Schjødt Andreassen.

Tande points out that patients do not lose all of their controls. Once a year they have to come for a proper check. In the future, they hope to use the same system on patients with pacemakers, and that there should be a mobile line to the home monitor. Now the pacemakers transfer the data on the analogue line. The device is offered to patients who live more than two hours away from the University Hospital in Tromsø. But since the device is so labour saving, UNN now considers whether it should be offered to patients who are also living in the area.

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98 This article was originally written by Jan Fredik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/hyppigere-kontroll-men-sparer-tid-og-penger.4620222-117531.html
(Last accessed: 5.2.2013.)
4.12 Teleorthopaedic

For many orthopaedic patients in the northern part of Troms County, a 12 hours travel for a 15 minutes’ consultation feels like a waste of time. To eliminate the travels for these patients, an X-Ray Lab at Sonjatun was opened 9 May 2006 (Figure 190). The lab is completely digital and offers the same quality of the examination as at the radiology department at UNN. The radiologists at UNN examine all images from Sonjatun. Radiographers staff the lab at Sonjatun. In 2006, they performed 1577 examinations, in 2007: 2976 examinations and in 2008, more than 3100 examinations were performed at Sonjatun. In average, 1.5 images were taken per survey patient.

In addition to guidance related to x-ray examinations, teleorthopaedic is considered to be suitable for supervision of treatment with plaster as well as simple clinical evaluation. A main incentive for establishing this service is that UNN has to pay the travel costs for all its patients (Figure 191). In 2006-2007, a radiographer from UNN manned the X-ray Lab at Sonjatun. In 2008, a radiographer was employed locally. In addition, one radiographer was ambulating from UNN. The main saving by the lab is reduced travel costs for patients. Due to the high travel costs, two or more patients per day are sufficient for making the lab profitable.
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 191  Electronic interaction will become increasingly important in the health sector in the future. The photo shows an orthopaedic consultation by videoconference. (Photo: Jan Fredrik Frantzen)

The X-ray images taken by Leif-Arne Pedersen in Nordreisa are at least as good as the pictures taken in Tromsø (Figure 192). If the patients can talk to the orthopaedic surgeon via teleconferencing, it allows the hospital to save money and patients do not have to travel unnecessarily long.

Figure 192  Radiographer Leif-Arne Pedersen is preparing a patient for a radiological examination. (Photo: Jan Fredrik Frantzen)
Dr. Astrid Buvik is working on a project to see if the telecommunications orthopaedic consultation at a remote health institution is just as good for some patient groups as an orthopaedic consultation at UNN (Figure 193). “The most important tool for orthopaedic surgeons is the X-ray images. And the quality of them is just as good if they are taken Sonjatun or at the University Hospital,” says resident dr. Astrid Buvik. She has received funding to find out whether the academic quality of telemedicine consultations is as good as when the orthopaedic surgeon meets the patient directly.

Figure 193 Dr. Astrid Buvik at UNN. (Photo: Jan Fredrik Frantzen)

Figure 194 Joakim Berg from Bakkeby is glad he did not have to take time off for a whole day to drive up to six hours to get to the consultation in Tromsø. (Photo: Jan Fredrik Frantzen)
Lessons learned from 25 years with telemedicine in Northern Norway

In Nordreisa, patients are happy for avoiding a trip to Tromsø to get an x-ray. “I was on MRI scanning in Tromsø one and a half years ago. To go there is cumbersome, I had to take time off from work and it was a full day to travel. I use up to three hours each way depending on the weather condition, in addition to time spent in the hospital. And then the whole day has passed,” says Joakim Berg from Bakkeby (Figure 194). He is convinced that local employers will appreciate the greater use of radiology services in Nordreisa. “My employer saves money too, since he will not have to hire extra people on the day I'm gone. So it is both faster and cheaper to come here,” says Berg.

Telemedical examination takes place as follows (Figure 195):

1. The nurse welcomes the patient at Sonjatun.
2. The nurse helps to put on plaster / examination.
3. Contact with a specialist at UNN through VC.
4. If needed, do a demo for the patient. Shows X-ray images.
5. Make agreements for further treatment, referral to surgery, further examination, etc.
6. Sick leave, prescriptions, applications for orthopaedic devices, etc. as needed.

Figure 195 A nurse at Sonjatun prepares for the next patient. (Photo: Jan Fredrik Frantzen)

Teleorthopaedics consultations are not suited for all orthopedic patients, e.g., patients with shoulder disorders, or young people with knee injuries. For these patients it is often important that the doctor examines them physically as well as studying the X-ray images.

Technical equipment includes:

- Broadband, Norwegian Healthnet (10Mbs full duplex).
- Video device, LCD monitor 26” with camera / mobile device codex at Sonjatun.
- Smaller unit in Tromsø, stationary.
Standard UNN PC and printer (in Tromsø and Sonjatun).
Remote controlled camera. Operated by UNN. The camera can zoom for more details, but it cannot move. In such cases, the patient must move.
Display
  - Pre-set / “layout”
  - Viewing x-rayed image

The procedure to connect to UNN is designed to be easy. To connect is similar to “Make a phone call”.

In the beginning, several technical problems occurred, including:

  - “Black screen”
  - Poor picture quality from Sonjatun (Dec 2007).
  - Poor picture quality from UNN (Oct 2008).
  - No contact with the Codex at Sonjatun (25 Nov 2008).
    - Needed to borrow equipment locally, delay of sound.

Lessons learned:

- Most patients want this service.
- The service works out well.
- Affordable technical problems.
- Municipal Health Services treats more patients locally:
  - More discussion between radiologists and radiographs.
  - More trained plasters (The Municipality doctor needed a plaster course).
- Not all consultations can be videoconference consultations. Sometimes there is a need for direct examination.
- Communication difficulties (oral) occurred.
- Very important:
  - Technical expertise locally.
  - Assistance from ICT Health North.

Status:

- In routine use.
- Moderate number of patients.
- Location: Helse Nord
4.13 Telemedicine in dental care

4.13.1 Sv@ltann

NST’s first project within the field of dental health was between the dentist clinic at Longyearbyen Hospital on Svalbard (Svalbard is an island located at the latitude of 74 to 81 degree north) and the ambulating orthodontist in Bergen at the west coast of Norway.

The dental clinic at Longyearbyen Hospital provides dental services for the Norwegian population on Svalbard (approx. 1500 persons). One dentist and one dental assistant work in the clinic. They perform approximately 1700 consultations annually. The majority of these consultations are emergency treatment. The need for surgeon dentists is covered by 5 yearly visits by the orthodontist from Bergen who takes care of 30 patients.

![Figure 196 The opening screen of Sv@ltann.](image)

The project Sv@ltann was established based on a request from the surgeon dentist, who wanted continuously access to patient data (Figure 196). The dentist expressed needs were the possibility for screening of patients in accordance with start of treatment, the possibility of planning of treatment before the visits in Longyearbyen, faster and better specialist evaluation and supervision and improved quality of emergency treatment.

The solution made was comprised of an IP based communication based network between the local dentist and the surgeon dentist in Bergen. Through this channel a specially developed Internet site, controlled by password, for x-rays (OPG, CEPH and individual tooth images) were developed. In addition digital still images were send (Figure 197, Figure 198).
Figure 197 Picture from a patient displayed in Sv@ltann.

The orthodontist has used the site for treatment planning prior to his visit to Longyearbyen, and consultations with other specialists at the Faculty of Dentistry, University of Bergen, especially in connection with the treatment of two patients with lip-jaw-palate.

Figure 198 X-ray image viewed in Sv@ltann.
Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem:</strong> How could the visiting surgeon dentist be offered continuously access to his Svalbard patients’ data?</td>
</tr>
<tr>
<td><strong>Solution:</strong> Development of Sv@ITann, an Internet-based tailored (“limited”) EHR.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Internet access, Sv@ITann.</td>
</tr>
</tbody>
</table>

Evaluation of the project is difficult because of the small population of Svalbard, just 30 orthodontic patients. Since there are only two main users of the service, the personal interest is crucial. Feedback from users is that the service meets your expectations and that it is desire that the service becomes permanent.

Lessons learned:

- Telemedicine services have improved the dentist services (surgeon dentists) at Spitsbergen.

4.13.2 Ortopol@r

Norway is one of the countries in the OECD countries with the highest proportion of dentists in relation to the population. But the dentists are very unevenly distributed geographically. Therefore, decentralized education of orthodontists, Ortopol@r-project, was initiated in 2002 (Figure 199).

In autumn 2003 it was taken up 10 candidates at the regular orthodontics program at the University of Oslo (UiO). Two of the candidates conducted training locally in Tromsø. They used distance learning based on video conferencing and online study tools to connect to UiO. Two sessions a day, four times a week over three years, the two Tromsø-students with students in Oslo, seated around their own tables in the two cities, heard lectures and discussed via the big screen. The project chose to focus on two general dentists who were established with family in Northern Norway, and gave them an offer where they could stay home while studying.

The clinical studies in which candidates practice patient care takes place under the guidance locally. The evaluation also showed that the two students in Tromsø are more satisfied with the quality of the time they had together with the teachers than the candidates in Oslo. The OrtoPol@r project established a solid foundation for developing decentralized orthodontist education.
4.14 Telemedicine at regional medical centres

An important part of the health care service in remote areas of Norway is the regional medical centres (DMS) or in Norwegian: “DMS - distriktsmedisinsk senter”. In Nordreisa, they are very familiar with long distances. Therefore, it is perhaps no surprise that Sonjatun Health Centre has adopted telemedicine as much as they have (Figure 200). They are in fact veterans of the field. Sonjatun was opened in 1977. The idea behind the new health centre was to bring together all health services in Nordreisa under the same roof. In 2008, they took the next step and gathered all health services in North Troms in one network (Figure 201).

Today, Sonjatun, in cooperation with UNN, offers, e.g., X-ray services, orthopaedic guidance from the specialist in Tromso and light treatment for patients with skin disorders. Sonjatun has already a history of the use of telemedicine. In 1991, they started a video phone-based

Further reading: (Høvik, Christiansen et al. 2004, Myrvang, Lunder et al. 2006, Olsen, Stenvik et al. 2006, Solvoll, Henriksen et al. 2007)
service to keep in touch with aphasia patients scattered throughout northern Norway (Figure 202).

![Figure 200 Sonjatun DMS. (Photo: Nordreisa commune, web-page)](image)

In 1996, videoconference from the Relatives School (“Pårørendeskolen”) in Oslo, in cooperation with NST, where offered to relatives of patients from Nordreisa. The relatives came to Sonjatun and followed the teaching that was transmitted from Oslo, 1200 km away.

![Figure 201 Herbjørg Fagertun would rather use the time and money on treatment of patients in North Troms, than to move them back and forth. (Photo: Jan Fredrik Frantzen)](image)

Sonjatun has also established various professional networks covering the northern part of Troms County. Health professionals from throughout the area meet regularly to discuss the treatment of cancer, dementia, drug abuse and mental health. Sonjatun DMS is also linked to the lung ward at the University Hospital and the Elizabeth Centre in Tromsø in the lung network in order to improve the treatment of COPD patients. Most of the work of these networks is done through VC, which means saved travel time for the participants. It takes about an hour to drive to Nordreisa from Kvenangen, Kåfjord and Skjervøy.
Videoconferencing is a great help to support those affected by aphasia, but to directly contact patients, it has its limitations, says speech therapist Kari Anne Berg.

(Photo: Jan Fredrik Frantzen)

The following health care services are offered at Sonjatun DMS:

- Learning and mastering centre
- Diabetes care
- (General) ward
- Maternity ward / Delivery room
- Intermediate units
- Cancer treatment
- Dialysis
- X-ray
- Skin / Light treatment
- Other specialist health services

“I think it's fabulous here. We get very good treatment by the nurses. And it is only 10 minutes from home. This is certainly much better than to sit half the day on the bus, and we can meet the dermatologist both through video conferencing and when they come visiting us from Tromsø.” Says dermatology patient Sissel Richardsen (Figure 203).

Patients from the northern part of Troms County appreciate that they can travel to Sonjatun instead of traveling the long road to Troms (Figure 204). Before the service was offered at Sonjatun, an elderly using hearing aids had to travel to Tromsø for hearing aid control. Given that an elderly who lives in Burfjord has an appointment at the ENT clinic, UNN Tromsø, at 11:00 AM, he/she has to get up at 4:15 AM and departure at 05:00 due to coordination with others who have an appointment at 10:00. (The transportation is coordinated from UNN.) He/she would probably have to return from Tromsø at 15:00 due to co-ordination, which means that he/she will be home at 20:00. This means a 15 hours travel for hearing aid control, which in itself probably takes 15 minutes.
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 203 Together with Ms. Torunn Hansen, nurse Solveig Tønder (right) offer dermatology patients from northern Troms county phototherapy for both the hands, feet or the entire body. Sissel Richardsen (left) from Sørkjosen appreciates this, and she also appreciates “a little extra color” in the dark period (i.e., the winter months without daylights from the sun). (Photo: Jan Fredrik Frantzen)

Table 5 shows the different health care services offered at the district medical centres in Troms county. They are all cooperating with UNN in Tromsø.

**Table 5  DMSs in the responsibility area of UNN**

<table>
<thead>
<tr>
<th>DMS</th>
<th>Sick bay/Observation bed</th>
<th>Inter-municipal emergency clinic</th>
<th>Radiology</th>
<th>Mobile specialist-service</th>
<th>Delivery room</th>
<th>Rehabilitation/Intermediate beds</th>
<th>DPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nord-Troms (Sonjatun)</td>
<td>X</td>
<td>Examination</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Indre Troms (TMS)</td>
<td></td>
<td>Military Civil examination</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Midt-Troms (Finnsnes)</td>
<td></td>
<td>Examination</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Tromsø</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Under establishment</td>
<td>X</td>
</tr>
</tbody>
</table>
Figure 204 Ms. Marit Jensen prefers to go to the cabin instead of spending the time on the bus between Skjervøy and Tromsø. (Photo: Jan Fredrik Frantzen)

Huge savings on treating the patients in the municipalities

According to an article in the Norwegian newspaper Aftenposten100, each year hundreds of thousands of bed-days in Norway could have been avoided if the health care services offered outside the hospitals have been better (Figure 205). The article refers to calculations done by the Ministry of Health and Care Services that show that, in overall, 550,000 bed-days could have been avoided at Norwegian hospitals on a yearly basis. 150,000 of these are pre-treated patients who are healthy enough to go home, but that does not have an alternative health care service outside the hospital. 400,000 patient days are spent by patients who did not needed hospitalization, but could have been treated in the municipality if the local health care service was appropriate. In total, Health-Norway would be able to save about NOK 1.1 billion a year if these patients were receiving help outside the hospitals.

The calculations are based on that one hospital day and night on average costs NOK 5,500. The price may vary based on the patient’s health condition and the type of hospital where the patient is treated. From this, the hospital budgets could save about NOK 3 billion. But it costs to treat patients in other locations as well. Alternative care is estimated to 24 hours price of NOK 3,500. Thus, the net saving for an overnight stays is NOK 2,000 respectively.

The National Centre of Rural Medicine (NCRM)101 is situated in Northern Norway, at the Department of Community Medicine, University of Tromsø – The Arctic University of Norway (Figure 206). The initiative to the centre was taken in 1999. The centre was started in 2005-2006. Since 2007 the centre is permanently established. NCRM is working to promote research, professional development projects, education and networking amongst physicians and health personnel in rural and remote areas. The aims are to bridge praxis and academia, to contribute to quality improvement, and recruitment and retention of health personnel.

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101 http://www.nsdm.no
Lessons learned from 25 years with telemedicine in Northern Norway

**Figure 205** “Health-Norway could have saved more than NOK one billion”, headline in the Norwegian newspaper Aftenposten, 20 October 2008.102

**Figure 206** The University of Tromsø hosts the National Centre of Rural Medicine (NCRM) (http://www.nsdm.no/english)

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102 [http://www.aftenposten.no/nyheter/iriks/article2723908.ece](http://www.aftenposten.no/nyheter/iriks/article2723908.ece) (Last accessed: 5.2.2013.)
Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem:</strong> How could we establish telemedicine services to regional medical centres (DMS)?</td>
</tr>
<tr>
<td><strong>Solution:</strong> Use VC and store-and-forward between professionals and between professionals and patients, especially for follow-up on discharged patients.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Videoconference equipment, secure e-mail communication, access to the Norwegian Healthnet.</td>
</tr>
</tbody>
</table>

Lessons learned:

- The use of VC in general, and in psychiatry, in particular, has been very successful. Due to long distances VC has been necessary for avoiding professional isolation and very efficiently connecting professionals and to follow up on discharged patients.
- The biggest users are the clinics. The success factor is that VC has become a natural part of the work to doctors, psychiatrists, psychologists, nurses, etc. (cf. Table 5)

Helse Nord Expert group:

- The Helse Nord Expert group concluded that a gradual escalation of telemedicine solutions at the regional medical centers (DMS) is wanted.
- The reason for focusing on the DMS is to provide a basis for an increased volume of telemedicine initiative. The focus areas are chronic illnesses, cancer and psychiatry.
- The Helse Nord Expert group had a number of critical issues to discuss regarding the DMS. Among other things, they questioned evidence of DMS effectivity and selection of appropriate specialties. It was also questioned whether it is right to devote a significant investment in telemedicine equipment to the DMS without first to have given priority to local hospitals. This because there is reason to believe that local hospitals will have a larger volume than the DMSs will have. Regional medical centres are in the melting pot and it is thus difficult to know how they will look like. Such centres will still get to be very different, where the design of each centre will depend on factors such as geography, demographics, distance to hospital, distance to clinics, ambulatory specialists, the presence of enthusiasts with special interest, etc. The use of telemedicine in such centres is definitely of interest, but it is difficult to create a template to be mechanically used at all centres.
- Each centre must in time find their needs, their partners and then try to implement the various telemedicine systems or develop new ones.
- The Expert group studied experience with physician-patient contact over the Internet. This project is out of specialist services. It contains, however, an interesting approach. In the future, there is reason to believe that patients want a stronger impact on their health journal.

4.15 Net-based competence

Distance education is currently the largest telemedicine service offered in Norway (Figure 207). Based on the solutions developed by NST in this field, in 2007 NST offered lectures via videoconference in more than 160 different medical topics with more than 13,000 participants (Figure 208). This lecture series covers relevant topics in areas such as the elderly, autism, physical therapy, substance abuse / mental health, nursing and many more (Figure 209). Health and social workers from local and specialist health services participating in the same lectures and 902 videoconferencing studios from across the country are registered participants (in 2007). Number of participants varies from 3 to 40-50 in the individual studios (Figure 210).

This service emerged in the mid nineties based on findings in early telemedicine projects that showed that linking the university hospital to more remote hospital by means of videoconference led to the transfer of competence from the centrum to the peripheries. This was seen in most of the services developed in the different medical professions, and it led to the thinking that this competence referral had to be put into an organized system.

NST started to invite all the hospitals, first in the northern region, and a year after, in all the 5 Norwegian regions, to participate in a voluntary work where the in-house lectures, held as a mandatory task to all hospital doctors, were broadcasted among all hospitals. Very soon the nurses joined in and all this lectures were announced, twice a year, in what was called a Distant Education Catalogue (Figure 209). In the first years, this catalogue was paper based. It soon became obvious that a maintenance organisation for handling the invitations to lecture, to teach the lectures to speak on videoconference, organizing the link up between the parties had to be established.

Figure 207 Example of early videoconference based teaching. (Photo: NST)
All these procedures were in the beginning manually taken care of. The next step was to engage a private company to make software that could handle all this. This was a success that made all the work much easier. However, the software was based on a proprietary solution, and it was in 2006 replaced with a new solution, based on open source code, primarily developed by the The Adaptive Technology Resource Centre in University of Toronto, Canada.

Figure 208 A health care worker following a lecture on her own computer. (Photo: NST)

Figure 209 The front page of NST’s 2001 National catalogue for distance education for health care workers.
Lessons learned from 25 years with telemedicine in Northern Norway

Today, online learning at NST is managed by the Online Skills Development group (NKU). NKU is a team with multidisciplinary expertise in pedagogic, media studies, health, marketing and technology. The development of online learning courses is done in collaboration with health and social workers, resource centres and unions to ensure that the courses respond to the needs among health care professionals. The online learning is available through the e-learning portal helsekompetanse.no.

![Figure 210 Multiple sites could participate. (Photo: NST)](image)

The online learning service allows for tailor-made solutions to suit each subject matter and audience. NKU provides assistance all the way from idea to course development, implementation, support and evaluation. This work is done through counselling and training in web-based tools for the production of content, pedagogical guidance for the development and implementation of health-related learning offers, advising the organization of knowledge services, coordination and marketing, technical support and operation and evaluation (Figure 212).

The tools used to develop skills provision is related to the NST's e-learning portal www.helsekompetanse.no and the use of videoconferencing. The combination of these, in addition to physical meetings, the starting point for development.

The e-learning portal contains:

- Overview of online courses, professional community (“fagnett”) and video lectures.
- Overview of videoconferencing studios in Norway.
- Tutorials, courses and information material for the development of online services.
- Database with links to the relevant centres.
- An active study centre.
- Tools for the development and sharing of expertise offers.
- Chat, forum, blog and cooperation and sharing of documents.
Videoconferencing is used to tie together groups, regardless of geographical location. Participants see and hear each other, and several studios are connected in professional networks, training and educational programs. Videoconferences are often recorded because it gives users who do not have videoconferencing equipment available at their workplace the opportunity to watch the lectures later via streaming to their own computer. Videoconferencing is, alone or in combination with helsekompetanse.no, used in:
Lessons learned from 25 years with telemedicine in Northern Norway

- Education
- Professional network
- Cooperation Forum
- Lectures with different themes
- Guidance

Figure 213 The idea behind the e-learning activity at NST is to try to constantly improve the learning material by taking into account the lessons learned from previous courses.

NST wants that these solutions and services should provide the healthcare system access to good and affordable technical solutions based on open source. There is desirable to have a greater degree of national coordination, so that cooperation and exchange of experience between regions and across the line level can be done at the lowest possible cost. The goal is to prevent duplication, unnecessary investment and resource use in health care.

Competence building across national borders was stated in 2006. Participants included 378 participants from Norway, Sweden, Iceland, Åland, Finland and Denmark in a joint competency program that focused on disability under the auspices of the Nordic Council of Ministers and Nordic Cooperation on the handicapfrågor¹⁰³ (NSH). The focus was expanded in 2007 and established a network of competence between Iceland, Greenland, Faeroe Islands and Norway.

¹⁰³ Nordiska samarbetsorganet for handicapfrågor
4.15.1 Example of courses
Below follow some examples of courses offered in 2011. For more courses, see www.helsekompetanse.no

Drug Calculations\textsuperscript{104}

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{drug_calculations.png}
\caption{Drug Calculations course page.}
\end{figure}

Audience:

- The main target group are nurses who want to brush up their knowledge about the drug calculation, but the course is also available for other professions who wish to practice medication calculations.

Practical information:

- The course is open. But if you want a diploma you must contact Hospital Pharmacy Northern Trust to take an exam.

Program coordinator:

- Hospital Pharmacy Northern Trust.

\textsuperscript{104} http://www.helsekompetanse.no/kompetansetilbud/kurs/medikamentregning (Last accessed: 5.2.2013.)
Training in Huntington's disease\textsuperscript{105}

Description:

- The online course is intended for professionals who work with patients with Huntington's disease and want to learn about diagnosis and various aspects of this disease. Through the Internet, participants come in contact with other professionals in the same situation, and advisors with special expertise in the field. The work will be acquisition of knowledge from the course pages on the Internet, sharing experiences in a discussion forum and Q&A via the course pages.

Audience:

- Professionals in nursing homes, care homes and home care

Contact: Centre for Rare Disorders, Oslo University Hospital.

Diversity and opportunities\textsuperscript{106}

Description:

- “Diversity and opportunity” is a collection of e-learning courses for people who work with persons with disabilities. The courses are open, and participants who complete the courses and pass the test receive a diploma. Service providers can demonstrate

\textsuperscript{105} http://www.helsekompetanse.no/kompetansetilbud/kurs/opplaering-i-huntingtons-sydom (Last accessed: 5.2.2013.) \textsuperscript{106} http://www.helsekompetanse.no/kompetansetilbud/kurs/mangfold-og-muligheter
their own competence, and the employer can document that training has been given. With these courses we offer quality-assured training that can contribute to the best possible services to people with disabilities.

- E-learning courses in diversity and opportunity for all who work for the handicapped opportunities to implement the same course.
- Diversity and opportunity consists of three courses:
  - Working in someone else's home.
  - Culture, leisure and friendship.
  - Challenging behaviour.
- Each of these is the extent of approximately 8 hours. They consist of a total of 30 chapters. You can split the courses just as you wish. When you are logged in, the system knows which pages you read. You also get a graphical representation of how much of the course you have completed.

Audience: People who work for persons with developmental disabilities.

Program coordinator: Coordination Council for work for people with disabilities.

Time period: Continuous

**Electronic Patient Record (EPR)**

Description:

- This is an Internet-based information portal for users of electronic health records (EHR) in the University Hospital of North Norway. The portal can help health professionals understand how the fulfillment of tasks and interaction routines in the clinic can be strengthened or weakened depending on how the EHR system (DIPS) is set up and used.

Audience:

- Health professionals in patient care, managers, super users of the EHR.

Practical information:

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Lessons learned from 25 years with telemedicine in Northern Norway

- The portal is open and can thus be accessed by anyone with Internet access. To access the information, the users must access the web pages within UNN.

Program coordinator:

- SKI, Clinical Systems, University Hospital of North Norway.

**Learn dementia with broadband**

![Learn dementia with broadband](image)

**Description:**

- This is an ICT-based learning program for those who want to learn more about dementia and how relatives experience their situation. The learning program is offered in cooperation between Bjønnesåsen Residential and Treatment Center in Notterøy Municipality, National Centre for Ageing and Health, University College of Vestfold and the Norwegian Centre for Integrated Care and Telemedicine.
- The aim of the learning program is to improve collaboration between employees in home care services and families of people with dementia. The learning program runs for seven months and consists of 4 modules. Problem Based Learning (PBL) is used as the learning method. The learning platform helsekompetanse.no is used in addition to videoconferencing.
- Learn dementia with broadband has been approved as meritorious for clinical specialists. The learning program is approved for 15 credits in the college system.

**Audience:** Employees in home services and nursing homes (all occupations).

**Practical information:**

- The online learning program begins with a two-day introductory course including computer training and the introduction of PBL as a learning method. Use of the Internet and video conferencing is part of the course. You must have Internet access and broadband to participate and have access to video conferencing facility.

Program coordinator:

- Bjønnesåsen Residential and Treatment Center, Notterøy Municipality in cooperation with the National Center for Aging and Health (NKAH).
Success for Internet courses: Provides professional security
By Jan Fredrik Frantzen (3 April, 2007)

The online course “Learn dementia with broadband” is now in its fourth year. And the feedback from the participants is clear: This gives professional confidence.

Mette-Marit Lødveteig Aasebø from Volda has worked in healthcare for 24 years and has daily contact with both dementia patients and their relatives. She is clearly pleased with the course, which the Norwegian Centre for Telemedicine (NST) has helped to develop. “This is very instructive. It's great to get professional input and be able to share knowledge,” she enthuses. The 20 students, who this time comes from Volda, Nord-Trøndelag and Notterøy work in groups at home and are gathering online on discussion forums, video conferencing and video lectures. Mette-Marit is the only participant from Volda in the course, but the technical solutions used in the course – videoconferences and discussion forums on the Internet - means that she does not have any problems to follow the course. “We learn a lot about how we can make life easier for the families through counselling and by providing adequate assistance to those affected by dementia,” she continues. In addition, participants learn more about the disease and the characteristics of the various stages of it. It gives them better opportunities to adapt the treatment to the situation the patient is in.

Anette Hansen is a group leader at the day centre and research unit at Bjønnesåsen Residential and Treatment Centre (“Bjønnesåsen Bo- og Behandlingssenter”) in Notterøy municipality. She took this course last year and is one of two instructors for this year's course. She has 14 years of experience in geriatric care. “I wish I had this course when I worked in home care. It is extremely useful and has given me much greater insight and confidence, especially in relation to family members and how we can help them.”

Along with Signe Gjelstad, the other instructor, Hansen updates the website for the project, arranges with speakers, manages the discussion forum on the web and guides students in academic matters. And she praises the cooperation with NST in Tromso. “We have a great partnership. Rigmor Furu and Zoltan Tot's professional expertise have given us lots of help along the way,” she concludes.

The course was developed as a collaborative project between NST, the Norwegian Centre for Dementia, Relatives School in Oslo and the company Inger Hagen. The development of the course was funded by the Research Council of Norway. Today, the course is offered in collaboration between Bjønnesåsen Residential and Treatment Center in Notterøy municipality, National Centre for dementia and the Norwegian Centre for Integrated Care and Telemedicine.

Through short videos on the Web site for the course, students formulate questions that are relevant in dementia care. Then they must create their own problems, which they must solve. In collaboration with the College of Vestfold, those who wish to do that can take exams and get 15 credits for the course. Norwegian Centre for Integrated Care and Telemedicine (NST) is responsible for technical development and educational organization. NST is responsible for training in distance learning, videoconferencing and follow up with appropriate support.

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108 This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/gir-faglig-trygghet.518222-80451.html (Last accessed: 5.2.2013.)
Lessons learned from 25 years with telemedicine in Northern Norway

NST also offers international courses. Some of the international courses follow as a natural part of NST’s WHO collaborating centre status.

Medical Peace Work

![E-learning course for new medical peace work project workers.](image)

**Module 1: Peace, conflict and health professionals.**

**Description:**

- In recent years, violence at all levels has been experienced as a serious health problem. This has led to an understanding that health professionals must take more responsibility for preventing violence. The course's main objective is to provide an introduction to the concepts that are collected under the term Medical Peace Work, and includes the following seven modules:
  - Module 1: Understanding peace and conflict
  - Module 2: Medicine and human rights
  - Module 3: War, weapons and strategies of violent conflict
  - Module 4: Structural violence and the underlying causes of violent conflicts
  - Module 5: Peace-health interventions in armed conflict
  - Module 6: Refugee and migration challenges
  - Module 7: Inter-personal and self-directed violence
Audience:

- The course is intended as an introduction to medical peace work to doctors, nurses, people who work with public health, or other health professionals. In particular, it is meant for those who want to:
  - understand peace and the relation to improved health.
  - work for humanitarian organizations or human rights.
  - improve the health of children, refugees and other vulnerable groups in conflict situations.

Practical information:

- The course consists of seven independent but concatenated modules. It is recommended to take them in order, but you can also choose whether it is someone that is particularly interesting for you. Each module is structured into 2-4 chapters, and each chapter has several lessons. Each lesson has several related questions for which you can test your knowledge. In addition, there are 19 multimedia cases with video, questions and voice that guide you through the key concepts. Estimated workload for one chapter is 2-4 hours – the course is estimated at around 60 hours.

Program coordinator: Centre for International Health
Time period: Continuous.

Other examples of international courses:

Welcome to ‘An Introduction to the AIDS Competence Process’

![Course in AIDS competence process. This course is also offered in French. (On peut trouver une version française de ce cours ici.)](image)
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 217 E-learning course for prosthetists and orthotists in Cambodia.

Figure 218 E-learning course for medical students abroad who need to take additional exams in Norway.
The learning portal Helsekompetanse.no is ready for a new season of courses and lectures on video. For the first time health care personnel from the Nordic countries are involved, both as presenters and participants. “We now have a wider choice and higher quality courses. By using the health care environment in the Nordic countries, we can offer more skilled teachers and greater breadth of topics. It will hopefully provide fully booked courses,” says education coordinator Torbjørg Lindquist at the Norwegian Centre for Telemedicine. She coordinates the lectures.

Helsekompetanse.no had in 2006 approx. 13,000 participants in the popular courses offered over videoconference in Norway. New this fall is to expand the geographical footprint and open the courses to participants from Sweden, Denmark and Finland. The Nordic Cooperation on Disability (NSH) in Sweden is responsible for some lectures. “NSH has helped to create courses in eighteen months. They are very happy with this way of sharing expertise,” says Torbjørg Lindquist.

The course "Design for All" is one of a total of 20 different topics in Helsekompetanse.no’s fall program. The course is specifically about the design and adaptation of buildings, so they can be used by people with physical disabilities. Lecturers and expertise come from both the Nordic Academy för folkhälsovetenskap in Sweden and the Ministry of the Environment and the Housing bank in Norway.

Among the most popular lecture series include those offered by the Norwegian Resource Centre for violence, traumatic stress and suicide prevention. At its peak there were 22 video conferencing studio connected at the same time as these courses were on the air this spring. “Ideally, we do not connect up more than 10 studios at the same time since everyone should be given opportunities to ask questions. 22 can be slightly in excess,” smiling Lindquist. In the lecture series from the Resource Centre participants this semester are introduced to topics such as violent fathers, forced marriage and how to prevent people from taking their own lives.

Figure 219 The learning portal Helsekompetanse.no offers a wide range of courses and obtain speakers from the Nordic countries to the popular lectures on video. 
(Photograph: Jan Fredrik Frantzen)
Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem:</strong> To provide eLearning courses for Norwegian health care workers.</td>
</tr>
<tr>
<td><strong>Solution:</strong> Establish an eLearning group at NST.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Videoconference equipment, learning administration system / learning management system (LMS).</td>
</tr>
</tbody>
</table>

Lessons learned:

- eLearning can be applied anywhere.
- Increases access to knowledge for Norwegian health care workers.
- Continuous education for health professionals.
- Reduces students’ travel abroad.
- Cost effective.
- Re-use of course modules possible.

Helse Nord expert group:

- Helse Nord expert group concluded that education is one of the winners in telemedicine. They advise Helse Nord to prepare telemedicine-based education independent of field. This can be done by having a sufficient number of VC studios available. The group expects that PC-based VC will be available soon, and that this service must get high priority in Helse Nord.
- Supervision of general practitioners is also important, and can take place through this kind of technology and services.
- The education is made available on the net, either as VC or as part of a digital library, where the technology is used to course/education, supervision and professional network within and between different health care service levels.
- More than 13,000 participants are involved, both from primary and secondary care. The services can be classified as:
  - Open interdisciplinary and cross sector lectures.
  - Field-specific lectures.
  - Course/further- and continuing education.
  - Field-specific networks and cooperation.

- Today, an increasing education effort is focused on the needs to patients and their relatives.
- Today, VC is most often used. This is expected to change to PC-based solutions.

Status:

- In routine use.
- Large number of users.
- Locations: Helse Nord, the whole country.

4.16 Teleendocrinology (Telediabetes)

Self-management of diabetes is a complex task, which involves maintaining healthy blood glucose levels through a balanced diet, physical activity, and for many, medication. Success depends on extensive monitoring of these parameters. For this purpose, researchers at NST have developed an interactive mobile tool, the Few Touch application, to help people with Type 1 and Type 2 diabetes to manage their health (Årsand, Olsen et al. 2007, Årsand, Olsen et al. 2008, Årsand, Olsen et al. 2008, Årsand, Olsen et al. 2008). Blood glucose and physical activity data are captured wirelessly from sensors, and nutrition data are registered through a simple user interface (Figure 220). The data are processed and presented to the user. Users can easily view how their blood sugar develops, how active they've been and where they are in relation to their personal goals for diet and activity (Figure 221).

![Figure 220 The Few Touch application includes sensors (blood glucose meter and step counter), wireless communication and smartphone.](image)

An important design goal has been to present the data in a simple and user-friendly manner. To optimize usability, blood glucose and exercise data are transferred automatically to the Smartphone. Users may choose to record only the time of their meals, or they can easily add a rough description of what they ate and drank. The user can also find general information about diabetes as well as some practical advice (Figure 222). A model has also been developed to transfer the health values to an Electronic health record (EHR).
Lessons learned from 25 years with telemedicine in Northern Norway

The functionality of the Few Touch application is described in (Årsand, Varmedal et al. 2007):

- **Automatic Data Transfer**: To capture blood glucose data and exercise data, the Few Touch application uses a blood glucose meter and a step counter. To optimize usability, data from these sensors are automatically transferred using a “no-touch” principle. This means that the users do not need to initiate data transfer from the sensors; the sensors set up short-range communication to the Smartphone automatically.

- **Entry of Nutrition Data**: The users can record their food intake using two different levels of detail: a) simply choose the kind of meal (breakfast, lunch, etc), or b) choose the kind of food they eat (bread, pasta, etc). This design has been chosen to make the data entry process as easy as possible, enabling the user to decide on the level of detail to record. Thus, the process requires only two or three touches or navigation moves. After each entry, users are presented with a summary of the current status of their nutrition habits.

- **Motivational Information**: By including daily tips and information related to practical situations, i.e., information that is sufficiently “down to earth”, the aim is to motivate and educate the user. Newer functionality includes the possibility to reflect upon the development of the glucose level (Figure 223).
Since 2008, nutrition has become more important. One of the major issues in this category is how to identify the appropriate nutrition or food items, e.g., from the typical food items that are available in Norwegian supermarkets (see Figure 224).
Lessons learned from 25 years with telemedicine in Northern Norway

By the use of the included camera, the users can take pictures of their meal for later examination. In the image, the following information is included: time, date, activity, blood glucose measurements before and after(!) the meal, the insulin dosage (in Insulin Units), and an optional comments from the user (see Figure 225). (The results from a pilot study is published in (Froisland and Arsand 2015).)

![Diagram showing the features of the Diabetes Diary](image)

**Figure 224** An important goal is to quickly and correctly identify the correct food item, and thus get the correct nutrition record.110

In research versions of the Diabetes Diary social media and motivational functionality have been tested, e.g., as described by Bønes et al. (Bønes, Østengen et al. 2013):

"In this project, we have been developing solutions for strengthening the Norwegian Diabetes Association’s concept “Motivation groups”. Motivation groups gather people with type 2 diabetes for the purpose of support lifestyle change. Motivation groups aims to gather 8-10 people and one instructor, who usually also has diabetes. The group meets a few hours once per week over a period of 3 months.

The solution we have tested as part of the Motivation groups was The Few Touch Application; an application (app) where the users get blood glucose measurements transferred from the blood glucose meter automatically, and can record food and physical activity. We tested the solution in two motivation groups, one in Harstad in 2010-2011, and one in Bjørkelangen in 2012.

The blood glucose functionality was highly appreciated in both groups. Recording of physical activity was used a lot in Harstad, but not so much in Bjørkelangen. We think this is because physical activity was an important part of the meetings in Harstad. Recording of food was not much used in either group. This may be because people with

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110 The figure is made by PhD candidate Naoe Tatara and is part of her PhD project.
type 2 diabetes are not used to register food intake.

In Bjørkelangen we also tested a social network concept on the mobile phone, where we could send tips and information to the users, and where the users could talk about their experiences anonymously with each other. This was however not used much. Since the users met regularly, there was probably not a high demand for this.

We think that the Few Touch Application can be a useful addition for Motivation groups, and be motivating for many of the participants.” (Page 4)
Lessons learned from 25 years with telemedicine in Northern Norway

situations, therefore aiding decisions regarding food and medicine.

During many projects over several years, and in close cooperation with end users, a research group at NST has developed and improved the Diabetes Diary. Our research shows that well designed mobile applications can improve health and quality of life for patients with diabetes.

The Diabetes Diary is made available as a result of this. The application is under continuous development, with the help of the patients in the research projects, and the app is regularly updated based on suggestions from the users.

All feedback will be considered when developing new versions, and is gladly appreciated.  

The Diabetes Diary webpage contains examples of diary usage (Figure 227). The webpage also presents the Pebble smart watch version of the diary (Figure 228).

Figure 226  Home page of the Diabetes Diary (www.diabetesdagboka.no) (Accessed 24.2.2015)

The Diabetes Diary webpage contains examples of diary usage (Figure 227). The webpage also presents the Pebble smart watch version of the diary (Figure 228).

111 www.diabetesdagboka.no  (Last accessed: 24.2.2015)
The Diabetes Diary webpage includes the following presentation of the Pebble version:

“Record and track your diabetes data – including step counts – directly on your wrist. The Diabetes Diary for Pebble enables you to monitor your dietary, insulin, glucose and activity levels throughout the day. You can track your progress through historically recorded data.”
Figure 228 shows the Pebble’s BG reminder function: “90 minutes after your last carbohydrates entry, the reminder to check your blood glucose is displayed accompanied by a long vibration.”
Want VC studio for diabetes treatment112
By Jan Fredrik Frantzen (14 November, 2008)

Videoconferencing studio must be taken into use, so that more diabetes patients can get help from their local hospital and do not have to travel for hours. “There is much that can be done with a camera and a phone line,” says consultant and diabetes patient Martin Moe.

Moe is from Brønnøysund. He has himself eight years of experience with the chronic disease. His personal experiences are an important prerequisite for the job he is doing to improve conditions for other diabetes patients in the Northern Health Region. As in the rest of Northern Norway, the distances in Nordland County are large. As “Brønnøysund-væring” (a person from the city of Brønnøysund) Martin has a 360 km driving trip to get to the diet and nutrition expert in Mosjøen. If he is going to Sandnessjøen for a control, he must take two ferries. “VC studio must be taken into use, so that we do these long journeys. Diabetes is such a normal disease that blood glucose value should be discussed over the phone,” says Moe.

In any case, it takes a long time for him and others with diabetes to physically get from their homes to the professional diabetes competence. It means that many simply drop the occasional control, and it is not beneficial. Especially not for kids who get the disease and need closer monitoring. Moe has great expectations to how diabetes patients’ lives are going to develop over the next few years. He hopes that they will be better heard when developing new services. In addition, he wants better information about the disease and legislative changes in order to exchange patient information between healthcare professionals. “The very first insulin I had to set myself, and then I just had to read on the package and try it out myself. We must have a group consultation with patients, nurses and doctors as those we have started with in Meløy in Nordland. It provides expertise to all parties.”

112 This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/vil-ha-telestudio-for-diabetesbehandling.4525493-42659.html (Last accessed: 5.2.2013.)
Lessons learned

**Problem – Solution**

*Problem:* To maintaining healthy blood glucose levels through a balanced diet, physical activity and medication for people with Type 1 and Type 2 diabetes.

*Solution:* Develope an interactive mobile tool, the Few Touch application, to help people with Type 1 and Type 2 diabetes to manage their health and motivate them to improve their blood glucose regulation.

*Equipment:* Smart-phone based self-help tool.

Lessons learned:

- User feedback from the 6-month user intervention demonstrated good usability of the tested system, and several of the participants adjusted their medication, food habits, and/or physical activity (Årsand, Tatara et al. 2010).
- Of the five different functionalities, the cohort (of initial users) considered the BG sensor system the best (Årsand, Tatara et al. 2010).
- After 7 years, all test users still appreciated the system and used it on a regular basis.

The Helse Nord Expert Group:

- The Helse Nord expert group discussed on their own initiative the possibility of establishing a telemedicine polyclinic in endocrinology at UNN. Today, many patients travel to the Endocrinology polyclinic to get answers to their blood tests and eventually adjust their substitution treatment without any need for clinical examination. For this group, the use of telemedicine solutions / VC or PC-based VC should be tested.
- Such a service should be tested before it eventually is recommended for large-scale operation.
- Automatic blood glucose measurements were found to have several interesting aspects, but the service as such is outside the scope of Helse Nord (specialist service).

Status:

- In routine use.
- Moderate number of patients. (Ca. 2000 users in Norway.)
- Locations: Helse Nord, the whole country
4.17 Telesurgery

At the late 1990’ies, Telenor Research and Development (R&D) in Tromsø started a project which goal was to provide telemedicine in surgery. The project developed a prototype system for laparoscopy for consultation and demonstration of surgery. Telenor R&D performed experiments with IPv6 between the university hospitals in Tromsø and Trondheim. The patient is in Tromsø, and the specialists are located at the Norwegian competence centre for laparoscopic surgery (Nasjonalt kompetansesenter for kikkhullskirurgi) in Trondheim (Figure 232). Due to phantom elements in the pictures, a result of the coding and decoding process of the images, this test service never became a regular service. Instead, a telesurgery service between UNN and Harstad Sykehus was established. The system is still in use to consultations and demonstrations between the hospitals or to lecture room.

Figure 232 Laparoscopic surgery. The camera in the ceiling is for remote monitoring. (Photo: NST)
Lessons learned

Problem – Solution

Problem: How could we offer guidance during operations from the Norwegian competence centre for laparoscopic surgery in Trondheim to the surgical department in Tromsø?
Solution: Development a VC-based solution for live transmission of pictures from the laparoscopic equipment in order to provide consultation and demonstration of surgery.

Equipment: Videoconference equipment, video camera connected to PC, end laparoscopic equipment connected to a PC, camera control, codex, communication network.

Lessons learned:

• The service was not introduced on a regular basis due to “phantom-elements” in the picture caused by the coding/decoding of the pictures.

Status:

• Not in regular use during laparoscopic surgery.

4.18 Telecare

4.18.1 Mobile access to electronic nursing record (the Alta-project)

In 1999, Telenor R&I and NST established a project in the home care unit in the Alta municipality (Stenvold, Bergvik et al. 1999). The goal was to test services in the home care sector based on UMTS bandwidth (Figure 237). The project established a broadband radio network in Alta (Figure 238), and a mobile edition of an electronic health record was developed and tested (Figure 233). Through the radio network, access to the central EHR database was enabled (Figure 234). This solution made it possible to include picture data in the EHR, and to submit requests to the community doctors and dermatologists. The goal was to improve the quality of the ulcer treatment in home care through the use of digital pictures. The system also included email between the home care unit, doctors and pharmacy for ordering of subscriptions.

The nurses’ experiences with access to patient data from the patients’ homes were solely positive. The nurses stress the availability to updated data as very positive. When they had their pc with them, they did not need to ask other staff members to provide the information or drive to the office themselves to search for the information. The easy access to information reduced the potential problem of need to remember several things at same time, and reduced the need for memo systems and thereby potential sources for errors. Another experience was that the patients could take part in the nurses’ reporting in a positive way.
Through the use of pictures to document the ulcer treatment, the nurses could document the development of the ulcer treatment (Figure 235). They had the possibility to study changes from the first to the last picture, and the healing or deterioration of ulcers were documented. The solution also enabled joint study of ulcer pictures. This also improved the nurses’ knowledge of ulcer treatment.
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 235 Example of Doris schema with picture of ulcers.

The nurse with a portable PC in the patient’s home

The car contacts antennas around Alta

The PC communicates with the antenna on her car

The central database at Alta health center is updated directly from the patient’s home

Figure 236 The home care nurse could access the electronic patient journal from the patient’s home. (Photo: NST)
With email service the nurses did not have to wait in the telephone. Instead, they could send requests asynchronously, and the doctors could answer the requests after they had completed their other consultations. In addition, the email contact with the local pharmacy was positive. The majority of these requests were questions regarding prescriptions (Figure 236).

Figure 237 This project was done before 3G (UMTS) bandwidth was available. Thus, the team of researchers had to establish a wireless network in the Alta area with similar bandwidth as the planned 3G networks would provide (some years later). The pictures show how the cars were equipped with communication units (left and middle) and the antennas on the roof of the health centre. (Photo: NST)

Figure 238 An overview of the covered area with wireless networks.
Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
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| **Problem**: To test services in the homecare sector based on UMTS bandwidth, and how this could be used in a mobile edition of an electronic health record. The EHR should include ulcer treatment (with pictures), email service to home care unit, doctors and pharmacy.  
| **Solution**: The project established a broadband radio network in Alta, and a mobile edition of an electronic health record was developed and tested.  
| **Equipment**: Mobile electronic health record, wireless network (from home to car), radio network (from car to home care unit), and standard PC. |

Lessons learned:

- The nurses’ experiences with access to patient data from the patients’ homes were solely positive:
  - Updated patient data.
  - No need for memos.
  - No need to travel to the office at the end of the day to update the HER.
  - The patients could take part in the nurses’ reporting.
  - The use of pictures to document the ulcer treatment improved the process.
  - The nurses’ knowledge of ulcer treatment was improved.
- The email service reduced use of telephone.

Status:

- The results used to offer a mobile EHR.


4.18.2 The Kroken-project

When Kroken nursing home and two assisted living homes in Tromsø in 2003 were connected to the Norwegian Healthnet, it became the first on-line institution for elderly in Norway (Nyheim 2005) (Figure 240). The goal of the Kroken project was to connect a part of the care sector in Tromsø municipality to the Norwegian Healthnet, and to offer the staff at Kroken nursing home the same services as those that had been offered within specialised health care. The project established electronic communication between nursing and supervisory physicians to exchange questions and answers via secure e-mail (Figure 241). In addition, it was established electronic communication between the nursing home and the university hospital for answers to lab tests and receive discharge summaries.
In 2003, Kroken nursing home had 78 residents, divided into five sections (Figure 239). At the end of 2003, 20 nurses were employed at the nursing home. The two assisted living homes had three divisions with a total of 40 beds. In 2003, it employed 16 nurses. Medical coverage was 15.6 hours per week, of which 12.5 was bound and 3.1 hours unbound time (Nyheim 2005). (Unbound time is the time doctors receive additional pay.)

The project was cooperation between NST, two doctors at Kroken health centre and Tromsø municipality. The project was realized by establishing a local network in the nursing home and to connect this to the Norwegian Healthnet. Since no local area network (LAN) existed at the nursing home, the project had first to wire the nursing home and install an appropriate LAN.
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 241 The regulatory doctor could see the patients at the nursing home through videoconference. (Photo: NST)

The Kroken project had 5 sub-projects:

1. **Preparation**: Develop detailed design; establish collaboration relations/agreements by contract; and, gain experience.

2. **Connecting/mobility**: Connection to the national healthnet; organize and test mobile communication solutions; and, test and choose mobile terminal equipment for use in home care.

3. **Safety/law**: Conduct risk evaluation; and, review and reports.

4. **Telemedicine services**: E-mail based guidance; e-mail between nursing homes and medical doctor (your doctor) for questions and answers (concept: polyclinic of wounds); electronic procedures for use in homecare- and nursing homes; electronic exchange of messages; electronic laboratory report between homecare- and nursing homes; and, electronic entry - and discharge messages.

5. **Research topic**: The technical solutions; the training for use of the solutions; the organizational (of the solutions); the relational aspects (identities); measure the effects (input factor, cost-benefit analysis); and, watch the international development (comparable studies).

In 2004, the services at Kroken nursing home were continued in a national lighthouse project, when NST was granted funds from the Ministry of Health and Social Affairs to accomplish a national project. The purpose was to show how telemedicine could improve health care in nursing homes. The project should also contribute to a holistic and co-ordinated service with focus on continuity and quality by electronic collaboration between the different units and levels in the health care sector. The main objective with the lighthouse project was to develop a model for use of telemedicine in homecare- and nursing homes that involves technical and organizational solutions that lead the way (show the opportunities) and are normative (document gains).
The tested services was a question/answer service from the nurses at the different departments in Kroken to the regulatory doctor (“tilsynslege”), and electronic transmission of lab answers and discharge letters from UNN to the nursing home (Figure 242). The experiences were positive. Both the staff at Kroken and the regulatory doctors reported that this kind of service was wanted. The preferred to use email instead of telephone to contact the regulatory doctors between the regular visits from the doctors. A limited negative effect was the need to change the routines and to learn to use the new tools.

Possible negative effects were identified:

- Shifting expenses.
- Change of focus from user to technology.
- Vulnerable system when instability occurs.
- Technological solutions do not cover the actual needs in the organization.
- “Internal riot” - resistance against changes and technology.
Lessons learned from 25 years with telemedicine in Northern Norway

Tromsø municipality: First with paperless care

By Jan Fredrik Frantzen (6 November, 2007)

2007: Nursing and care services in Tromsø municipality is the first in the country that can send patient information electronically to GPs in the municipality. Through the easy exchange of information between these health actors, patients can get a better quality of care.

The introduction of national standards for electronic health record messages in nursing and care services will primarily provide better documentation.

Transfer of patient information is done in writing and placed directly into the individual patient's medical record from the doctor. “Kroken doctor's office and Kvaløysletta doctor's office in Tromsø are currently the only ones to receive electronic information about patients from the nursing and care services. They are pioneers in a nationwide project in which six pilot municipalities are involved in testing a service that will eventually be nationwide,” says Heidi Jacobsen at the Norwegian Centre for Telemedicine (NST). She is responsible for implementation of the system in pilot municipalities.

In addition to that, the documentation of each patient will have better quality, it is expected that the system will provide timesaving, especially in the care sector. “The nursing and care services are used to spend a lot of time on hold. Nurses often have to wait on the phone to make contact with the patient's general practitioner or the nursing home’s regulatory doctors. In the new solution, a question-answering service is included that substantially simplifies the care service life in this area,” said Heidi Jacobsen.

Figure 243 More time for what matters most. Electronic transmission of patient information improves the quality of the information - and saves nurses for a lot of waiting when they want to get hold of the doctor.

(Photo: Jan Fredrik Frantzen)

113 This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/foerst-med-papirloes-omsorg.553757-80451.html (Last accessed: 5.2.2013.)
Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
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<tr>
<td><strong>Problem:</strong> How could Kroken nursing home be connected to the care sector in Tromsø municipality to the Norwegian Healthnet? The main problem was how the staff at Kroken nursing home could be offered the same services as those that had been offered within specialised care.</td>
</tr>
<tr>
<td><strong>Solution:</strong> The project was realized by establishing a local network in the nursing home and connects this to the Healthnet. The tested services were a question/answer service from the nurses at the different departments in Kroken to the regulatory doctor (“tilsynslege”), and electronic transmission of lab answers and discharge letters from UNN to the nursing home.</td>
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<tr>
<td><strong>Equipment:</strong> Access to the Norwegian Healthnet, LAN at the nursing home, digital cameras, software for submitting pictures in the healthnet.</td>
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</tbody>
</table>

Lessons learned:

- The experiences with the new digital services were positive. Both the staff at Kroken and the regulatory doctors reported that this kind of service was wanted.
- The nurses preferred to use email instead of telephone to contact the regulatory doctors between the regular visits from the doctors. (The email service reduced use of telephone)
- A limited negative effect was the need to change the routines and to learn to use the new tools.

Status:

- In routine use.
- Small number of patients.
- Locations: Helse Nord


4.18.3 MyHealthStation

The project MyHealthStation studied the possibility of using broadband connection in home care, in particular, training, and follow-up of COPD (Chronic obstructive pulmonary disease) and diabetes patients. In the project, a communication unit for video-based contact between the patient’s home and the health services has been developed. In this way, the patient can take part in rehabilitation programs without being transported to a health institution (Figure 245). The project group argues that we in this way can offer an adequate service to more persons, and that people with chronic diseases can improve their quality of life and avoid delayed injuries through tighter control.
A major goal was to make a user friendly and easy available system. Thus, the TV set with remote control was chosen as the user interface (Figure 244). The advanced functionality was hidden in a small computer that connected the TV to a broadband connection. The system was tested by a small group of COPD and diabetes patients (around 10). (In Norway, around 250,000 people have COPD and around 200,000 have diabetes.) The patients measured their state of health and submitted blood pressure and pulse data via the TV to the hospital.

The project was cooperation between Department of endocrinology (Endokrinologisk seksjon) and the Lung rehabilitation team (Lungerehabiliteringsteamet) (both at Medisin B), Department for clinical nutrition (Avdeling for klinisk ernæring), IT department (IT-avdelingen) and NST, all at UNN, and Norut IT, Well Diagnostics and University of Tromsø.
Individual guidance took place on a weekly basis:

- Duration 10 - 15 minutes
- Call on the basis of health diary
- Activity, number of meals, oxygen use
- Oxygen saturation in the blood and pulse

Figure 246 The system is simple to use. Everything can be handled with the remote control. On this screen, the patient must answer the question: “How would you say your health is today?” Alternatives: (1) “Very poor”, (2) “Poor”, (3) “OK”, (4) “Good”, and (5) “Very good”. (Photo: NST)

Figure 247 Design of the user interface.

Simplicity and easy to use have been the main design goals (Figure 246). An important part of the system is the health diary, which includes (Figure 247):
Lessons learned from 25 years with telemedicine in Northern Norway

- **Health related questions**: The patient has to answer a few questions regarding his/her health on a daily basis.
- **Self-Monitoring**: The patient records his/her measurements by the use of the remote control. In addition, the user can get an overview of his/her results.
- **Patient record**: The recorded data are submitted weekly to the health care workers.

The system offers both individual and group-based guidance (Figure 248, Figure 249).

![Figure 248 The physiotherapist (left) organizes the training for a group of patients. The physiotherapist can see all participants on the screen. (Photo: NST)](image)

![Figure 249 COPD patient, Karin Ludvigsen (66), doing exercises in front of her TV while following the instructions from her physiotherapist. (Photo: NST)](image)
Breathing is a struggle, and it costs her an enormous effort to do things that the rest of us manage in a moment. Karin Ludvigsen lives with chronic obstructive pulmonary disease (COPD), but telemedicine made her everyday life easier. She had already been ill for many years when she finally collapsed 10 years ago. Since then, she has struggled with breathing difficulties, flare-ups, and hospital admissions, because sometimes her breathing fails altogether. “When I have an attack like that, it feels as though I am about to suffocate. I also get terribly hot, and have to hang out of the window to cool down while I wait for the ambulance,” says Karin.

But not all the years have been this difficult. During the autumn of 2005, she took part in a project through the Norwegian Centre for Telemedicine. A total of 10 participants in the project had a computer installed and connected to the TV at home in their living rooms. This technical solution enabled the participants to measure their oxygen level themselves, for example, and then to send the results to the rehabilitation service at the Elisabeth Centre in Tromsø. They could also talk directly with the physiotherapist in town, and take part in common exercise sessions for all the participants via the TV screen in their own living room.

“It was a bit strange at the beginning to sit at home and see all the others in the group exercising. But it was fun. We started all the group sessions with a round of laughter,” she confides, and smiles, thinking back to the autumn a year and a half ago. Patients with COPD are absolutely dependent on exercise to keep the disease under control. But for very many of them, the journey to a rehabilitation centre is long.

If you are very ill, you cannot manage even the short trip from the suburb of Kroken into the centre of Tromsø, only 6 km (less than 4 miles) away. Karin has experienced this herself many times. The solution developed through the telemedicine project “Min Helsestasjon” (“My Health Centre”) can then make the difference between regular exercise or becoming even more ill and being admitted to hospital time after time.

Karin has an illness that she will never be able to shake off, and it makes its mark on her life. There are many things she used to enjoy that she can no longer do. But her cheerfulness, her persistence and her hobbies leave a lasting impression. Karin has no intention of giving up. She talks about her hobbies, and every single day she does what she can manage and what she feels like doing. For example, she has created both exquisite necklaces and fabric pictures, while photography is now one of her great passions. “I focus on what I can do, and I don’t sit around moping about what I cannot manage any more,” she says, and shows one of the beautiful wall hangings she has created during the good times.

Although the telemedicine project is over, her memories of all the good experiences from the autumn a year and a half ago remain. She had the opportunity to be involved in developing technology that can be used to help others. It also became extremely important for her to be able to take part in a social fellowship, even though she was sitting at home in her chair and could not go out. “Taking part in this project gave me a boost throughout the autumn of 2005, when I was actually very ill. In spite of that, I was able to be involved and contribute something positive. And then I could meet others and start exercising again, during a period when I was so ill that I could not travel into town.”

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114 This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/-loeftet-meg-gjennom-hoesten.450580-80451.html (Last accessed: 5.2.2013.)
Lessons learned

Problem – Solution

Problem: How could we use broadband connection in home care for training and follow-up of COPD (Chronic obstructive pulmonary disease) and diabetes patients?
Solution: A communication unit for video-based contact between the patient’s home and the health services has been developed.
Equipment: Communication unit, with VC on TV, for private homes.

Lessons learned:

- The experiences with the new digital services were positive. Both the health care staff and patients express a positive attitude towards the use of the system.
- The patient can take part in rehabilitation programs without being transported to a health institution.

Status:

- Not in use. (The presented service was part of a research project.)

Further reading: (Burkow, Vognild et al. 2008)

4.18.4 The hospital that gets into your home – The Sunnaas model

Sunnaas hospital is Norway’s largest specialist hospital in rehabilitation and one of seven hospitals in the Eastern Norway (Figure 252). The hospital is geographically located in three places, Nesodden, Askim and Drøbak. The hospital has 169 beds. Sunnaas has patients from all over Norway, but most live in municipalities in South-East of Norway (approximately 70% of the patients are coming from Eastern Norway). In 2008, patients came from 207 different municipalities. From 1995, the hospital has had the status of a university hospital providing educational services to students in various subjects in medical rehabilitation.

Figure 252 Sunnaas hospital on Nesodden. (http://www.sunnaas.no/omoss/english/Sider/side.aspx) (Last accessed: 5.2.2013.)
The Sunnaas hospital has a region responsible for the complex rehabilitation of patients within the Health East. This includes spinal cord injury, severe multi-trauma, and complex head injuries. For certain special examinations and treatments, the hospital receives patients from the other health regions as well.

The challenges for Sunnaas hospital are among others:¹¹⁵

- Patients are spread over large geographical area.
- Front-line healthcare services have little expertise in this area.
- Many patients have reduced mobility and the need for special transportation and follow-ups.
- The threshold for referral and availability are perceived as high.

In 2005, NST supervised a pilot rehabilitation project.¹¹⁶ The purpose was to establish better cooperation between the specialist healthcare services and primary healthcare services in the municipalities within this category of patients. The project is using ICT (VC, multimedia applications, electronic integrated care) to establish a partnership between Sunnaas hospital, other healthcare institutions and primary healthcare services, related to: Referral - discharged - Follow-up of persons with permanent disabilities.

![Figure 253 Sunnaas hospital follow up patients after they have moved home.](Photo: Kari Hagen)

In the project, five subprojects were defined:

- **Sub-project 1 HS Municipality & Sub-project 2 HS health trust (“Helseforetak”):** Use of videoconference for the interview of the patient in advance of the group delay.
- **Sub-project 3 “RRM kommune” municipality:** Follow-up after staying with a focus on the individual plan.


• **Sub-project 4** Dysphagia: Eating and swallowing difficulties.
• **Sub-project 5** Home visits: Can telemedicine be used at home visits?

Figure 253 shows how a user got tools at his workplace, with the help of occupational therapist Unn Svarverud at Sunnaas hospital and Monika In Farnø at Assistive Technology in Buskerud (Hjelpemiddelsentralen i Buskerud).

**Sub-project 1 and 2 – HS:**
In the Department of Brain Injury, telemedicine is used both in rehabilitation straight after injury, treatment at earliest 1.5 years after injury (Late Life Program), and in-group living. VC is used to better prepare the interdisciplinary team to receive a patient (e.g., to get a visual impression, by having demonstrated activity and by being able to ask detailed questions along the way). In addition, VC is used to help to clarify patients' goals and thus the efficiency of the mapping phase, during his/her stay.

![Figure 254 Meeting with the municipality – “The killer application”](image)

The advantages of VC for sub-projects 1 and 3 are among others that VC “creates” highly motivated clinicians. An issue with the use of VC has been long distances. For these groups of patients this is not an issue – even short travel distances can be a burden. VC is also used in advanced courses. In this way, the entire team around the patient can be gathered and they will all receive the same information. The threshold for using videoconference in the meetings has been drastically reduced. It is a tool that saves time and money related to travel, and getting the right equipment to the patient before admission. When used in planning of the return of the patient to his/her municipality, they are well prepared to receive the patient (Figure 254).

The disadvantages include technological challenges: choice and operation of equipment on all locations and network problems. Some of these problems are related to the participants’ qualifications to use technical solutions. However, the overall conclusion and lesson learned is that interviews with videoconferencing are a good alternative when direct attendance is not possible.
Project 3 - Individual plans are typically:
In the Department for spinal cord injury and multiple traumas\textsuperscript{117}, the goal for the use of VC has been to ensure safe and sound transfer of patients through installing an open communication channel to their home district (Figure 255). The tools are videoconference used in meetings and training videos focusing on special needs and display of various techniques for managing different tasks.

The VC equipment was easy to use making it easy to wind up the meeting, and the VC-based meetings served as regulars meeting with the exchange of information. They also experienced that CD (with video) is a good medium to describe and demonstrate problem-positions. The patient received valuable information and time to reflect on the various problem areas and was more actively participating in their own rehabilitation process.

The disadvantages included problems with equipment locally, i.e., to find a place that was not too far away from patients and the team around him/her. The participants were also unfamiliar with the equipment used. This lead to internal problems in relation to access to videoconferencing and cameras, assistance when using the equipment, editing, etc.

Project 4 - dysphagia (eating and swallowing difficulties):
In Sunnaas hospital centre – The school\textsuperscript{118}, the aim was to study the effect of information recording and preparation of the patient before admission, effect of the rational use of time when the patient is admitted to hospital, and the effect of further follow-up treatment plan with patients themselves, health professionals and family after discharge.

\textsuperscript{117} Avdeling for ryggmargskade og multitraume.
\textsuperscript{118} Sunnaas sykehus kompetansesenter – Skolen.
The experience with the use of VC was positive. Through the use of VC, demonstration of correct techniques could easily be performed (Figure 256). The health staff in their home community experienced increased “safety” and less “pressure” since they could meet with nurses and doctors from Sunnaas before the patients were discharged from Sunnaas (Figure 257). The knowledge could be shared with others in the nursing home, which leads to increased competence among the local staff. Also, the patient could get improved follow-up in his/her home district (Figure 258).

**Project 4 - Medical Professional experience:**
The medical staff used the VC connections in training of intake of food, voice function and motion. They experienced improved voice function and pronunciation of certain words familiar to understand. When it comes to motion, they experienced consistent performance and improved range of motion of the tongue and lips and at the request. The overall effect was increased quality of life: because of improved oral motor skills and voice function, the patients managed to eat some food by through their mouth again.
Figure 258 Dysphagia following up with relatives and support staff present.

Figure 259 Sunnaas Hospital cooperate with Haukeland Hospital, Bergen, Department for severe fire injuries, for rehabilitation of people with severe fire injuries.

Figure 260 Videoconference course on brain injuries.

Sunnaas offers VC-based course on rehabilitation of brain injury: 600 participants from local authorities (Figure 260). The VC-based courses are combined with e-learning.
Lessons learned from 25 years with telemedicine in Northern Norway

Rehabilitation: Better monitoring of videoconferencing
By Jan Fredrik Frantzen (25 March, 2010)

Better collaboration and exchange of expertise. These are a few of the good results the players in the South-East is left with after the two-year project “Telemedicine in rehabilitation - the use of ICT in patient monitoring”, which is in routine operation.

Sunnaas is the largest specialty hospital in rehabilitation. Each year the hospital treats nearly 3,000 patients with major complicated injuries from, e.g., accidents or strokes. Common to all is that they have a great need for rehabilitation. But good rehabilitation requires good collaboration and coordinated effort from several parties, and often for a long time. In addition, travel distances are large and patients are not very mobile.

“...This is not in any way the first time video conferencing is used in rehabilitation work, but as far as we know, this is the first time such telemedicine services are set out in a fixed routine operation and is well anchored in the organization. It is an important factor for the success of the service,” says Bodil Bach, who has been the project manager in the NST project “Telemedicine in rehabilitation.” Since the project started in 2007, all departments of Sunnaas Hospital have been connected with the municipal health services and a range of aid centres (“hjelpemiddelsentraler”) in the health region. As a result, all parties in the rehabilitation has been able to communicate better and be coordinated on the further processing, such as when a road traffic injured patient is sent home after his/her stay at Sunnaas. Then the patient is offered a videoconference with health care professionals and other stakeholders who will receive him/her in his/her home community and he/she can explain directly to the staff at the Assistive living office what he/she need when he/she get home. “It has been held 55 meetings by videoconference during the project period, and the vast majority of these were held in connection with the discharge of patients. It illustrates that this method of communication works very well when the patient should be passed on to the system,” says Bach.

Speech therapist Borgny Mylén at Sunnaas worked in the project with patients with moderate and severe dysphagia (eating and swallowing difficulties). She is also left with positive experiences after using videoconferencing in patient care, although she is not in the same room as the patient.

First, patients were entered into a three-day stay assessment of how the training of dining skills could best be organized. Then Mylén offered them follow up through videoconference, together with the local management team after discharge. During the videoconference they could, among other things, adjust the sitting position, try out new kinds of food, and discuss the amount of food per mouthful and so forth “on the fly”. “We got the opportunity to provide the same information to all involved. In addition, we were in a straightforward way receiving information about the necessary local conditions and constraints that had to be taken into account. We got to know each other and had the opportunity to identify current challenges, and sometimes is was necessary to make both adjustments and changes.” Mylén concludes by saying that they had also received good feedback from local stakeholders, such as increased sense of security, increased motivation, feelings of being taken seriously and that rehabilitation was binding. “For my part, I also got broader experience both with teamwork and different subjects, and it gave me motivation to continue the efforts,” she concluded.

119 This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/rehabilitering-bedre-oppfoelging-med-videokonferanse.4757450-150024.html
(1ast accessed: 5.2.2013.)

Figure 261  Good training is essential for rehabilitation. Now Sunnaas hospital is offering rehabilitation and follow-up of videoconferencing as a permanent service, says Bodil Bach at the NST. (Photo: Jan Fredrik Frantzen)

Figure 262  It is good to be able to connect a face to the voice, when you explain your new circumstances to the case manager at NAV. (Photo: Hilde Sørlø, Sunnaas)
Lessons learned:

- Improved quality of the rehabilitation process, increase mastery of the life situation of the patient.
- Offer possibility to take the right choices at once, avoiding changing tools after a short period of use.
- More people get the same information about the choices made at the same time.
- Saved travel time and travel costs.
- Knowledge exchange between health professionals.

The VC-meetings gave, according to staff members at Sunnaas:

- “Knowledge transfer and possible recommendations for further action.”
- “Opportunity for good demonstrations of stand-up training (both in the standing table and the chairs of standing function), and demonstration of tracial tube and how it works and what must be taken.”
- “Clarification of the circumstances surrounding the patient's departure, assessments made by the team at SunHF, dialogue with the team in the patient's home municipality, how the patient should be monitored, who should follow up the patient and where he should be discharged to. In addition to clarifications about aids that are important to use for further rehabilitation.”
- “Opportunity for common understanding of certain social security rights for patients. That many people can participate from Askim and Oslo was a great advantage.”
- “A good orientation about the patient and a good dialogue with the recipient.”

Status:

- In routine use.
- Moderste number of patients.
- Location: Sunnaas Hospital to the whole country

Further reading: (Bach, Driveklepp et al. 2010, Bach, Sørli et al. 2010, Hansen, Bønes et al. 2013)
4.19 Telegeriatric

In telegeriatric, the focus has been on distant education (Figure 263). NST has also participated in several research projects about telemedicine in homes and telehomecare.

Next of kin school for relatives to people with old-age dementia:

- Videoconferences have been used to offer 90 next of kin to people with old-age dementia in six municipalities education about the condition and the possibility to exchange experiences.
- This kind of service is most wanted from patients and their relatives.
- The evaluation of this service has shown that the relatives are very satisfied with the teaching offered. (This service has been offered from Ullevål hospital in Oslo.)

Distant education in geriatric - GerIT

- In the project, distant education in geriatric was offered to hospitals with a geriatric activity. The education was offered through telephone meeting with preloaded PowerPoint presentations.
- The solution is considered to offer a rational internal education and development of professional network.
- This service is assumed to be suitable for large-scale operation.

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Figure 263 List of educational meetings in geriatric on the Norwegian geriatric association’s webpage. (Last accessed: 5.2.2013.)

http://legeforeningen.no/Fagmed/Norsk-geriatrisk-forening/fjernundervisning-i-alderspsykiatri/fjernundervisning-i-geriatri/Tidligere-undervisningsmoter/
The National Centre of Competence for old-age dementia and Net based Education (NKU) at the Norwegian Centre for Telemedicine developed in collaboration a net-based course about dementia that was named "Learn dementia with broadband". The project was supported by Høykom, and Norway's research council. The project started in the autumn 2002.

The participants at the course were 20 health care workers that came from 3 municipalities in eastern Norway; the district of Bøler in Oslo, Nøtterøy and Horten. The participants had multidisciplinary backgrounds. They all work with people with dementia at nursing homes, at home care services, and home based care. For the course to be accomplished, it was required that the participants had access to broadband.

The course contains, among other things, the use of video with appurtenant role-playing. Professional actors had been used in making of these videos, and they fabricate genuine problems that next of kind to people with dementia has experienced. Professionals from, among other things, the National Centre of Competence for old-age dementia contributed to the content of the different modules, and they contributed in discussion groups and chat. Text, animations, freeze frames, links, news, and discussion groups were represented at the website. The participants were expected to actively take part and make use of different tools for interaction and collaboration. The health care workers made use of problem solving learning (PBL) as a work method, and they were required to hand in papers, both individually papers and group work.

The participants have to, in addition to working at the Internet, also put to use videoconferencing equipment, and participate at personal meetings. The training programme for the participants was started April 28th - 29th 2002 at the computer-lab at the University College of Vestfold.

The enthusiasm was great when everyone had discussions at the net!
Lessons learned

<table>
<thead>
<tr>
<th>Problem – Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem</strong>: How could we offer education within geriatric (dementia) to health professionals in Norway?</td>
</tr>
<tr>
<td><strong>Solution</strong>: Set up distant education program “Learn dementia with broadband”.</td>
</tr>
<tr>
<td><strong>Equipment</strong>: Videoconference equipment, pedagogical software, access to the Norwegian Healthnet.</td>
</tr>
</tbody>
</table>

Lessons learned:

- The experiences with the Internet-based course were great and the course trigged a lot of discussions.

Status:

- Moderate use.
- Small number of users.
- Location: Helse Nord, the whole country

### 4.20 Videoconference

The first telemedicine services were all based on the use of videoconference equipment (Figure 265). The service was based on very expensive leased lines. In 1993, (Akselsen, Eidsvik et al. 1993) wrote that:

> “Today, the applications are based on a variety of networks, ranging from the ordinary telephone network to specialised data and video communication networks. The cost, ease of use and availability of network solutions and terminal equipment have been identified as major factors that have to be addressed in order to make telemedicine a realistic and affordable tool for the region’s health institutions. Thus, the technical solutions pose limitations due to their cost; lack of flexibility (design for special purpose use; special subscription requirements) and availability.”

Figure 265 It all started with videoconference. The picture shows one of the first demonstrations of VC at RST. (Photo: NST)
The authors suggest to use, at that time a new, and much cheaper communication channel, the Integrated Services Digital Network (ISDN). They argued that ISDN “will provide one single network for a wide range of applications. An internationally standardised and widespread ISDN will also stimulate the production of a wide range of relatively cheap terminal equipment. In this paper we discuss the use of ISDN as an infrastructure for telemedicine applications.” For some years, ISDN became the preferred communication line. But, as IP-based networks gradually were introduced, the VC activity was gradually moved to the IP-based health network. (As late as 2011, ISDN was is still in use, mostly as a backup communication channel.)

Figure 266 “Saves millions on video-conferences.” Dagens IT, No. 14, 7 September 2006. The article describes how the health service in Finnmark County saves millions NOK through the use of videoconferencing.

Figure 267 Overview of the videoconferencing activity in 2006 at the different VC studios in Finnmark County.
According to an article in Dagens IT from 2006, the health service in Finnmark County (50,000 km², 75,000 people) saves about 1 million NOK (125,000 EURO) each month using videoconferencing in meetings (Figure 266). The use of videoconferences in Finnmark County started in 1989, and was regularly used from 1994. VC has been important for the development of health care in the area. Specialists, doctors, and patients have been able to meet without traveling. The activity level is illustrated in Figure 267.

Most of the VC activity in Norway is in the north. Even though Finnmark County has less than 2% of the Norwegian population, Helse Finnmark uses 1/3 of the traffic in the Norwegian Healthnet. All hospitals in North Norway use VC. The biggest users are the clinics. The success factor is that VC has become a natural part of the work to doctors, psychologists, nurses, etc. (Figure 268, Figure 269)

16 of the 19 municipalities in Finnmark County have infirmary, which forms the interface between primary care and specialist care at the hospitals in Kirkenes, Hammerfest and Tromsø. Since 2005, the wards in Vadsø, Båtsfjord, North Cape, Alta, Karasjok and Porsanger have had installed mobile video-conferencing equipment, as part of the large infirmary project in Helse Finnmark in order to facilitate interaction between the wards and specialist services. Norwegian Centre for Telemedicine (NST) has been responsible for the technical solutions and training in the use of the equipment.

Normann et al. (Normann, Breivik et al. 2011) argue that VC has been tried out in a large number of health specialist area, including: emergency medicine, dermatology, geriatrics, cardiovascular, respiratory medicine, nephrology, neurosurgery, neurology, obstetrics and gynaecology, oncology, pediatrics, pathology, psychiatry, radiology, rehabilitation and otorhinolaryngology. However, the services are organized differently and ICT tools used in various ways, often in combination with other technologies.

The use of VC in education has been very important for the development health services in Northern Norway (Figure 270). It is expected that PC-based VC solutions will improve the use of VC even more.

Rygh (Rygh 2007) describes how videoconference meetings contribute to improved care at Fosen DMS (Figure 271):

“Fosen department for observation and treatment in South-Trøndelag has a total of eight beds, two of which are observation beds reserved for emergency admissions from emergency services. Fosen DMS daily arranges joint morning meetings with the medical department at Orkdal hospital by videoconference. Here patients are discussed before the transfer from the hospital and continued in the course of treatment at the treatment unit. Especially useful is the influence around the acute patients admitted for observation beds and acute medical problems in rehabilitation patients. The advantage of these telemedicine joint meetings described by the large number of patients with complex problems, and that the entire research group at the medical de-
partment can provide input to the treatment. The added value of video meetings is that it established a joint team of therapists at Fosen and Orkdal. The five to ten minutes that are used on this common morning meeting, save the doctor at Fosen for multiple phones to individual specialists throughout the day."

Figure 271 Morning meeting on video. Chief municipal medical officer Morten Jensvold and nurse Liz Raaken at Fosen get advice from the chief physician Siegfried Gutschmidt at Orkdal hospital. (Photo: Chris Guldberg, ST. Olav's Hospital)

Figure 272 Large or small, for every need. Equipment for videoconferencing comes in several sizes and with a variety of functionality. But the challenges with regard to the digital infrastructure are the same, says Stig Karoliussen at the Norwegian Centre for Telemedicine. (Photo: Jan Fredrik Frantzen)
According to an article in dagensit.no\textsuperscript{124} from 2009, Norwegian health care could save large sums on using videoconferencing and patients could save much time. But doctors prefer the old way:

“Even if telemedicine can be profitable for the community and save patients for travel, it is one group that does not profit on working smarter – primary care doctors.
– Primary care doctors have no incentive to use telemedicine solutions, says Kjell Borthne, former children's heart doctor and now medical director of the health IT company Imatis.

The money comes in fact by having the patient physically present in the office. Video consultations are GPs simply not paid for, and then it's no wonder that their interest is lacklustre.
– Telemedicine gives poor reimbursement through the tariff systems. Seen from a busy primary physician's point of view it may seem as if there is better use of time to send a note in the mail and ask hospitals to see the patient. In addition, the doctor's office has to pay for the technical equipment to be used in telemedicine, says Kjell Borthne.

The Norwegian Centre for Telemedicine (NST) in Tromsø shares the Imatis-Director's opinion.
– When using videoconferencing in emergency medicine, a local doctor send live pictures of the damage to the specialist. Increased use of telemedicine would have relieved the patient lives. Here in the north, people can spend up to two days to get to a specialist and get a fifteen-minute consultation. Also elsewhere in the country, the distances between the specialists are long. This causes a lot of unnecessary stress for the patients. If the doctors were offered incentives to take telemedicine in use, this would have given patients a better meeting with the health care system, says communications director Elisabeth Jakobsen.” (Original in Norwegian)

\textbf{Figure 273} “Get smarter by talking” is the essens in a PhD dissertation at NST by Line Lundvoll Nilsen. Source: Computerworld, 19.6.2011, page 26.

\textsuperscript{124} Guro Aardal Hagen, “Ingen betaling for å jobbe smart” (“No payment for working smart”), dagensit.no, 23 June, 2009. URL: http://www.dagensit.no/k/smarterenorge/article1693061.ece (Last accessed: 5.2.2013.)
Lessons learned from 25 years with telemedicine in Northern Norway

According to a PhD dissertation by Line Lundvoll Nilsen, the use of videoconferencing can decrease the academic and physical distance between specialists and GPs. Lundvoll Nilsen discovered that when using VC, both the GPs and specialists asked questions to the patient. In this way, the specialist was able to follow the patient even closer (Figure 273). This was expressed in an interview with Lundvoll Nilsen in Computerworld in 2011:

“—Instead of one-way communication, a dialogue occurred. Generally, physicians exchange knowledge and seek cooperation in their own workplace, not across levels and institutions, says Lundvoll Nilsen.

—Sharing of information and communication between health professionals at different institutions provide the opportunity for new work methods. As a result, GPs and specialists can complement each other and access the knowledge they need. Nevertheless, the question is: Why is it taking so long to introduce this in Norway. The technology itself is relatively simple. The problem lies in the traditional labour sharing. GPs refer to a specialist, and after treatment or assessment the specialist refer the patient back to the general physician. Most often, without disclosing the full information, says Lundvoll Nilsen.

Health care still looks up on continued treatment chains as very isolated. With VC equipment, the various institutions are perceived as a single level of treatment. Sharing information and knowledge between the levels of health care provides an overall patient picture with improved coordination and continuity. The specialist follow the reallocated patient all the way and are better equipped to receive the patient if he or she is sent back.” (Original in Norwegian.)

Table 6 presents documented achievement of VC as identified by Normann et al. (Normann, Breivik et al. 2011). According to Normann et al. documented benefits of the use of videoconferencing are in nature both qualitative and quantitative. Rotvold et al. (Rotvold, Knarvik et al. 2003) and Ekeland et al. (Ekeland, Bowes et al. 2010) found that technology for VC services work satisfactorily and that both patients and health are satisfied with telemedicine services.

<table>
<thead>
<tr>
<th>Quantitative profits</th>
<th>Qualitative profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoided/reduced ambulating (Rumpf, Arild et al. 2005)</td>
<td>Improved clinical decision-making (Bolle, Larsen et al. 2009, Øvernes 2010)</td>
</tr>
<tr>
<td>Fewer evacuations (Rumpf, Arild et al. 2005)</td>
<td>Increased treatment quality (Rumpf, Arild et al. 2005)</td>
</tr>
<tr>
<td>Reduced number of hospital admissions / patient days (Rumpf, Arild et al. 2005)</td>
<td>Increased competence (Nordal, Mosegård et al. 2001)</td>
</tr>
<tr>
<td>Fewer consultations (Knol, van den Akker et al. 2006)</td>
<td>Improved access to multidisciplinary expertise (Hagen 2010, Øvernes 2010)</td>
</tr>
<tr>
<td>Faster treatment (Stormo, Sollid et al. 2004)</td>
<td></td>
</tr>
</tbody>
</table>

Videoconference technology has also been used to realise other services. One example is the interpreter service between Norwegian and Sami language / Lappish. Furskognes et al. (Furskognes, Eliassen et al. 2013) describe one project that was done to serve Sami people in Finnmark County:

“Results from the project shows that it is possible to provide not Sami-speaking health professionals and Sami patients access to Sami interpreter using technology. The selected solutions enabled interpretation to the patient both on arrival at hospital and during their stay in hospital although the Sami interpreter was not physically present. Interpreters were used to interpreting stayed respectively in Tromsø, Kautokeino and Hammerfest. The technology used was Jabber video (audio / visual solution).”

Figure 274 shows how the interpreter is integrated in the user interface.

Another example of use of implementation of videoconferencing based on the advice from NST is the emergency videoconferencing service at “Sunnfjør og Ytre Sogn interkommunale legevåktsamarbeid IKS (SYS-IKL) Førde”. It is organized as a low-threshold service, with the patient alone, or together with paramedics and nurses in the infirmary as support during the videoconference. The service was set up at two locations and has expanded and evolved somewhat over time. In order to optimize the service, a medicine cabinet that belonged to the emergency ward was managed by nursing staff.
Lessons learned from 25 years with telemedicine in Northern Norway

Many applications areas for video rack

By Jan Fredrik Frantzen (26 October, 2009)

Video conferencing equipment at the infirmary in Vadsø rolled easily from room to room when needed. And the equipment is useful in several areas, be it counselling or doctor visits.

It is three years (i.e., 2006) since the infirmary in Vadsø, with six beds, had set up its mobile video rack through the infirmary project in Finnmark. The state of the art equipment has the potential for both conventional video conferencing and transfer of vital data to specialists in Kirkenes, Hammerfest and Tromsø as needed. The goal was to improve the interaction between the infirmary and the hospital in Kirkenes. But the technology has at times been little used, and the infirmary in Vadsø has been plagued with fuses that blow and picture that disappears.

But now things are under control, and the staff at the infirmary rolls out video rack at least once a week to connect to the hospitals or other wards. They run regular doctor visits on video from Kirkenes, and meetings regarding complex patient cases with interdisciplinary treatment team take place with VC in the health network. Then the conversation is more freely, and experts discuss more openly further treatment. It provides new perspectives and better ideas of which treatment is best for the patient. “It is very good when it works, a great supplement. And it is very handy since it is on a rack with wheels,” said oncology nurse Sissel Andreassen who works with palliative cancer treatment in Vadsø.

Sometimes patients themselves can meet the specialist who is going to treat them when they, for example, are transferred to the hospital in Kirkenes. And the nurses feel that it gives patients a sense of security.

When we ask whether there are other telemedicine services they could have use for in near future, both Sissel Andreassen and Tom Olav Stavseth, unit manager at the health centre, say that they will take the development step by step. “The most important thing now is that we fill the technical solution with content and get the features up and running. The challenge is that all people using the equipment should be familiar with it and that it is integrated in the department.” “There is a way to go to get it into the thinking processes that this can be used to replace part of the trips,” said Stavseth.

And there may be much to gain. Even if it is a short flight over the fjord (“Varangerfjorden”) between Vadsø and Kirkenes, along the highway the taxis rolls 170 km in each direction to transport patients to the specialist. And if the patient needs to go all the way to the University Hospital in Tromsø, then we’ll talk soon about an hour to fly – or nearly 900 kilometres in the car. Then you may want to dial an IP number instead, in many cases this can do the same thing.

Figure 275  Telerack is on wheels and rolled easily to where the need is greatest. If the patient cannot be moved, they move the telerack. Thus, the patient met hospital doctor on the TV screen before they leave the infirmary in Vadsø to Kirkenes for specialist treatment. “One of the advantages of the system and positive for the patient,” tells the nurse Angela Montalvo. Cancer nurse Sissel Andreassen and unit manager Tom Olav Stavseth are watching. (Photo: Jan Fredrik Frantzen)

telemedicine services they could have use for in near future, both Sissel Andreassen and Tom Olav Stavseth, unit manager at the health centre, say that they will take the development step by step. “The most important thing now is that we fill the technical solution with content and get the features up and running. The challenge is that all people using the equipment should be familiar with it and that it is integrated in the department.” “There is a way to go to get it into the thinking processes that this can be used to replace part of the trips,” said Stavseth.

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Best for complex treatment\(^{127}\)
By Jan Fredrik Frantzen (28 August, 2009)

It is in the most challenging patient cases that have the greatest advantage of video conferencing, says nurse Jannik Sannes at Kirkenes Hospital.

Sannes worked for several years at the medical department and was on the ward project, which started in 2005. In recent years she has worked a lot with video meetings between the hospital in Kirkenes and the wards in Vadsø and Båtsfjord. She says that it quickly turns out that video conferences really come into its own when they have had a patient with a complicated clinical picture in the treatment and this patient are going to be transferred back to his/her community and the infirmary.

Then the face-to-face contact with those who will follow up the patient is very valuable. It often shows up multiple perspectives in these video meetings, and information is more thorough. “The use of VC has been a lot better in those situations than using the phone. Instead of having doctors, nurses and physical therapists to send over their report, we’ll put us down “over the table” and together go through further treatment,” said Sannes.

Therefore, the multi-disciplinary meetings are seen as very important, but what always limits us is the use of time. Is it too much to do, we cannot give priority to a video meeting. Then we make a quick phone call. But this is not the ideal solution …

“Something happens when you can see people in their eyes. We talk maybe a little more freely and may touch upon issues that we cannot get to on the phone. But it's not just for the transfer meetings the video conference is valuable. A few years ago there was an outbreak of the NORO virus in the hospital, and they did not have a hygiene nurse in place. Then we took a meeting by videoconference with the hygiene nurse in Hammerfest. It was very good – and much better than sitting one person on the phone and then disseminates information to the other,” says Sannes.

\(^{127}\) This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/best-ved-komplisert-behandling.4625642-117531.html (Last accessed: 5.2.2013.)
Lessons learned from 25 years with telemedicine in Northern Norway

Connecting Health Finnmark with VC
By Jan Fredrik Frantzen (18 June, 2008)

13. June, 2008, NST sent 120 kilograms of telemedicine equipment for wards in Lakselv and Karasjok. Soon, six of the 16 wards in our northernmost county connected with hospitals in a video network.

Through the “infirmary project” at the Norwegian Centre for Telemedicine (NST) the wards in Alta, Finnmark, Båtsfjord and Vadsø have since 2006 had mobile videoconference equipment connected to the local hospitals in Hammerfest and Kirkenes. Now, also the wards in Karasjok and Lakselv are moving into the same network, which will make it easier for clinicians to interact at a distance. It should again make it easier to treat more patients locally. The equipment enables, among other things, that the emergency departments in Tromsø and Kirkenes can remotely control the camera in the ceiling in the wards, so that they can receive live video in the acute setting and have vital data such as pulse, blood pressure, temperature and oxygen levels in the blood instantaneously transferred. In this way, emergency doctors at AMK centres can help when the infirmary in Båtsfjord receive people who are injured after an accident.

“Basically, we have not developed any new technologies to put together this equipment. We have purchased portable stands and put it together with equipment such as cameras, remote control and TV screen. So, we have coupled it with the monitoring technology we have at NST (VAKe) that makes AMK centres able to remotely control the camera in the infirmary to get a full overview,” says project manager Erik Øvernes. But emergency situations are not the only application for the mobile “VC-racks”, each of which is 170 centimetres tall and costs about NOK 200,000. As the equipment goes on wheels it can easily be moved between rooms in the wards, so it might as well be used to attend meetings, clinical reviews and telemedicine consultations. A little Kinder Egg which has several things on the sly, in other words.

Øvernes says that they have received good feedback from the first four wards, after they have been given the equipment and have used it for eighteen months. It is especially the nurses who are positive. It seems that they save time working with this equipment. “It happens regularly that patients are transferred from hospitals to the wards in the municipalities, without at the same time having sent over a detailed discharge summary or discharge notice. Then it is okay to take a short VC meeting to get a full update on what treatment the patient already has received and what should follow,” says Øvernes. “Several of them have said they might use fifteen minutes on the telephone conference, but that they soon save that time again. This is because they do not have to take more phone calls to several doctors and nurses to gather the information they need for further treatment. In the video sessions, they are all gathered in a community and can share all the information right away,” he concludes.

128 This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/samler-helse-finnmark-med-videokonferanse.4493167.html (Last accessed: 5.2.2013.)
Electronic interaction UNN-Nordland Hospital: Close is dear to cancer patients

By Jan Fredik Frantzen   (25 January, 2008)

In just over three years, the oncology unit in Bodø and oncology department in Tromsø had a weekly interactive instruction using videoconferencing. “It makes the patients feel safer and they can be treated close to their relatives and friends in the community,” says Dr. Astrid Dalhaug at Nordland Hospital.

Every Monday and Thursday the oncology unit in Bodø and the oncology department in Tromsø connect on video conferencing over the health network. Then they do teaching and discussing new approaches and treatments for various types of cancers. Cancer Nurses at the Nordland Hospital in Lofoten has also participated in these videoconferences. “When we started this it was only 1-2 oncology doctors in addition to oncology nurses here in Bodø. It was hard to establish internal teaching here, and therefore we saw that telemedicine provided an opportunity to cooperate with the exception of this,” tells Dalhaug. In addition, the doctors in Bodø sit in at the University Hospital of North Norway (UNN) so that the contact between the communities is good. Bodø-doctors can send MRI, CT and X-ray images of the health network of the University Hospital for help with difficult issues.

After the weekly interaction with Tromsø Dalhaug feels that they are academically stronger at the oncology unit in Bodø. They have expanded to four doctors and almost five oncology nurses, and besides, a palliative care team of four has been established. In addition comes the radiation unit, which provides palliative care. Thus, they have a larger internal environment to play and have now begun their own internal training. But international education with Tromsø continues each week, and when it is taken up topics that are relevant to other hospitals in the health region are invited also to the feed. “This is a great way to keep up to date on. You become familiar with the doctors at the University Hospital so that the threshold for calling to Tromsø and discuss individual patients is lowered. Moreover, we become more coordinated and follow the same guidelines for cancer treatment.” Dalhaug also says that she feels that the treatment of patients has improved with this contact. Depending on the cancer they have and how far the disease has come, they can now be treated at the right level of health care so that not everyone has to travel to the University Hospital in Tromsø for treatment. “Patients benefit by the fact that we are professionally updated. They can feel confident that they receive the same treatment here as they would have received at the University Hospital in Tromsø,” Dalhaug said.

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129 This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/naert-er-kjaert-for-kreftpasienter.4452819-97537.html (Last accessed: 5.2.2013.)
Lessons learned

Problem – Solution

Problem: To provide specialist services in different fields to small hospitals in Troms and Finnmark County.
Solution: Teleconsultations through the use of videoconference equipment.
Equipment: Videoconference equipment, access to computer network (later Norwegian Healtnet).

Lessons learned:

- In Northern Norway, videoconference has become a natural part of the work to doctors, psychologists, nurses, etc.

Status:

- In routine use.
- Large number of patients/users.
- Locations: Helse Nord


4.21 Messages and electronic communication

Electronic messages are encrypted electronic (digital) information, which is sent from one part of the health care sector to another. The messages are sent through the Norwegian Healtnet. The purpose of this network is increased efficiency and improved security. Together with the EHR providers, a number of standardized messages that can be sent between health care personnel in the health net have been developed. The messages have been formed in a way such that they can be sent from one patient journal to another journal. The goal is to provide faster and more secure communication within the health care sector, while improving the documentation quality.

One of the first high volume messages was the electronic discharge letter (epicrisis) from UNN to general practitioners. In 2000, NST in cooperation with UNN’s IT department an medical departments, 5 GP offices, (North-)Norwegian Healtnet and Well Diagnostics established a service for electronic submission of discharge letters between the hospital and GP offices. After the test phase was completed, the service was extended to include other hospitals. In 2004, this service was included to cover all hospitals and GP offices in Helse.

130 This NST spin-off company was later acquired by DIPS.
Nord (that were connected to the healthnet). In addition, the GPs could send referrals and x-ray requisition to all hospitals in the area (Figure 279).

Around year 2000, the North-Norwegian Healthnet offered the following service packages to general practitioners:

Connectivity and basic services:

- E-mail, Internet
- Web hotel
- Antivirus
- Router / Firewall
- 128kb line
- Support

Volume services:

- Discharge summary
- X-ray reports
- Lab results (Figure 280)
- Pathology reports
- Referrals
- E-mail, Internet
- Web hotel
- Antivirus
- Router / Firewall
- 128kb line
- Support

Figure 279 Record of referrals.
Telemedicine:

- Videoconference
- Education
- Psychiatry, ENT, Dermatology, Eye, Heart sound
- Radiology, Dialysis
- Ultrasound, spirometer
- Discharge summary
- X-ray reports
- Lab results
- Pathology reports
- Referrals
- E-mail, Internet
- Web hotel
- Antivirus
- Router / Firewall
- 128kb line
- Support

In order to get treatment in hospitals and specialist health services, the majority of patients need a referral from a GP / primary care. In the Northern Health area the vast majority of referrals are sent electronically, directly from the GP’s computer system to the health institutions (Figure 281). References with sufficient information about feasibility studies, medical information and relevant medical history will likely provide better prioritization and faster and more efficient patient care in healthcare services (Figure 282).

Figure 280 Test results (from the hospital laboratory).

<table>
<thead>
<tr>
<th>Analyse</th>
<th>Verdi</th>
<th>Enhet</th>
<th>Refverdier</th>
<th>Patologi</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin</td>
<td>15.6</td>
<td>g/dl</td>
<td>13.0 - 17.0</td>
<td></td>
<td>F</td>
</tr>
<tr>
<td>Patient har sammengjøra av bakteriell infeksjon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SR</td>
<td>100</td>
<td>mm/l</td>
<td>0 - 20</td>
<td>H</td>
<td>F</td>
</tr>
</tbody>
</table>
Figure 281 UNN provides web-based information for general practitioners.131

Figure 282 Guidelines for referrals within psychiatry can be found at the UNN’s web site.132

Messages for GPs and specialists

- Epicrises (“Epikriser”)
- Referrals (“Henvisninger”) (Figure 284, Figure 285)
- Referral response (“Tilbakemelding på henvisning”)
- Sample requisitions (“Rekvisisjon av prøver (patologi, radiologi, biokjemin, mikrobiologi, immunologi”)”

131  http://www.unn.no/henvisningsrutiner/category8775.html (Last accessed: 5.2.2013.)
132  http://www.unn.no/henvisningsrutiner/voksenpsykiatrisk-poliklinikk-henvisningsveileder-article18885-8775.html (Last accessed: 5.2.2013.)
Lessons learned from 25 years with telemedicine in Northern Norway

- Answer to requisitions (“Svarrapporter på rekvisisjoner”)
- Doctor's certificate (“Legeerklæringer”)
- Medical certificate (“Sykemeldinger”)
- Tumor report (“Innrapportering av svulster”)
- SYSVAK messages (“meldinger”)

Figure 283 The service minDoktor.no is used to get in contact with a general practitioner.

On the web site minDoktor.no (Figure 283) patients can safely and easily:

- Ordering prescription.
- See answer to the prescription order.
- Make an appointment with your GP.
- Unsubscribe doctor's appointment that is booked through this service.
- Sending and receiving messages to your doctor or health care institution.
- Ordering a new certificate.

Figure 284 Referrals within dermatology.
According to (Normann, Breivik et al. 2011), benefits of electronic communication and collaboration solutions have proven to be medical, qualitative and quantitative. (Cf. Table 7)

Table 7  Documented benefits of electronic communication and interaction (Source: (Normann, Breivik et al. 2011), Table 3.2, page 34)\textsuperscript{133}

<table>
<thead>
<tr>
<th>Medical benefits</th>
<th>Qualitative benefits</th>
<th>Quantitative gains</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Improved decision-making.</td>
<td>(Bjorvig, Johansen et al. 2002, Johansen and Breivik 2004)</td>
</tr>
<tr>
<td></td>
<td>Increased disease coping.</td>
<td>Fewer admissions / number of patient days.</td>
</tr>
<tr>
<td></td>
<td>Improved quality of life.</td>
<td>Saved postage and paper.</td>
</tr>
<tr>
<td></td>
<td>Improved coordination and utilization of specialized resources. (Johnsen, Joakimsen et al. 2003)</td>
<td>(Aanesen, Moilanen et al. 2006)</td>
</tr>
<tr>
<td></td>
<td>Improved communication between health personnel and patient.</td>
<td>Saved time. (Aanesen, Moilanen et al. 2006)</td>
</tr>
</tbody>
</table>

Electronic messages are not only important in specialist health care. Also in care electronic messages are of great value. In the Elin-k project, led by the Norwegian Nurses’ Association, they have developed a range of message types for local health care services. The goal has been to get started with large-scale electronic interaction between local health services, GPs and specialist services. This will provide better communication between the levels of health care and community health services such as help in being better prepared when a patient in need of care are discharged from hospital and returned to the municipality.

\textsuperscript{133} The original Table comes with references to each of the bullet points.
Lessons learned from 25 years with telemedicine in Northern Norway

Among the messages that are under development are:

- Admission Report
- Dialogue messages
- Notification of absence
- Information on the services
- Transfer of drug information
- Transfer of medical information
- Patient Logistics
- Interdisciplinary discharge summaries

![Figure 286](image)

**Figure 286** Headline from digi.no: “Fewer errors with electronic requisition”

According to an article in digi.no from 2008, the number of errors in laboratory requisitions has dramatically decreased with electronic requisition (Figure 286):

“Each year, the six laboratories at the University Hospital North Norway (UNN) perform some three million analysis on the half a million samples submitted. Of these, 40 percent, or 200,000 samples, are from primary care. But not all of these tests can go straight to the medical laboratory technologists for examination.

A survey conducted in 2003 showed in fact that about 12,000 or 6 percent of the requisitions had so incomplete information that laboratory staff had to spend much time figuring out where the samples came from, the patient sample was from - and what they actually should be tested for.

– Thus, UNN and Well Diagnostics developed in 2006 a new system so that GPs should be able to order laboratory tests electronically through the Norwegian Health-net. This saves doctors spending precious time with patient to choose the appropriate requisition form on paper and fill it, with ink, with the correct information about the

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patient and the symptoms. The number of defects in laboratory requisitions from GPs has gone down dramatically after that we started with electronic requisition, says Special Adviser Earl Haaheim at the University Hospital of North Norway to the Norwegian Centre for Telemedicine.

– Error rate has fallen from 6 to 0 percent for the 26 GPs who have been associated with the scheme from autumn 2006 to the present day. It allows those who work in laboratories to not having to spend much time on detective work to find out where the sample comes from the sample that belong together with the requisition,” says Haaheim.” (Original in Norwegian)

**FUNNKe - Electronic exchange of health information**

Several projects to improve quality and productivity of Norwegian health care have been initiated over the last ten years. One such project is FUNNKe, which is a large-scale implementation project in the health region of Northern Norway. The project period was between 2010 and 2014. According to Rødseth et al. (Rødseth, Ersdal et al. 2015), the main objective of FUNNKe was:

“... to establish electronic exchange of health information in all sectors of the health service delivery in the region. By electronic exchange of health information, we mean electronic messaging. Such messages include referrals, discharge summaries, requisitions, test results and dialogue-based messaging between health personnel. The project supports all levels of the health sector - general practitioners (GPs), community care and nursing homes, and hospitals - in taking electronic messaging in use.

FUNNKe was part of a National program owned by the Ministry of Health and managed by the Norwegian Healthnet. The National program implemented electronic messaging in the other Norwegian health regions.

NST took care of project management in FUNNKe. The purpose of FUNNKe has been:

“... quality and efficiency in the health service delivery in Northern Norway. The main objective of FUNNKe was; “a public health service sector in Northern Norway communicating electronically by the end of 2014”.

By the end of the project period 85 of 87 municipalities, Over 400 GPs and all four hospitals in the region had implemented electronic messaging as their main communication tool. The two missing municipalities will start up in February 2015. The project therefore reached its goal.

The challenges of implementing use of electronic messaging are connected to the fact that only nine of the 87 municipalities in Northern Norway have a population above 10 000, and 65 of the municipalities have a population under 5000. Remotely situated municipalities with a small population size often lack personnel in sectors like ICT and health care personnel. Many of these municipalities also have outdated and insufficient ICT equipment. The situation when it comes to updated ICT equipment is better at the four hospitals in the region.”
Lessons learned from 25 years with telemedicine in Northern Norway

One of the findings in the FUNNKe project was the importance of enthusiasm among health- and ICT personnel. The project group found that lack of enthusiasm could explain some of the problems the implementation project faced in some municipalities in the last period of the project. Another observation was that management support is crucial for e-health initiatives, but the personnel at the user level has to buy into the idea and get enthusiastic about it.

**Lessons learned**

<table>
<thead>
<tr>
<th>Problem – Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem:</strong> To provide electronic messages between the users of the Norwegian healthnet.</td>
</tr>
<tr>
<td><strong>Solution:</strong> Develop a number of standardized messages that can be sent between health care personnel in the healthnet. The messages have been formed in a way such that they can be sent from one patient journal to another journal.</td>
</tr>
<tr>
<td><strong>Equipment:</strong> Access to the Norwegian Healthnet, Software to transmit encrypted e-mail.</td>
</tr>
</tbody>
</table>

Lessons learned:

- The uses of electronic messages provide faster and more secure communication within the health care sector, while improving the documentation quality.

Status:

- In routine use.
- Large number of users.
- Location: Norway


**4.22 National Action Plan for e-messages**

The National action plan for e-messages (“Nasjonalt meldingsloft”) is a program for realization of efficient, integrated and functioning exchange of referrals, discharge summaries, laboratory and radiology requisition / responses between hospitals and medical offices as well as the submission of medical certificates and medical payments from the doctor's office to NAV (Figure 287, Figure 288). The National Action plan for e-messages takes hold of challenges related to implementation of collaborative solutions across businesses. This involves coordination and coordination of efforts among the various stakeholders to ensure concurrency and progress.

Message Promotion is a huge boost to both technological and organizational character. Old solutions should be replaced in favour of new standard solutions as ebXML, XML, and use of PKI certificates. Organizationally, this requires reorganization of the new coordination procedures in cooperation between hospitals and medical offices. Health Directorate leads initiative
Hartvigsen and Pedersen

on behalf of the Health and Care Services. The program duration was from 2008 - 2010. The Health Directorate’s list of the messages the various health authorities can send and receive shows that hospitals in the north is no longer in the lead. In 2008-2009, Asker and Bærum health trust hold the top spot alone. (Table 8)

Through the National Action Plan for e-messages is it defined 12 types of messages that hospitals and medical offices to exchange electronically (Table 9). These are:

- Referrals and discharge summaries
- Requisitions and answers medical biochemistry
- Requisitions and answers pathology
- Requisitions and answers immunology
- Requisitions and answers Microbiology
- Requisitions and answers radiology
Along with the action plan, the use of electronic messages is being mandatory. E.g., from January 2010 the doctors have a duty to send the settlement and medical certificates online, and since autumn 2009 has been a marked increase. Electronic submission of medical settlement is a good measure of the use of electronic solutions for medical offices. Electronic submission of the settlement requires that the doctor's office has the technical infrastructure in place:

- An EHR system that supports electronic transmission of messages.
- Connection to the Norwegian Healthnet.
- Digital certificates for encryption and signing of messages (PKI).
Table 8 The table is taken from the National Action Plan for e-messages 2009 - 2010 and shows the plans for the region with regard to the introduction of the basic messages.

<table>
<thead>
<tr>
<th>Message type</th>
<th>Helse Finnmark</th>
<th>UNN Tromsø</th>
<th>UNN Harstad</th>
<th>UNN Narvik</th>
<th>Nordlands-sykehuset Vesterålen</th>
<th>Helgelandssykehuset</th>
<th>Nordlandssykehuset Lofoten</th>
<th>Nordlandssykehuset Bodø</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referral v1.0 – receive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Referral v1.0 - reply</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
</tr>
<tr>
<td>Requisitions Medical Biochemistry v1.5</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
</tr>
<tr>
<td>Answer Medical Biochemistry v1.3</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
</tr>
<tr>
<td>Requisition pathology v1.5</td>
<td>Not fixed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reply pathology v1.3</td>
<td>1.1.11 Pilot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requisition immunology v1.5</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
<td>Not fixed</td>
</tr>
<tr>
<td>Reply immunology v1.3</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
<td>No date – postponed</td>
</tr>
<tr>
<td>Requisition microbiology v1.5</td>
<td>Pilot, Not fixed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reply microbiology v1.3</td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requisition Radiology v1.5</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>Reply Radiology v1.3</td>
<td>Kirkenes OK</td>
<td>OK</td>
<td>OK</td>
<td>Q2 2011 Postponed</td>
<td>Q2 2011 Postponed</td>
<td>OK</td>
<td>Q2 2011 Postponed</td>
<td></td>
</tr>
</tbody>
</table>
Table 9 This table provides a detailed description of the introduction of the basic messages in accordance with the plan.

<table>
<thead>
<tr>
<th>Meldinger (Messages)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Henvisning (Referral)</td>
<td>Version 1.0 for use.</td>
</tr>
<tr>
<td>Epikrise (Discharge summary)</td>
<td>Version 1.1 in use</td>
</tr>
<tr>
<td>Rekvisisjon Medisinsk biokjemi (Requisition Medical Biochemistry)</td>
<td>Version 1.4 in use. Only UNN receive from a selection of doctor's office. The procurement process is on going.</td>
</tr>
<tr>
<td>Svar Medisinsk biokjemi (Answer Medical Biochemistry)</td>
<td>Edifact used. XML Version 1.3 has been delayed due process in Northern Norway Regional Health. Acquisition Process underway</td>
</tr>
<tr>
<td>Rekvisisjon immunologi (Requisition immunology)</td>
<td>Not used. The procurement process is on going.</td>
</tr>
<tr>
<td>Svar immunologi (Reply immunology)</td>
<td>Sent as Medical Biochemistry. Is delayed due process in Northern Norway Regional Health. The procurement process is on going.</td>
</tr>
<tr>
<td>Rekvisisjon mikrobiologi (Requisition microbiology)</td>
<td>Version 1.4 in use. Run only in the pilot at UNN. Small number of medical offices. Profdoc has not yet adopted version 1.5.</td>
</tr>
<tr>
<td>Svar mikrobiologi (Reply microbiology)</td>
<td>Version 1.3 introduced.</td>
</tr>
<tr>
<td>Rekvisisjon patologi (Requisition pathology)</td>
<td>Pilot planned for UNN.</td>
</tr>
<tr>
<td>Svar patologi (Reply pathology)</td>
<td>Version 1.3 approved. Pilot runs with successive error corrections from Tieto.</td>
</tr>
<tr>
<td>Rekvisisjon Radiologi (Requisition Radiology)</td>
<td>Version 1.5 OK</td>
</tr>
</tbody>
</table>

The table below (Table 10) is taken from the National Action Plan for e-messages 2009 - 2010 and shows the plans and the status of the region with respect to the liquidation of paper shipments.
Table 10 Plans and the status of the region with respect to the liquidation of paper shipments.

<table>
<thead>
<tr>
<th>Meldinger (Messages)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Henvisning (Referral)</td>
<td>All, except NLSH Bodø</td>
</tr>
<tr>
<td>Epikrise (Discharge summary)</td>
<td>All, except NLSH Bodø</td>
</tr>
<tr>
<td>Rekvisisjon Medisinsk biokjemi (Requisition Medical Biochemistry)</td>
<td>None. Only UNN Tromsø receiving some in electronic form.</td>
</tr>
<tr>
<td>Svar Medisinsk biokjemi (Answer Medical Biochemistry)</td>
<td>All, except NLSH Bodø</td>
</tr>
<tr>
<td>Rekvisisjon immunologi (requisition immunology)</td>
<td>None</td>
</tr>
<tr>
<td>Svar immunologi (Reply immunology)</td>
<td>All, except NLSH Bodø</td>
</tr>
<tr>
<td>Rekvisisjon mikrobiologi (requisition microbiology)</td>
<td>None</td>
</tr>
<tr>
<td>Svar mikrobiologi (Reply microbiology)</td>
<td>All, except NLSH Bodø</td>
</tr>
<tr>
<td>Rekvisisjon patologi (requisition pathology)</td>
<td>None</td>
</tr>
<tr>
<td>Svar patologi (Reply pathology)</td>
<td>UNN Tromsø</td>
</tr>
<tr>
<td>Rekvisisjon Radiologi (requisition Radiology)</td>
<td>All</td>
</tr>
<tr>
<td>Svar Radiologi (Reply Radiology)</td>
<td>All, except NLSH Bodø</td>
</tr>
</tbody>
</table>

The status of the region (unrolling of paper, all messages):
All hospitals except NLSH Bodø is paper-free, to the extent possible.

Table 11 Doctor offices in Health North.

<table>
<thead>
<tr>
<th>GP office</th>
<th>Contract-specialist office</th>
<th>XML message</th>
<th>Eb XML</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health North</td>
<td>205</td>
<td>90</td>
<td>200</td>
<td>191</td>
</tr>
</tbody>
</table>

Health North communicates electronically with 99% of GP practices.

Additional contract specialists have adopted ebXML. Health North ICT does not connect up a new communication partner if they are not using ebXML (Table 11).

The status of laboratory / X-ray requisition in the Health North region (the number of medical offices that order service electronically / what messages) (Table 12):

- All enterprises in the region receive X-ray requisitions on KITH. XML messages, v. 1.2. UNN Tromsø receive requisitions for Medical Biochemistry of KITH. XML v.1.2.
- Well Interactor is installed in every doctor's office using WinMed 2.X in Troms and Ofoten.
Table 12 The number of medical offices in Health North that order service electronically / what messages.

<table>
<thead>
<tr>
<th>Meldinger (Messages)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rekvisisjon Medisinsk biokjemi (Requisition Medical Biochemistry)</td>
<td>Dipslab receive KITH XML requisitions. XML requisitions converted to ASTM for script loading in DipsLab. Rolled out on WinMed office is around the University Hospital Trust.</td>
</tr>
<tr>
<td>Rekvisisjon immunologi (requisition immunology)</td>
<td>No plans exist.</td>
</tr>
<tr>
<td>Rekvisisjon mikrobiologi (requisition microbiology)</td>
<td>Piloted at two medical offices in Tromsø (UNN HF)</td>
</tr>
<tr>
<td>Rekvisisjon patologi (requisition pathology)</td>
<td>No plans exist.</td>
</tr>
<tr>
<td>Rekvisisjon Radiologi (requisition Radiology)</td>
<td>In full operation in the region.</td>
</tr>
</tbody>
</table>

The Directorate of Health has published a guide on how the community can get started with electronic messaging exchange, what the municipality must have in place and where they can find more information (Figure 289).

Figure 289 Directorate of Health’s “Wizard. How to get started with electronic messaging in the municipality”.
According to Johnsen et al. (Johnsen, Breivik et al. 2006) the volume of messages in Norwegian healthcare is high. In 2003, it was estimated that the yearly volume is approximately:

- 20 million patient contacts with GPs per annum. The cost is covered by the National Insurance Service.
- 3.5 million certificates of absence due to sickness/sickness benefit certificates to the National Insurance Administration.
- 1.9 million referrals to hospitals.
- 3.9 million discharge letters from hospitals.
- 7 million requisitions for tests to laboratories (+ corresponding number of results).
- 1.3 million requisitions for images to hospitals.
- 1 million requisitions for physiotherapy.
- 17 million prescriptions to pharmacies.

In addition to the figures above, there is a significant sum of internal information exchanged in hospitals and also between hospitals and in communications with the municipal care and nursing services. Johnsen et al. (Johnsen, Breivik et al. 2006) argue that it is "A great potential for benefits in regard to the reduction of duplicated tasks and potential for errors is a logical conclusion, if many more were to exchange of information electronically. This exchange is technically possible, and the Norwegian Health Network offers secure transfer of electronic information. However, what is technically possible is not necessarily socially possible, to the same degree – greater changes in user behaviour are needed in order to realise the full benefit potential."

In Tromsø, Norway, we find many good examples of how electronic messaging makes the day easier for health professionals. Birgitte Forsaa Åbotsvik, a home care nurse (at “Hjemmetjenesten Nordøya”), said to the newspaper “Nordlys” 30 September 2011: “We do not have to spend hours on the phone and we can send off messages at any time of day. We can also make inquiries or reports of concern that we consider not sufficiently important to initiate a phone call. The time we win, we can use for users.”

Electronic contact between GPs and their patients is not straightforward. According to an article in the Norwegian newspaper VG in March 2001, doctors at Skansen legekontor in Tromsø are actually violating Norwegian law when they communicate with their patients through e-mail:

“Two of the four doctors at the Skansen doctor's office in Tromsø violate the law. They have given patients the opportunity to contact the doctor via email. (...) Skansen is one of about 50 medical offices affiliated with the North Norwegian Healthnet, a closed system for secure exchange of sensitive patient information between medical offices and hospitals. The (...) doctor's office is paper-free in the sense that all patient information in the form of records, laboratory tests and X-ray images are handled in a computer network. Doctors at Skansen have also taken one step further in their communication with patients.”

135 http://www.telemed.no/tromsøe-er-best-i-klassen.4966947.html (Last accessed: 5.2.2013.)
Lessons learned from 25 years with telemedicine in Northern Norway

— Two of the doctors have given their email address to their patients. We are very conscious that sensitive information will not be communicated via email, but we actually break the law by responding to inquiries from patients,” told the doctor Nils Kolstrup (..).

The Norwegian Data Inspectorate has denied this form of communication between doctor and patient. But if the same patients go on the Internet they can communicate with doctors in Denmark or the United States. They can also get advice from sources that claim they are experts without that it is possible to verify competence. Ministry of Health has set a target to test secure communications by email to the doctor's office in 2003. (…)

GP Nils Kolstrup says that expanded communication by e-mail helps to shorten the telephone line in the half-hour each day that is reserved to brief patient consultations for patients. “It is an advantage for us. It is an advantage for the patient. I can via email give short messages like “your blood sample is fine,” but will ask them to contact you if there is anything serious,” says Kolstrup. He characterizes it as “highly regrettable” that he is not allowed to provide this kind of information to patients via email. The reactions from patients have been unambiguously positive.” (Original in Norwegian)

4.23 Electronic Health Records

Electronic Health Records (EHRs) are used at all levels of Norwegian healthcare. EHR is a description of the patient's condition and the health care professionals' judgments and actions. Generally, we can divide EHR in two groups: “shared EHR” and “local EHR”. In order to establish EHR as a tool for collaboration between health professionals and health organizations, shared EHR, or EHR that is shared between multiple healthcare organizations, is preferred. EHRs are important for telemedicine services. It is crucial for telemedicine services that patient data from the telemedicine consultation is stored in the EHR. Norway is in the forefront of the use of electronic health records. Almost 100% of hospitals and general practitioners use EHR, which is the highest usage of EHR in Europe.

Figure 290 shows that almost all hospitals have implemented EHR, a process that has been going on for over 20 years. In 2000, more than 80% of the Norwegian hospitals in specialist health care were using EHR.

EHR were introduced in primary health care in Norway in the end of 1970s (Nilsen and Fosse 1982, Bassøe and Sørli 1983, Hasvold 1984). The first systems were stand-alone systems. With the introduction of local area networks and PC-based EHR, the systems were more available. Figure 291 illustrates how the use of EHR in primary increases with the introduction of the PCs.
Figure 290 Number of health trusts having implemented EHR.\textsuperscript{137}

Figure 291 Number of general practitioners having implemented EHR.\textsuperscript{138}

Figure 292 shows the number of GP practices connected to the health network. The number for 2010 is estimation. (In 2015, all GPs were connecte to the Norwegian Healtnet.)

According to Norum et al. (Norum, Pedersen et al. 2007), who present the recommendations from an expert group that evaluated which telemedicine services that should become large-scale telemedicine services, integration of patient data from telemedicine services into the EHR is crucial for sustainable telemedicine services. For several of the examined services the expert group argues: “documentation must be integrated into the EMR for it to be systemati-


easily available”, e.g., image documentation in dermatology. The expert group concluded that a single electronic interaction platform (lab data, EHR, referrals, discharge summaries, messages, images, sounds, movies, graphics, etc.) must be given high priority.

![Graph showing percentage of GP practices connected to Norwegian Healthnet either through a separate contract or agreement with the municipality.](http://hiwiki.idi.ntnu.no/images/c/c5/EPJ-monitor-2010-v1.2.pdf)

Figure 292 Percentage of GP practices connected to Norwegian Healthnet either through a separate contract or agreement with the municipality. (Translation: “Egen” = own / separate contract; “Kommunal” = municipality / contract through the municipality).

The expert group argues that patient data should only be stored where they are created and that the data must be made available to all when needed. Patients often relate to a number of players (GP, home care, specialists, training institutions, pharmacies, etc.) that communicate with each other – they should all have access to the same information.

For the distribution of multimedia artefacts (skin images, video, heart sounds, ECG, spirometers, etc.) the expert group argues that an electronic envelope that can handle this kind of information is developed. This should be integrated into the patient record systems both in the hospital and in primary care. The group also argues that parts of the text of the electronic referrals should be considered (if they follow a certain template) used directly in the hospital records in order to achieve efficient operation.

One patient, five doctors and paper-inferno

By Jan Fredrik Frantzen (14 May, 2009)

“I will have better information flow, especially for the treatment of chronic illnesses. I have a pain in the joints, and it is not dangerous that five doctors know about it!” Arnsten Linstad has clear opinions.

It breeds a health debate on how far we should strive to ensure that patients receive quality care. Should the GP be able to read the hospital record, and the patient should have read what the doctor has written ... or maybe even update their own records? Several aspects of this debate will be discussed during this summer's conference, and you also get to meet those affected most by the issue of sharing of patient information: the patients.

One of them is Arnsten Linstad, whose rheumatic pain must relate to five different doctors. They give treatment to the patient, but they are not allowed to look up directly in each other's patient records.

“I will have better flow in the system, especially for chronic illnesses. Having pain in some joints, it is not dangerous that five doctors know about it! If I can decide they all should have access to the data,” he says firmly.

Linstad want as a patient to give health professionals who need it access to his patient records in a convenient manner, so that doctors do not have to spend time on duplication and letter writing. “The doctors are very good, but they have to spend lots of time writing letters to each other and ask to know what treatment the doctors have given me. I guess that time could be better spent.”

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140 This article was originally written by Jan Fredrik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/index.php?id=4590228 (Last accessed: 5.2.2013.)
Patient Journal is poorly structured, BUT: Important to share information

By Hilde Pettersen  (6 June, 2006)

“The current patient journal is a threat to my son’s life and health,” stated Paula Iren Bø Syrstad during a seminar in Tromsø under the auspices of the Norwegian Centre for Telemedicine and HIT Northern Norway. The Trondheim woman Paula Iren Bø Syrstad has a 24 years old son with cystic fibrosis. Many years of contact with Norwegian hospitals has given her better insight into the systems and procedures at hospitals than most people have. This experience and knowledge she uses to influence health care, government and providers from the private sector to improve the existing patient information systems in Norway.

During the seminar “Access across – the sharing of patient data” contributed Bø Syrstad with her own experienced examples of how vital the “right information to the appropriate health person at the right time” may be especially for chronic illnesses, patients with complex diagnoses and people who have been sick for a long time. “Access across departments, hospitals or service is not as significant when the information in the patient record is not good. The structure has not improved with the introduction of electronic patient records. When you cannot, in a simple manner, find critical information, it is my experience that health professionals choose “easy” solutions. Too many medical practices are based on doctors’ and nurses’ memory,” said Bø Syrstad.

Relatives representative Bø Syrstad is the leader of the user committee of Hospital Pharmacy in central Norway (“brukerutvalget for Sykehusapotekene i Midt-Norge”). She works with the user committee in a pilot project with the aim that patients will face a thoughtful and operational logistics specialist services. “The goal should surely be that critical information must be available when health professionals need it. And then it’s essential to think about structure. One must look at the structure, form and content of patient records. And I ask, should the electronic medical records (EMR) be a log that provides health care system legal backing, or should it be a tool for the treating physician?”

Figure 294 Paula Iren Bø Syrstad.
( Photo: Hilde Pettersen)

141 This article was originally written by Hilde Pettersen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/viktig-aa-dele-informasjon.329494-80450.html (Last accessed: 5.2.2013.)
In the near future, doctor’s round at the hospitals in Hammerfest and Kirkenes imply that the nurse or doctor comes with a PC under their arm. The project Electronic Health records (EHR) is fully operational with several pilot departments. In ward C in Hammerfest, nurses now switch the old Kardex with a PC when they go their rounds. Here, they write their nursing documentation of each patient directly into the computer.

In Hammerfest, medical ward C is one of the most important pilot departments. Kari-Anne Wæraas is head nurse. What is particularly new for nurses is that all nursing documentation will now be entered in the PC, into the system called DIPS. “It is very exciting,” insists Kari-Anne. Kari-Anne says that the department is well underway. Ward C was chosen as a pilot department because they have a stable and experienced staff. The focus is on teaching everyone in the department basic computer skills. It is both challenging and exciting for the employees — one employee became motivated to order a laptop for home use.

“What are the biggest challenges?”, Kari-Anne is asked. “It is to get all employees to use computers as a tool. There is no choice, everyone must be there,” says Kari-Anne. At the University Hospital in Tromsø, some of the nurses got additional training and became super user. This strategy has been adopted in Helse Finnmark. There are a total of four nurses receiving additional training in the pilot departments to be an additional resource. Three in ward C and one in the clinic. These are offered optional courses in Tromsø and Kirkenes. “It is important that the nurse can get help when she stands there and suffer, and that resources for guidance and help are available at all times.”

The pilot project makes its way forward little by little. The department is still waiting for the wireless connection to work properly, and then they also will have many new desktop computers and notebook PCs. The visible difference will be that the amount of paper will decrease and instead of the old and heavy "Kardex" folder nurses have carried around, they now come to roll around with a PC on their daily rounds to patients. All patient information will hereinafter be only on their computer. The new life will be well received by nurses. Nurse Ingunn Jeremiassen is looking forward to not having to look in the paper pile. “There is much new, but we do not have papers, do not have to do things over again, not to mention having to decipher a lot of illegible writing,” says Ingunn.

142 This article was originally written by Helen Åsli and Marit Kvarum, Helse Finnmark, and later translated into English by the authors. URL (Last accessed: 5.2.2013): http://www.helse-finnmark.no/getfile.php?FIN%20Helse-Finnmark%20INTERNETT/Nyhetsbrev/Nyhetsbrevet%205-2006.pdf
Lessons learned from 25 years with telemedicine in Northern Norway

The first paperless department\textsuperscript{143}
By Helen Åsli and Marit Kvarum (27 October, 2006)

The Radiology Department at Kirkenes Hospital is the first paperless department in Helse Finnmark. Everyday life is now much easier for employees in the department.

![Radiographer Steinar Larsen shows off a busy radiology department at Kirkenes, but no papers.](Photo: Marit Kvarum)

Radiographer Steinar Larsen presented proudly his office. There are no piles of paper to see. “Previously, we had 17000 requisitions lying here in the course of a year,” says Steinar. This was paper that was carried around. Now we have no paper here. The department currently receives electronic requisitions from primary physicians throughout Finnmark and from the other departments in the hospital.

“An example is the primary doctor on Måsøy that sends MRI requisition electronically to us,” says Steinar. “After 5 seconds it is in Kirkenes, where it is being examined. The answer goes out immediately after it has been dictated. This is both time saving and safer,” says Steinar.

That system is much safer because the imaging system (PACS) and the radiology information system (RIS) are synchronized with each other. “Before we could run the risk that we got the wrong picture to the description of the patient. Now the systems are synchronized with each other. With this we are assured that the legal text is automatically linked to the right image.

Departmental chief physician Vibeke Seierstad praises the job Steinar has done to get the department paperless. “He has done a great job of getting our daily lives to slide easier,” she says. Personally, Steinar is a little more sober about it: “I was lucky enough to receive training at the University Hospital in Tromsø. Through this we didn’t have to wait for the EPR project, which unfortunately has been somewhat delayed. Now we start to make the outpatient clinics at the hospital paperless,” he concludes.

\textsuperscript{143} This article was originally written by Helen Åsli and Marit Kvarum, Helse Finnmark, and later translated into English by the authors. URL (Last accessed: 5.2.2013): http://www.helse-finnmark.no/getfile.php/FIN%20Helse-Finnmark%20INTERNETT/Nyhetsbrev/Nyhetsbrevet%205-2006.pdf
### 4.24 Reimbursement

Without reimbursement, no telemedicine services (after the idealists have logged out). Thus, the hospitals, general practitioners and others that are determined of reimbursement, must get decent paid for their effort, compared to the F2F (“face-to-face”) alternative.

The first telemedicine fees in Norway were introduced in August 1996. This made Norway become the first country to implement an official telemedicine fee schedule making all telemedicine services reimbursable by the national health insurer.

Examples of telemedicine fees anno year 2002 (in NOK – Norwegian kroner):

<table>
<thead>
<tr>
<th><strong>Ear-Nose-Throat:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The agent receives the patient’s specialists fee</td>
<td>NOK 185</td>
</tr>
<tr>
<td>The agent receives consultation fee</td>
<td>NOK 110</td>
</tr>
<tr>
<td>In addition: a telemedicine assistant fee</td>
<td>NOK 75</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>NOK 370</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Dermatology:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The agent receives the patient’s specialist fee</td>
<td>NOK 185</td>
</tr>
<tr>
<td>The agent receives consultation fee</td>
<td>NOK 110</td>
</tr>
<tr>
<td>In addition: a telemedicine assistant fee</td>
<td>NOK 20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>NOK 315</strong></td>
</tr>
</tbody>
</table>

**Specialist fee dependent on method** | NOK 350/500

These fees have later been inflated. Figure 297 shows the booklet for activity-based funding anno 2009. The directorate of Health has given a definition of what can be defined as telemedicine contacts (Figure 298).

*Figure 297 Directorate of Health’s catalogue for activity-based funding*
Lessons learned from 25 years with telemedicine in Northern Norway

Figure 298 The Directorate of Health’s description of what is categorised as “telemedicine contact”.

In 2009, the following rates with the use of telemedicine listed in the tariff booklet for public outpatient clinics:

<table>
<thead>
<tr>
<th>Ref</th>
<th>Note</th>
<th>NOK</th>
</tr>
</thead>
<tbody>
<tr>
<td>O01b</td>
<td>Telemedical consultation</td>
<td>426,-</td>
</tr>
<tr>
<td>O01c</td>
<td>Freeze-frame consult., ear-nose-throat</td>
<td>426,-</td>
</tr>
<tr>
<td>O01d</td>
<td>VC, ear-nose-throat</td>
<td>622,-</td>
</tr>
<tr>
<td>O01e</td>
<td>Freeze-frame consult., dermatology</td>
<td>426,-</td>
</tr>
<tr>
<td>O01f</td>
<td>VC, dermatology</td>
<td>622,-</td>
</tr>
</tbody>
</table>

In the notes it says:

- **Note O1**: “This tariff applies to activity that takes place at a specialist in a hospital in the examination and diagnosis without the patient present. Rates may not be used together with other outpatient charges by the specialist, but has no effect on the tariffs applied locally either by the GP or specialist at the hospital. Rates are valid only when performing procedures that are otherwise described in this tariff booklet.”

- **Note O2**: “The tariffs O01c and O01e can only be claimed if the specialist on the basis of a consultation with a doctor in primary health care diagnoses and provide treatment advice based on the submitted image. It is assumed that the patient is not present.”
Note 03: “Tariffs O01d and O01f can only be claimed if the specialist on the basis of a consultation with a doctor in primary health care diagnoses and provide treatment advice based on the submitted image. It is assumed that the patient is not present. Rates may not be used in conjunction with other outpatient charges, but has no effect on the tariffs applied locally by GP.”

According to the Directorate of Health, telemedicine is a new communication tool that has led to more effective coordination, both between hospitals and between primary care and specialist services. Telemedicine is used in parts of the country, especially in the North Norwegian Health region. The outpatient tariff system for public clinics includes tariffs that can be triggered by the use of telemedicine. In 1997 it was introduced two tariffs for telemedicine – a consultation rate and one for transmission of radiology images (X-ray rate was later discontinued).

From 1 July 2002 it was introduced four new tariffs for the different uses of telemedicine in skin and ear-nose-throat. These rates are used by outpatient clinics at the advice and guidance to the primary care on the basis of still image or videoconference. (This is examination and diagnosis made by specialists in outpatient clinics, without the patient being present.) Rates are subject to the rule that the patient is located at the primary care physician and cannot be used along with other outpatient charges.

The Norwegian Centre for Telemedicine argues that:

- The changes within the health service organization and cooperation happens quickly. Changes in funding on the other hand, slowly, and helps to delay the necessary restructuring processes in the direction of more effective forms of cooperation.
- Established charges will apply only to public clinics. Private practitioner specialists can therefore not use these fares so that public and private healthcare providers are not equal. Expenditures occur on both levels of the health services, but specialist health care is the only level that gets triggered revenues.
- Investment in infrastructure is made difficult because of lack of funding. Ideally, investments in equipment considered as a common expense of primary and secondary care, and covered by the same economic framework.
- Today's rates are subject-specific and not generic, and are not based on actual time spent.

According to official 2007 numbers from The Norwegian Labour and Welfare Service (NAV), 8243 taxations were recorded in 2007 (Figure 299). The total cost in 2007 was NOK 1,821 million (Figure 300).

Specialist outpatient clinics and GP practices by public contract are financed by charges paid by the government (via Social Security Administration) and by patients’ fees. An important milestone was reached 1 July 2013 when a tax for text-based communication (e-taxation) between patient and doctor was introduced for general practitioners.

According to an article in “Helserevynen Online” in 2006, the Health North Trust spent NOK 527 million in 2005 to transport patients to and from hospitals in the region (Figure 301). Through the use of telemedicine, much of the expense could be saved. The CEO of Northern
Health Trust, Lars Vorland, said in an interview that: “Instead of having the patients be treated where they live, the Health North pay their journey to hospital. We could have saved lots of money if it was prepared for more telemedicine services.” According to the newspaper, both NST and Health North Trust have argued for the value of more telemedicine services, but so far, with little success.

**Figure 299** The number of taxations in health care in Norway 2002 - 2007. Telemedicine (“telemedisin”) represents a small group with 8243 taxations in 2007.

**Figure 300** The reimbursement in health care in Norway 2002 - 2007. Telemedicine (“telemedisin”) represents a small group with the total cost of NOK 1,821,515 in 2007.
Figure 301 “Late with rates for telemedicine.” Health trusts can save several hundred million NOK a year to use known, telemedicine technology. But the central government is dawdling with the rates. (Helserevyen online, 24 February 2006)\textsuperscript{144}

4.25 Master program in telemedicine and e-health

In autumn 2005, the University of Tromsø started a 2-year master's of science in telemedicine and e-health. Students can choose between a technology and a health track, and the program starts each fall. The master's program is developed and run in close collaboration between the University of Tromsø and the Norwegian Centre for Telemedicine (NST).

The idea behind the development and implementation of telemedicine is to move information instead of patients and reduce the growing burden on health care. Master's degree in Telemedicine and e-health provides a thorough introduction to medical technology, how health care is organized and how best to introduce telemedicine to provide better services to patients. The teaching language is English. Teaching is a mixture of lectures and group work. All students write a final thesis, and it is possible to take parts of the program abroad.

\textsuperscript{144} Helserevyen online / helserevyen.no does not exist anymore.
Lessons learned from 25 years with telemedicine in Northern Norway

Of the 11 students who finished in the first group of master students in 2007, nine were from Norway, one from Latvia and one from Russia. In the second group, which started in autumn 2006, the majority students were from abroad. Only two students came from Norway. The others came from USA, Bangladesh, India, Zimbabwe, Nepal and the Philippines (Figure 302).

One of the students who graduated in 2007 was Ieva Vitola from Latvia (Figure 303). In the study in Tromsø, she immersed herself in the interaction between people and technology. What happens in an organization when you use new technology and how it affects the human touch? In an interview with NST’s journalist Jan Fredrik Frantzen, she said that: “I am probably the first in Latvia with expertise in telemedicine.” She expressed that she was looking forward to begin to disseminate the new information on telemedicine at her work at Stradini Clinical University Hospital in Riga.

Even the majority of students from the class of 2007 started to work for hospitals and other public organizations after graduating, some of the students started to work for international private companies. On of them was Terje Johannesen, who started as a manager in PwC, and soon was promote to director of PricewaterhouseCoopers Consult in Bergen, Norway.

The telemedicine master gives also access to PhD studies. Of the class of 2007, one of the candidates, Kristoffer Røed, continued with PhD studies at the Faculty of Medicine, University of Tromsø.

One of the students who graduated in 2008, was Shabbir Syed Abdul from India (Figure 304). Before he came to Tromsø, he had completed his medical studies in Arkhangelsk and St. Pe-
Hartvigsen and Pedersen

tersburg in Russia. In his master’s thesis in Tromsø, he analysed the transition from patient records on paper to electronic records in Indian hospitals.

Figure 303 Ieva Vitola has written a thesis on the development of electronic medication card. She envisions great opportunities to make use of several telemedicine services in the country of Latvia. (Photo: Jan Fredik Frantzen)

In an interview with NST’s journalist Jan Fredrik Frantzen, he said that: “When you are born and raised in India, it quickly becomes very natural to be concerned with technology. The huge subcontinent has produced a large number of skilled physicians and surgeons, as well as very skilled system developers. It was natural for me to be interested in the combination of ICT and medicine, because we Indians have always been interested in new technology, while I was a trained doctor.” After he graduated from the University of Tromsø, he continued with doctoral studies at Graduate Institute of Biomedical Informatics, Taipei Medical University in Taiwan.

Figure 304 There are now several hundred million mobile phones in India, and the number is rising rapidly. Master student Shabbir Syed Abdul will give Indians the opportunity to bring information about their medications, allergies and chronic diseases on the phone. “This will save lives,” he said. (Photo: Jan Fredrik Frantzen)
Kassaye Yitbarek Yigsaw from Ethiopia
Espen Andreassen (22 March, 2012)

Kassaye has studied telemedicine and e-health technologies at the University of Tromsø since August 2010. He had a degree in electrical engineering from Addis Ababa. “You will not find a program like this anywhere else in the world, and I think this course was very interesting.” Kassaye argues that what he learns in Tromsø can be very valuable in his home country. He elaborates: “Telemedicine relies on an existing telecommunications infrastructure. In this area, a lot happens on the African continent and thus telemedicine will become more and more relevant,” he said. Kassaye has received a regional development grant to take the master’s degree. “I considered more appropriate program, but eventually I came across the Master's program in telemedicine,” he says. The Ethiopian was through contacts in the telemedicine community in Tromsø admitted access to the prestigious practice program "Extreme Blue", hosted by IBM France.

Kristian Martin Andreassen from Norway
Espen Andreassen (22 March, 2012)

Kristian entered the master’s program in telemedicine and e-health technology with a desire to explore something other than pure science. He graduated in 2008, and was thus one of the first who completed the master’s program. “We were the first class, but we still had many subjects that proved in-depth insight into ICT in the health care sector. The topics we had that were related to telemedicine were very good,” he says. He places particular emphasis on the ability to work with their own projects. In Kristian's case he was involved in developing a prototype of a waiting room analysis. Before the Master's degree, he had graduated as a computer engineer from Narvik University College. At the moment he is employed by the Northern Health ICT in Tromsø.

Wael Ruba from Palestine
Espen Andreassen (22 March, 2012)

Wael is originally from the West Bank in Palestine, but arrived in Norway as a refugee in 2005. He completed his master's degree in telemedicine in February 2011, the final year of study was spent in Spain. “Last year I was in Valencia to complete the master's thesis with a program I developed for the iPhone to promote physical activity,” he said. Wael is currently working as a programmer for the iPad and iPhone, and he is employed by the firm Cessa, which produces digital books for children. He hopes he will get an opportunity to work within the health sector. “I want to see this program shine, and I hope and believe it will,” he says.

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145 These three articles were originally written by Espen Andreassen, NST, and later translated into English by the authors. URL to the originals: http://mit.cs.uit.no/J/index.php/masternorsk/studentpresentations-msc-norsk (Last accessed: 5.2.2013.)
4.26 PhD studies in telemedicine and e-health

Until the end of 2011, more than 30 candidates had defended their PhD dissertation in telemedicine and e-health at the University of Tromsø. The PhD degrees have been granted within many different fields, including telemedicine, medicine, computer science, medicalinformatics, statistics, sociology, economics, anthropology, psychology and educational science. Almost all PhD candidates have been affiliated with NST.

In the beginning of 2012, around 20 PhD candidates were working with PhD projects related to telemedicine and e-health. Most of the PhD candidates were affiliated with Tromsø Telemedicine Laboratory and its PhD-school in telemedicine and e-health.

One of the PhD-students, Taridzo Chomutare from Zimbabwe, did research on the integration of patient data from a mobile self-help application for people with diabetes into social media (Figure 308). Chomutare graduated from University of Tromsø’s Master program in telemedicine and e-health, Technology track. He was awarded best master’s thesis at the Faculty of Science and Technology146 the year he graduated. As part of his PhD-project, Chomutare spent the year 2013 at University of Texas Health Science Center at Houston.

Almost all PhD candidates in telemedicine and e-health spend 0.5-1 year abroad. The majority go to the US, followed by Europe and Australia. E.g., Chomutare spent one year at University of Texas Health Science Center at Houston.

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146 Faculty of Science and Technology comprises the Departments of Geology, Physics and Technology, Chemistry, Computer Science, and Engineering and Safety.
Lessons learned from 25 years with telemedicine in Northern Norway

New PhD study: Internet chat results in better diagnoses
Jan Fredrik Frantzen (6 October, 2008)

It is a timeworn myth that all health work should take place face to face. On the contrary, discussions on Internet forums can result in better communication and better diagnoses. This is the finding of new research from the Norwegian Centre for Telemedicine.

It has been an accepted “truth” that consultations and health services must be provided face to face if they are to be effective. For this reason, many people are worried that “cold technology” will replace the “warm hands” of the public health service.

This fear may well be overstated. At least, this is the implication of doctoral research by psychologist Jan-Are Kolset Johnsen, who defended his thesis on Friday 5 September at the University of Tromsø.

Lowering the threshold for openness
The research was conducted against the background of studies from Australia showing that 40% of those who struggle with mental illnesses do not get help. The reasons for this may include long distances, costs that are too high, and the feelings of shame and stigmatization associated with seeking help for mental illnesses. But the Internet costs nothing and eliminates the distances, with the result that more people look for services on the Net.

“The Internet helps patients to overcome such barriers to seeking help. But another and very important effect is that they are in fact more open when they are to describe their symptoms through text on the Internet,” says Johnsen.

Effective communication = better diagnoses
For many people, it is not easy to explain what the problem is when you are sitting opposite the doctor. And if you keep information to yourself, there is a strong possibility that the diagnosis will be wrong. This can in turn result in the wrong treatment and the wrong medication.

With the backing of Johnsen's research, the public health service can thus build new and more effective forms of communication based on text. This gives doctors a better basis for decisions, which in turn means better diagnoses and better treatment.

The doctoral degree is entitled “Electronically Mediated Health Communication: Uses of Text-Based Media”. Johnsen has conducted his research at the Norwegian Centre for Telemedicine with supervision from the University of Tromsø. The study is funded by the Research Council of Norway.

147 This article was written in English by Jan Fredrik Frantzen, NST. URL to the article: http://www.telemed.no/internet-chat-results-in-better-diagnoses.4516596-97537.html (Last accessed: 5.2.2013.)
New PhD thesis: Breakthrough for diabetes self-help

Jan Fredrik Frantzen (15 January, 2010)

A PhD project at the NST has resulted in the development of a new self-help system for diabetes, based on a mobile telephone, blood glucose meter, and step counter. “We would never have succeeded in this without dedicated users,” says researcher Eirik Årsand. Together with the other researchers and the system developers in the diabetes team at the Norwegian Centre for Integrated Care and Telemedicine (NST), Årsand has spent the past four years developing this system in his PhD project.

Strong user loyalty to the system

“It would not been possible to develop this tool without involving people with diabetes over a period as long as two years,” says Årsand, and adds that as far as he knows, there are no other equivalent projects that have included users to the extent that this project has. The trials of the system that the users have helped to develop actually lasted half a year, but all the users were so pleased with it that they are still using the system nearly one and a half years after they received the equipment.

Wireless and automatic

Today, we have a mobile phone with us almost wherever we are – and this is the principle that inspired the system. In addition, telephones are becoming more like computers that you can use to phone people. This creates new opportunities.

“The blood glucose meter transmits the blood values wirelessly to the telephone, and so does the step counter that we developed two years ago. Dietary information is also easy for the user to enter. And the tool functions as a practical aid in everyday life,” he adds. All the values are collected and stored in the phone, and you can keep track of the trend in your blood glucose, how active you have been, and how successful you have been in maintaining healthy eating habits. This feedback enables you to monitor and change both your diet and your activity level on the basis of your blood sugar values. The best-case result is a stable and healthy blood glucose level, which in turn reduces the risk of complications resulting from the illness.

Ready for large-scale testing in EU project

Testing so far has involved only 12 users, which is not enough to draw any clear conclusions about the medical effect of using the tool. However, the EU project “Renewing Health” – which starts in February – will give 200 people the opportunity to use the system. This will provide a much better basis for finding out whether the “Few Touch” application does in fact help to improve eating habits, physical activity, and blood glucose values. And, in turn, the health of its users. Comments from the 12 testers indicate that the equipment is easy to use, and that several of the participants have changed their medication, physical activity, and diet after starting to use the system. The PhD research was conducted at the University of Tromsø and the NST. The project was funded by the Committee for Telemedicine Research Programme at the Northern Norway Regional Health Authority and Tromsø Telemedicine Laboratory (TTL).

Figure 310 The diabetes team at the NST has come a long way since starting the first trials in 2005. In December Eirik Årsand defended his thesis on the diabetes diary, which can simplify everyday life for people with diabetes. (Photo: Jan Fredrik Frantzen)

Figure 311 The mobile phone is at the heart of the whole system. The menus are simple and it is easy to enter diet details on the phone. Automatic wireless transmission of data from the step counter and the blood glucose meter gives users a convenient way to track the development of their health. (Photo: Jan Fredrik Frantzen)

Figure 312 Icelandic Björgvin Hrafnsson, living in Norway for the past 25 years, was diagnosed with diabetes in 2003. “The problem is to stay focused, in order to prevent the blood sugar from spinning out of control. The system helps me to keep track of my diet and physical activity, and I can see how it affects my glucose levels,” he says. (Photo: Jan Fredrik Frantzen)

148 This article was written in English by Jan Fredrik Frantzen, NST. URL to the article: http://www.telemed.no/breakthrough-for-diabetes-self-help.4721284-150024.html (Last accessed: 5.2.2013.)
4.27 Other services

This chapter has presented some of the major telemedicine services that have been implemented in Northern Norway or based on expertise developed in Northern Norway. Other services that have been explored in Northern Norway include:

**Pain treatment:** In 2011-2012, a pilot system was implemented in cooperation between the operation and intensive clinic (OPIN clinic) at the Pain Department (Smerteavdelingen, UNN) and the National Centre for Telemedicine (NST) (Normann, Landström et al. 2012). The project's overall objective was to propose solutions in which ICT can be used to optimize and leverage the use of limited resources (specialists) within pain management in the region. Management of persistent pain represents a major public health problem in Troms and Finnmark counties. The treatment of persistent pain problems is a lengthy and multidisciplinary treatment, where the collaboration between the patient, pain department, primary care, as well as a variety of other actors involved, is essential for the results. Treatment should for many reasons also take place in or related to the patient's home environment. Technology used include videoconference equipment, EHR access, e-messages between GP and specialists and between patients and health care workers.

**Patient care:** In the project “The health service seen from a patient perspective”, Berntsen et al. (Berntsen, Høyem et al. 2014) have identified bottlenecks and problems in the treatment of patients with long-term conditions. They argue that: “Despite the many positive patient experiences in this study, we have also found serious mishaps, disorder and discontinuity of care. In long-term conditions, the patient's own efforts are crucial for treatment success, but there is no systematic identification and support of patients’ own resources. All collaboration between professionals concern patients, yet the health care system continues to ignore that the patient is the hub of all interaction and coordination. Quality of care for patients with long term conditions include 1) the correct diagnosis and appropriate multidisciplinary treatment 2) coordinated and predictable health care, and 3) support for self-care and self-management. We need a health service, which puts what matters to patients first, and then secondly uses diagnostic interventions as tools to promote the goals that matter to patients. This requires a significant cultural change, professional development and system changes. Health professionals, who are patient-centered, must feel that they are working with and not against the system. We need a visionary and bold long-term commitment from a management willing to change both organizational, cultural and economic incentives in support of the good patient pathway.” (Page 4)

A summary of existing telemedicine services at UNN is provided in the next chapter.
5 Benefits from telemedicine

5.1 What is telemedicine all about and how should telemedicine be evaluated?

The introduction of ICT into medicine is not the introduction of a new treatment method. It is a new way of communicating patient’s information. Based on this information the doctors and nurses still make the diagnoses and decide the treatment just as they used to do before ICT was introduced into their normal working day.

To evaluate, new and old, medical diagnostic and treatment procedures the medical society has methodologies that go back more than a thousand years. Core principles are that the new medical regimes have to demonstrate its importance based on values as double blind and randomised clinical trials before introduction into everyday practise.

The question to be raised is if it is fair to the ICT solutions of tomorrow to be judged by the methodology of yesterday, or to be judged by the methodology of another discipline? Has the medical society anything to learn from the introduction of ICT in other areas? Is it thinkable emails, SMS and the use of VISA cards should have to go through the same methodology to prove their value before their introduction? The answer to this question is obviously “no”. So why is the rest of the world acting so differently when it comes to the use of ICT?

In a paper published in 2007, (Whitten, Johannessen et al. 2007) reviewed more that 10,000 articles of telemedicine. These articles were assessed against inclusion criteria, and after eliminating articles that did not meet the inclusion criteria, 1615 remained for analysis. In the conclusion the authors write:

“Until the telemedicine field adheres to agreed standards of reporting methodological details it will be difficult to draw firm conclusions from review studies. Lack of methodological details limits our ability to understand and explain telemedicine, because it violates one of Kuhn’s basic tenets: the existence of intertwined theoretical beliefs and methodological strategies make it possible for a field to evaluate its own body of research. In fairness, similar analyses for the methodologies of other health interventions might yield the same results. Nonetheless, our study raises the question whether the reporting of telemedicine methodology is of sufficient quality,”

Weaknesses or not in the methodology, based on the fact that there has been a very slow implementation rate of telemedicine solutions in almost all medical societies around the globe, The Health North Trust in 2005 put into existents a group of experts and gave the group the mandate of reviewing the exciting telemedicine services in Northern Norway and, based on this review, to advice the management of the region on which telemedicine services were mature for big scale implementation.

The groups work is described in the publication called “Prioritisation of telemedicine services for large scale implementation in Norway” (Norum, Pedersen et al. 2007) and presented in full in the next chapter. In spite of these very clear recommendations the speed of the implementation is still disappointing slow.
5.2 What have we learned about telemedicine services?

Johnsen et al. (Johnsen, Breivik et al. 2006) describe and systemise documented benefits for Norwegian health services of telemedical services and projects (Figure 313). The authors reviewed all relevant projects and services and available documentation of both economic and qualitative benefits.

Figure 313 The Høykom report “Benefits from telemedicine in Norway” from 2006.

The authors identified 29 studies that described qualitative profits. They divide the qualitative profits in three main categories: (1) Electronic patient records (EPR) and electronic messages, (2) discipline-specific solutions and (3) patient-oriented solutions.

In the first group, electronic patient records (EPR) and electronic messages, the authors found improved integration between EPRs and electronic information exchanged between primary and specialist health services. In this way, institutions avoid duplicating tasks and there are fewer errors made in recording patient information. The authors report that:

“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 up-dated records and to faster communication with the outside world.”
In the second group, discipline-specific services, the authors identified improved knowledge for health personnel, which improved patient treatment, e.g., in teledermatology. In addition, the selection process for dermatology patients requiring hospital treatment was improved. For teledialysis, a higher level of care quality was experienced. By the use of teleradiology, patient travels were reduced. For emergency medicine, the authors report that the solution for acute heart problems saves time and the benefits increase in step with the travelling time to hospital.

In the third group, patient-oriented solutions, telemedicine resulted in increased patient empowerment. Johnsen et al. (Johnsen, Breivik et al. 2006) argue that:

“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.”

When it comes to economical benefits, Johnsen et al. (Johnsen, Breivik et al. 2006) argue that:

“Nine of the studies of the economic consequences of telemedicine show benefits or potential for benefits. Analysis shows that the cost-effectiveness of telemedical 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 break-even point that 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 two of the studies, the conclusion is that the evaluated service is cost-effective; seven of the studies show that there is some potential for cost-effectiveness; however the services were not used enough at the time of evaluation to show benefits.”

Figure 314 The reduced need to travel is the most obvious benefit from the use of telemedicine. (Photo: NST)
Hartvigsen et al. (Hartvigsen, Johansen et al. 2007) argue that “In almost twenty years, UNN and The Norwegian Centre for Telemedicine have been in the forefront of developing telemedicine services, both regionally, nationally and internationally. Today, telemedicine is widely used in Northern Norway and is well integrated into routine health service provision.”

Table 13 Documented areas of benefit from telemedicine services (based on the table on page 16 in (Johnsen, Breivik et al. 2006))

<table>
<thead>
<tr>
<th>Economic</th>
<th>Qualitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reduced travel costs</td>
<td>• Time for other tasks</td>
</tr>
<tr>
<td>• Reduced number of hospital admissions</td>
<td>• Data quality</td>
</tr>
<tr>
<td>• Reduced time spent by health practitioner</td>
<td>• Patients do not have to travel – more satisfied patients</td>
</tr>
<tr>
<td>• Reduced sick leave</td>
<td>• Health benefit where “time counts”</td>
</tr>
<tr>
<td>• Reduced paper and postage costs</td>
<td>• Selection of patient</td>
</tr>
<tr>
<td></td>
<td>• Competence in medical disciplines</td>
</tr>
<tr>
<td></td>
<td>• Professional confidence</td>
</tr>
<tr>
<td></td>
<td>• Access to specialists – increased availability of service</td>
</tr>
<tr>
<td></td>
<td>independently of the patient’s place of residence</td>
</tr>
<tr>
<td></td>
<td>• Efficient use of specialist expertise – increased productivity</td>
</tr>
<tr>
<td></td>
<td>• Patients’ empowerment</td>
</tr>
<tr>
<td></td>
<td>• Balanced workload between different levels of health care</td>
</tr>
<tr>
<td></td>
<td>and between institutions</td>
</tr>
</tbody>
</table>

5.3 Current use of telemedicine services in Norway

In 1999, Uldal (Uldal 1999) published a survey of telemedicine programmes in Norway. The survey identified 102 different telemedicine programmes, mainly within psychology (15), radiology (10), pathology (7), dermatology (5), geriatrics (5), diabetes (4) and otolaryngology (4). Uldal wrote:

"At the time of the survey (May 1998), 66 programmes were active and 26 had concluded, while for 10 it was not possible to decide whether they were active or inactive. (...) The inactive programmes had not necessarily failed: some had finished the project phase and gone operational; others had lacked staff with the initiative and time to carry them further; and finally some were indeed deemed to be of limited use, although this was usually only confirmed verbally by the contact persons.” ((Uldal 1999), page 33)

Knarvik et al. (Knarvik, Zanaboni et al. 2014) reports that from 2000-2010, “significant resources were directed to the development of telemedicine services, with the aim of achieving high-quality and cost-effective healthcare. In 2003, the Norwegian Centre for Telemedicine (NST) conducted a survey of telemedicine activities in Norway. The survey showed variations between health regions with respect to both the type and the number of activities, and it found that telemedicine was provided as a routine service only to a minor degree (Knarvik, Bach et al. 2004).” (page 8)
According to Knarvik et al. (Knarvik, Zanaboni et al. 2014) most of the use of telemedicine in Norway in 2011 takes place in Northern Norway (54%), followed by Western Norway (45%). The activity in Central and South-Eastern Norway was limited. Of the 4.9 million outpatients consultations in Norway in 2011, only 1,827 (0.04%) were telemedicine episodes.

“The four health regions deliver healthcare services through 28 hospitals. Most hospitals delivering telemedicine contacts in 2009 showed a considerable decrease in their level of activity in the following years, with a few exceptions. 19 out of 28 hospitals (68%) reported that they had used telemedicine during the three-year period. However, the number of hospitals which actually used telemedicine was 14 in 2009, 14 in 2010 and 13 in 2011, i.e. some hospitals did not use telemedicine continuously over the period. The number of hospitals providing more than 50 telemedicine contacts every year decreased from 9 in 2009 to only 3 in 2010 and 2011. The University Hospital of North Norway in Northern Norway and the Stavanger University Hospital in Western Norway are the two hospitals which covered most of the telemedicine contacts in 2011 (90%). The University Hospital of North Norway and the Stavanger University Hospital were also the two hospitals with the highest relative use of telemedicine. Other hospitals have a similar potential to deliver part of the health services through telemedicine, according to the total number of face-to-face visits. However, they currently provide little telemedicine activity.” (Knarvik, Zanaboni et al. 2014, page 11)

Knarvik et al. (Knarvik, Zanaboni et al. 2014) found that the main use of telemedicine was for neurosurgery. This was also the “clinical area with a relatively high use of telemedicine compared to the total number of outpatient visits (5.5% in 2009).” According to Knarvik et al. “six hospitals had 10 or more clinical areas involved in the provision of routine telemedicine. These were the Stavanger University Hospital and the Fonna Hospital in Western Norway, the Finnmark Hospital, the University Hospital of North Norway and the Nordland Hospital in Northern Norway, and the Innlandet Hospital in South-Eastern Norway.” (page 11)

In their survey, Knarvik et al. (Knarvik, Zanaboni et al. 2014) identified of 75 telemedicine services:

“Of these, 50 were excluded because they were not routine services but still pilot projects. Of the remaining 25 routine telemedicine services, 8 were operational at the University Hospital of North Norway, 3 at the St. Olavs University Hospital, 8 at the Haukeland University Hospital, 2 at the Stavanger University Hospital, and 4 at the Oslo University Hospital. The 25 routine services were implemented in several clinical fields. Most routine telemedicine was delivered through synchronous services via videoconference. The remaining services were asynchronous, or used a combination of both synchronous and asynchronous technologies.” (page 12)

According to Knarvik et al. (Knarvik, Zanaboni et al. 2014) their analysis of data from the Norwegian Patient Register (NPR) show that:

“- the adoption of routine telemedicine in Norway is 100% at regional level, while at institutional level it reaches 68%;
- the level of use of telemedicine shows an irregular trend over the three-year study period, and most telemedicine contacts (90%) included in the registry were provided by two hospitals in Northern Norway and Western Norway, as confirmed by the survey. This might be the result of contextual factors, such as geographical needs (i.e. long dis-
Lessons learned from 25 years with telemedicine in Northern Norway

tances), which characterize those regions;
- despite telemedicine being widely adopted, its level of use is still low compared to the number of face-to-face outpatient visits. There is therefore a high potential to deliver health services throughout telemedicine. Neurosurgery is the field with the highest relative use of telemedicine;
- several of the hospitals delivering routine telemedicine have services in 10 or more clinical areas. This means that, when telemedicine is adopted by a hospital, it is more likely that services are offered through the whole organization. However, the number of telemedicine contacts in each area remains low.” (page 14)

Knarvik et al. (Knarvik, Zanaboni et al. 2014) also conducted a survey at the largest publicly funded hospitals in Norway. (The hospitals were chosen based on their highest telemedicine activity documented in the NPR.) The survey showed that:

“- most routine telemedicine services identified in the five largest public hospitals connected hospitals at the same healthcare level, while there were fewer telemedicine services connecting secondary care with primary care;
- Norway has a long history of implementation of telemedicine, with some services, including teleradiology, teledermatology, telepathology, and maritime medicine, existing since the 1990s. However, several telemedicine services became routine in the last few years, suggesting that telemedicine is slowly becoming more mature;
- the majority of the telemedicine services were synchronous and used videoconferencing, while fewer services were asynchronous. This might stem from the reimbursement scheme currently in use in Norway;
- most of the telemedicine services were delivered as hospital-based teleconsultations, while there was only limited routine telemedicine in home monitoring.” (Knarvik, Zanaboni et al. 2014, page 15)

Knarvik et al. (Knarvik, Zanaboni et al. 2014) concluded that:

“Routine telemedicine in Norway has been widely adopted, probably due to geographical needs, in a similar way to countries such as Brazil, Canada, and USA. The percentage of hospitals adopting telemedicine is high, and examples of routine telemedicine can be found in several clinical specialties. However, the level of use of telemedicine in Norway is rather low, with a high potential for further development as an alternative to face-to-face outpatient visits. We believe that the adoption of telemedicine is influenced by several contextual factors, such as reimbursement policies as a form of incentive for health professionals.” (page 18)

5.4 Current use of telemedicine services at UNN

The number of telemedicine consultations at UNN has varied over the years. It has actually been difficult to get the exact number of telemedicine consultations. Table 14 is listed from the electronic health record (DIPS) at UNN and shows the number of consultations from January to September in 2011. Table 14 shows that the largest user of telemedicine consultations is the outpatient clinic for neurosurgery (469), followed by outpatient clinic for ophthalmology (166), outpatient clinic for dermatology (145), outpatient clinic for orthopaedic (47) department for rehabilitation (15).
NST is the Norwegian centre for telemedicine. Thus, when studying the number of telemedicine consultations, we should not only study the numbers from UNN, but from all hospitals in which NST has contributed to the establishment of telemedicine consultations. E.g., today Sunnaas hospital performs quite many telemedicine consultations. These are all a result of the consultancy activity at NST in which experts from NST have managed the process of implementing such services.

**Table 14 Number of telemedicine consultations at UNN Jan-Sept 2011. (Text in Norwegian. Antall = Number of telemedicine consultations.)**

<table>
<thead>
<tr>
<th>Division</th>
<th>Place</th>
<th>Care level</th>
<th>Code list name</th>
<th>Code</th>
<th>Text</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Div of Surgery, Oncology and Women’s Health 149</td>
<td>Harstad</td>
<td>Hospitalisation</td>
<td>NCMP 155</td>
<td>ZWUU40</td>
<td>Telermedicine 152</td>
<td>1</td>
</tr>
<tr>
<td>Division of Rehabilitation Services 150</td>
<td>Tromsø</td>
<td>Polyclinical care</td>
<td>NCMP 152</td>
<td>ZWUU40</td>
<td>Telermedicine 4</td>
<td></td>
</tr>
<tr>
<td>Division of Rehabilitation Services 151</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 153</td>
<td>ZWUU40</td>
<td>Telermedicine 1</td>
<td></td>
</tr>
<tr>
<td>Division of Rehabilitation Services 152</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 154</td>
<td>ZWUU40</td>
<td>Telermedicine 15</td>
<td></td>
</tr>
<tr>
<td>Div of Cardiothoracic and Respiratory Medicine 153</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 155</td>
<td>ZWUU40</td>
<td>Telermedicine 2</td>
<td></td>
</tr>
<tr>
<td>Division of Internal Medicine 157</td>
<td>Narvik</td>
<td>Hospitalisation</td>
<td>NCMP 156</td>
<td>ZWUU40</td>
<td>Telermedicine 1</td>
<td></td>
</tr>
<tr>
<td>Division of Internal Medicine 158</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 157</td>
<td>ZWUU40</td>
<td>Telermedicine 1</td>
<td></td>
</tr>
<tr>
<td>Division of Internal Medicine 159</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 160</td>
<td>ZWUU40</td>
<td>Telermedicine 1</td>
<td></td>
</tr>
<tr>
<td>Division of Internal Medicine 161</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 162</td>
<td>ZWUU40</td>
<td>Telermedicine 145</td>
<td></td>
</tr>
<tr>
<td>Division of Neurosciences and Orthopedics 163</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 164</td>
<td>ZWUU40</td>
<td>Telermedicine 1</td>
<td></td>
</tr>
<tr>
<td>Division of Neurosciences and Orthopedics 164</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 165</td>
<td>ZWUU40</td>
<td>Telermedicine 1</td>
<td></td>
</tr>
<tr>
<td>Division of Neurosciences and Orthopedics 166</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 167</td>
<td>ZWUU40</td>
<td>Telermedicine 1</td>
<td></td>
</tr>
<tr>
<td>Division of Neurosciences and Orthopedics 168</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 169</td>
<td>ZWUU40</td>
<td>Telermedicine 166</td>
<td></td>
</tr>
<tr>
<td>Division of Neurosciences and Orthopedics 170</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 171</td>
<td>ZWUU40</td>
<td>Telermedicine 469</td>
<td></td>
</tr>
<tr>
<td>Division of Neurosciences and Orthopedics 172</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 173</td>
<td>ZWUU40</td>
<td>Telermedicine 6</td>
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</tr>
<tr>
<td>Division of Neurosciences and Orthopedics 174</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 175</td>
<td>ZWUU40</td>
<td>Telermedicine 1</td>
<td></td>
</tr>
<tr>
<td>Division of Neurosciences and Orthopedics 176</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 177</td>
<td>ZWUU40</td>
<td>Telermedicine 1</td>
<td></td>
</tr>
<tr>
<td>Division of Neurosciences and Orthopedics 178</td>
<td>Tromsø</td>
<td>Hospitalisation</td>
<td>NCMP 179</td>
<td>ZWUU40</td>
<td>Telermedicine 1</td>
<td></td>
</tr>
</tbody>
</table>

Table 15 presents the major telemedicine services used in Norway in the year 2012-13 that has been either initiated, developed or co-developed by NST.

---

149 Gastrokirurgisk avdeling  
150 Vanlig innleggelse  
151 NCMP Medisinske prosedyrekoder  
152 Bruk av telemedisin  
153 Barnehabiliteringen  
154 Barnehab. pol. Tromsø  
155 Poliklinisk omsorg  
156 Habiliteringsavdelingen  
157 Habilitering Tromsø  
158 Habilitering Tromsø  
159 Hjerte- og lungeklinikken  
160 Medisinsk klinikk  
161 Hud, ONH, Revmatologisk avdeling  
162 Hud pol. Tromsø  
163 Nevrologisk-og nevrofysiologisk avdeling  
164 Nevrologisk pol. Tromsø  
165 Ortopedi- og plastikkirurgisk avdeling  
166 Akutt pol. Narvik  
167 Akutt pol. Tromsø  
168 Kir/Ort pol. TMS  
169 Ortopedisk pol. Tromsø  
170 Øye og nevrokirurgisk avdeling  
171 Nevрокir. pol. Tromsø  
172 Øye dagbeh. Tromsø  
173 Øye pol. Tromsø
### Table 15 Examples of telemedicine services in Norway in 2012-13 initiated or co-developed by NST.

<table>
<thead>
<tr>
<th>Services</th>
<th>Description</th>
<th>Where</th>
<th>Effects</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prehospital trombolysed</td>
<td>Use of inexpensive, easy to use, mobile device for 12-lead ECG with the option of telephone transmission to the terminals in the AMK-centres, where the doctor on duty helping with ECG interpretation and decision about the indication for thrombolytic treatment.</td>
<td>Routine service in all Norwegian HFs (Health Trusts)</td>
<td>Reducing the time from diagnosis to treatment. Enable treatment in more cases.</td>
<td>(Van de Werf, Bax et al. 2008)</td>
</tr>
<tr>
<td>Home monitoring of defibrillators</td>
<td>Use of home monitor equipment for control of pacemakers and ICDs.</td>
<td>UNN</td>
<td>Saves travel time / travel costs and time at the clinic. Increased safety for the patient. Transfer of responsibilities from doctor to nurse.</td>
<td>(Færestrand 2010, Landolina, Perego et al. 2012)</td>
</tr>
<tr>
<td>Telesstroke (Teleslag)</td>
<td>Establishes a telestroke service for diagnosing and treatment of stroke patients at Nordlandssykehuset. Uses videocall between the neurological department in Bodø, and the local hospitals in Lofoten and Vesterålen.</td>
<td>Nordlandssykehuset in Bode, Lofoten, Vesterålen</td>
<td>10% reduction in mortality Comparable with face to face VC consultation more efficient compared with telephone. Reduced number of incorrect diagnoses, mortality and need for nursing home placement.</td>
<td>(Meyer, Raman et al. 2008, Schwamm, Holloway et al. 2009, Sørensen, Solvoll et al. 2011)</td>
</tr>
<tr>
<td>DeVaVi</td>
<td>Use VC between professionals and between professionals and patients, especially for follow-up on discharged patients. DeVaVi emergency service is a 24/7 on call service operated by Ambulant Psychiatric Team and telephone watch at day units.</td>
<td>UNN</td>
<td>Strengthens the acute psychiatric services at the Centres for Mental Health in rural areas.</td>
<td>(Arild, Forskognes et al. 2011)</td>
</tr>
<tr>
<td>Teledialysis</td>
<td>A virtual workplace has been established by integrating satellite staff into UNN's everyday routines. Daily communication with the satellites is established using IP-based VC.</td>
<td>Helse Nord</td>
<td>UNN experienced improved reliability of advice given. The dialysis staff is integrated as a team through the telemedicine setting. Alta and Hammerfest experienced faster response, higher information quality, and improved safety</td>
<td>(Rumpsfeld, Arild et al. 2005, Arild, Rumpsfeld et al. 2007)</td>
</tr>
<tr>
<td>Coop-creation on admission, discharge and follow-up, outpatient - the Sunnaas model</td>
<td>Establishes better cooperation between the specialist health services and primary health care services in the municipalities. Uses ICT (VC, multimedia applications, electronic integrated care) to establish a partnership between Sunnaas hospitals, other health and primary health care services, related to: Referral - discharged - Follow-up of persons with permanent disabilities.</td>
<td>Sunnaas Hospital and all municipalities in Norway.</td>
<td>Improved quality of the rehabilitation process, increase mastery of the life situation of the patient. Offers the possibility to take the right choices at once, avoiding changing tools after a short period of use. More people get the same information about the choices made at the same time. Saved travel time and travel costs. Knowledge exchange between health professionals.</td>
<td>(Bach, Driveklepp et al. 2010, Bach, Serl et al. 2010)</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>Establishes orthopaedic in North Norway through the use of VC between professionals</td>
<td>Helse Nord, Orkdal and DMS Fosen.</td>
<td>Most patients want this service. The service works out well. In addition to guidance</td>
<td></td>
</tr>
</tbody>
</table>
Hartvigsen and Pedersen

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
<th>Location</th>
<th>Comments</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image-based referral</td>
<td>Offers a number of standardized messages that can be sent between health care personnel in the health net. The messages have been formed in a way such that they can be sent from one patient journal to another journal. Along with the action plan, the use of electronic messages is mandatory for primary doctors.</td>
<td>Haukeland, Helse Stavanger and Sandtangen legefamiljest, Helse Nord between UNN and Sonjatun.</td>
<td>Reduced patient travels. Many studies show that 20-50% of patients can be treated locally.</td>
<td>(Dahl, Hasvold et al. 2003, Rotvold, Knarvik et al. 2003)</td>
</tr>
<tr>
<td>Web-based collaboration between the patient and the specialist</td>
<td>Still images for dermatological cases where the skin diseases are photographed and send via a web-based application from the patient to the specialist in dermatological diseases.</td>
<td>Helse Nord</td>
<td>60% of cases showed that it took less than five minutes to answer the request. 32% took between 5-10 min and 8% required more than 10 minutes to respond. Regular consultation takes 20 min. Few studies on how web consultations affect the working day to dermatologists exist.</td>
<td>(Schopf, Bolle et al. 2010)</td>
</tr>
<tr>
<td>Ulcer treatment</td>
<td>Offers examination of ulcers without moving the patient out of their nursing homes. Images of the ulcers are sent through email.</td>
<td>Helse Nord UNN and Sonjatun Tidligere UNN and Tromsø kommune</td>
<td>Faster and more efficient contact with referred patients. Advice and guidance, expertise and good follow-up of patients. Patients experience good supervision and avoid unnecessary travel to UNN.</td>
<td>(Lotherington, Bakkevoll et al. 2006, Lotherington and Nyheim 2010, Aanesen, Lotherington et al. 2011)</td>
</tr>
<tr>
<td>Ulcer EHR</td>
<td>The Danish solution Pleje.net is chosen as EHR for the Internet-based ulcer polyclinic.</td>
<td>Helse Nord, Unn and sever-al municipalities in Nord-Troms. Helse Vest, Stavanger</td>
<td>Pleje.net offers several special designed functions to support treatment of ulcers, included images, size measurements, etc.</td>
<td>(Pedersen, Hartviksen et al. 1994, Steventon, Bardsley et al. 2013)</td>
</tr>
<tr>
<td>Videoconference-based consultation</td>
<td>Provides specialist services in different fields to small hospitals in Troms and Finnmark County. Teleconsultations are offered through VC.</td>
<td>Helse Nord HSØ, Sunnas, Hallingdal, Otta, Kristiansand og Setesdal</td>
<td>Reduced travel costs. In North Norway, VC has become a natural part of the work to doctors, psychologists, nurses, etc.</td>
<td>(Eide, Nordrum et al. 1991, Nordrum, Engum et al. 1991, Nordrum, Amin et al. 1998)</td>
</tr>
<tr>
<td>Pathology</td>
<td>Offers access to pathology services through videoconference and store-and-forward solutions.</td>
<td>Helse Nord (Harstad to Tromsø and Kirkenes to Tromsø (UNN). Haukeland to Stavanger and Hospital Østfold in Fredrikstad)</td>
<td>Result from this service was that the hospitals submitted images instead of tissue. Small hospitals improved their link to specialists at UNN. As a result, images instead of tissue were submitted. Could provide pathology service at smaller hospitals.</td>
<td>(Eide, Nordrum et al. 1991, Nordrum, Engum et al. 1991, Nordrum, Amin et al. 1998)</td>
</tr>
<tr>
<td>Teleradiology</td>
<td>Provides radiology services in Nordland, Troms and Finnmark County through transferring of digitized x-ray images to UNN.</td>
<td>Norway</td>
<td>Radiologist at UNN available 24 hours a day. Reduced patient travel and local control. Patients were very satisfied with the fact that the service offers radiology locally and that the waiting time is minimal.</td>
<td>(Stormo, Sollid et al. 2004)</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>A fundus camera linked to a digital camera and electronic</td>
<td>Between UNN, Hammerfest,</td>
<td>Both patients and health personnel express greater</td>
<td>(Nilssen and Burkow 2004,</td>
</tr>
<tr>
<td>Transfer of digital still images to an ophthalmologist at UNN for further examination and diagnosing. The camera is operated by special trained nurses.</td>
<td>Satisfaction in the use of telemedicine instead of more traditional solutions. Most patients were satisfied with the local availability of eye ground screening using telemedicine, because they did not have to travel, gained access to specialist services and because the service was offered in familiar surroundings. Increased quality &amp; efficiency of diabetes treatment.</td>
<td>Johansen, Fossen et al. 2008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternity ward</td>
<td>Established videoconferencing between Lofoten and Bode. Ultrasound pictures were transferred from Lofoten to Bode where they were examined by gynaecologists</td>
<td>Academic confidence, prompt attention from the obstetrician, avoid unnecessary patient travel.</td>
<td>(Norum, Bergmo et al. 2007)</td>
<td></td>
</tr>
<tr>
<td>Dialog messages</td>
<td>Electronic messages that enable nursing homes and hole care nurses in municipalities to communicate with general practitioners and the Health Trusts (HF).</td>
<td>Better documentation Safer drug administration, fewer phone calls, more efficient use of time and improve workflow.</td>
<td>(Aanesen, Molianen et al. 2006)</td>
<td></td>
</tr>
<tr>
<td>Guidance and Educa-</td>
<td>To provide elearning courses for Norwegian health care workers</td>
<td>Norway</td>
<td>(Aasebo, Opdahl et al. 1998)</td>
<td></td>
</tr>
<tr>
<td>tion</td>
<td>Self-management of Diabetes</td>
<td>To maintain healthy blood glucose levels through a balanced diet, physical activity and medication for people with Type 1 and Type 2 diabetes. Develop an interactive mobile tool, the Few Touch application, to help people with Type 1 and Type 2 diabetes to manage their health and motivate them to improve their blood glucose regulation.</td>
<td>Helse Nord</td>
<td>Training of specialists. Lifestyle Changes, better self-management, self-help.</td>
</tr>
<tr>
<td>Slutta.no</td>
<td>The site <a href="http://www.slutta.no">www.slutta.no</a> is offered to those who want to be smokeless. The course is web-based, free of charge and tailored to your needs.</td>
<td>Norway</td>
<td>The main features of the evaluation are that the program reached many, had good effect and was experienced as useful by the users.</td>
<td>(Wangberg, Nilsen et al. 2011)</td>
</tr>
<tr>
<td>Digital radiology at DMS and nursing homes</td>
<td>Offers e.g., X-ray services, orthopaedic guidance from the specialist in Tromsø and light treatment for patients with skin disorders. Health professionals from throughout the area meet regularly to discuss the treatment of cancer, dementia, drug abuse and mental health.</td>
<td>Norway</td>
<td>The reason for focusing on the DMS is to provide a basis for an increased volume of telemedicine initiative. The focus areas are chronic illnesses, cancer and psychiatry.</td>
<td>(Johnsen 2005)</td>
</tr>
</tbody>
</table>
Lessons learned from 25 years with telemedicine in Northern Norway
6 Large-scale telemedicine services

In June 2005, Health North Trust established a working group of senior doctors that should perform a systematic evaluation of which of the tested and suitable telemedicine services in North Norway should be selected for large-scale implementation (Figure 315). The group was asked to perform their assessment on evaluation of clinical needs, cost/benefit compared with transportation of patients or health personnel, requirement to the service’s functionality and user-friendliness, and requirements to relevant and adjusted training. In addition, actions that could motivate health workers, both in hospitals and primary care to start using tested and appropriated telemedicine services should be emphasized.

Figure 315 The group’s report: “Which of the tested and suitable telemedicine services should be given priority for large-scale implementation?” Report from a project group appointed by the Helse Nord board 22. June 2005 in connection with the case “decentralization of specialist health service” (Submitted to the board of Northern Norway Regional Health Authority 1st March 2006) (Helse-Nord 2006)

The Helse Nord Expert Group identified 282 projects were based on NST project portfolio and response from clinicians and researchers at UNN and University of Tromsø (Figure 315, Figure 316).
Lessons learned from 25 years with telemedicine in Northern Norway

The 282 reported projects were all from the period 1992-2006:

<table>
<thead>
<tr>
<th>Project</th>
<th>Number of Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>NST 1993-1999</td>
<td>112 projects</td>
</tr>
<tr>
<td>NST 1999-2005</td>
<td>121 projects</td>
</tr>
<tr>
<td>On-going projects 2005/2006</td>
<td>37 projects</td>
</tr>
<tr>
<td>Reported projects from UNN HF (excl. NST)</td>
<td>12 projects</td>
</tr>
<tr>
<td>Reported from UiT</td>
<td>0 projects</td>
</tr>
</tbody>
</table>

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### Prioritisation of telemedicine services for large scale implementation in Norway

Jan Norum, Steinar Pedersen, Jan Steiner, Markus Rumpfeldt, Anders Storm, Nina Jamieson, Harald Sunde, Tor Ingebrigten, and Mal-Liss Larsen

*Department of Oncology, University Hospital North Norway, University of Tromsø, Norwegian Centre for Telemedicine, Department of Radiology, University of Tromsø, Department of Medicine, University Hospital of North Norway, Tømmernes, Department of Oncology, Akershus Hospital, University of Tromsø, Norwegian Centre for Telemedicine, Department of Radiology, University of Tromsø, Department of Medicine, University Hospital of North Norway, Tømmernes, Department of Oncology, Akershus Hospital, University of Tromsø, Norwegian Centre for Telemedicine, Department of Radiology, University of Tromsø, Department of Medicine, University Hospital of North Norway, Tømmernes, Department of Oncology, Akershus Hospital, University of Tromsø.*

**Summary**

In late 2005, the Northern Norway Regional Health Authority requested an evaluation of all tested telemedicine services in northern Norway to clarify which were suitable for large-scale implementation. A total of 382 reports on telemedicine were collected from various sources and reviewed. The reports were divided into categories based on clinical relevance and feasibility. A panel of experts selected 21 priority areas for further evaluation.

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### Introduction

The Norwegian Centre for Telemedicine (NST) was established in 1993. The Centre received significant financial support from the Government to develop and implement telemedicine services in northern Norway. The Centre has been successful in delivering telemedicine services in various areas, including primary care, acute care, and specialist care.

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**Figure 316 A summary of the report were published in Journal of Telemedicine and Telecare 2007;13:183-192. (Norum, Pedersen et al. 2007)**
The selection of the reported projects for review was based on the following exclusion criteria: telemedicine services not tested in Norway and/or not including the secondary (specialists/hospitals) health-care sector. This excluded 178 reports. A second revision of the remaining 104 papers / 54 studies excluded eight further studies which were preliminary reports, too little data to draw any conclusions or outside the focus of secondary health care. The remaining 46 studies covered 21 subject areas (Table 16).

Table 16 The table shows a list of projects included in the study by medical topics (the original list in Norwegian were in alphabetical order).

<table>
<thead>
<tr>
<th>Theme Area</th>
<th>Number of projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Emergency Medicine</td>
<td>1</td>
</tr>
<tr>
<td>2. Cardiology</td>
<td>2</td>
</tr>
<tr>
<td>3. Endocrinology</td>
<td>1</td>
</tr>
<tr>
<td>4. Geriatrics</td>
<td>3</td>
</tr>
<tr>
<td>5. Dermatology</td>
<td>4</td>
</tr>
<tr>
<td>6. Communications</td>
<td>5</td>
</tr>
<tr>
<td>7. Nephrology</td>
<td>1</td>
</tr>
<tr>
<td>8. Neurosurgery</td>
<td>1</td>
</tr>
<tr>
<td>9. Nuclear medicine</td>
<td>0</td>
</tr>
<tr>
<td>10. Obstetrics / Gynaecology</td>
<td>1</td>
</tr>
<tr>
<td>11. Ophthalmology</td>
<td>2</td>
</tr>
<tr>
<td>12. Oncology</td>
<td>4</td>
</tr>
<tr>
<td>13. Orthopaedics</td>
<td>1</td>
</tr>
<tr>
<td>14. Pathology</td>
<td>2</td>
</tr>
<tr>
<td>15. Paediatrics</td>
<td>3</td>
</tr>
<tr>
<td>16. Nursery / Care</td>
<td>0</td>
</tr>
<tr>
<td>17. Primary health care (DMC)</td>
<td>2</td>
</tr>
<tr>
<td>18. Psychiatry</td>
<td>2</td>
</tr>
<tr>
<td>19. Radiology</td>
<td>2</td>
</tr>
<tr>
<td>20. Education</td>
<td>6</td>
</tr>
<tr>
<td>21. Ear, nose and throat diseases</td>
<td>3</td>
</tr>
</tbody>
</table>

The expert group used five evaluation criteria, which were equally weighted (0–5 scale). These were: overall score, quality of care, personnel resources, communication and health economics. Each item was scored by the expert group (0 = no need/disadvantage, 1 = equal to alternatives, 2 = there may be minor benefits, 3 = there are some benefits, 4 = there are clearly benefits, 5 = there are major benefits). The health economics score was measured as the number of ‘yes’ responses. The expert group contacted senior doctors at departments employing telemedicine services, including eight departments at UNN (dermatology, ophthalmology, cardiology, plastic surgery, orthopaedics, pediatrics, pathology and psychiatry) and three at Nordland Hospital (anaesthesia, pathology and obstetrics/gynaecology).

The expert group defined telemedicine as “access and communication of digitized medical information in order to realize the objectives of Decentralisation of health services.”
All projects were categorized into one of four groups:

- Diagnosis/Treatment
- Teaching
- Administration
- Other

Then the projects are divided into stages according to the following options:

- Technical test
- Pilot
- Larger trials
- Implementation

The projects and services included in the analysis were evaluated based on the following conditions:

- **Need for service:** The need was assessed in the
  - Options
  - Ability to increase quality
  - Compensation for personnel shortage
  - Possibility of improved communication.

  Each of the four sub-paragraphs were rated on a scale of 0-5 where 0 represented the lowest possible value and 5 the best possible value.

- **Cost / benefit:** Projects/services were considered cost-effective based on the following options:
  - Volume
  - Investment needs / reuse opportunity for other services
  - Opportunity cost
  - Quality

  Each of the items was answered with yes/no.

- **Requirements/qualifications:** The projects were evaluated on the basis of the following requirements/conditions:
  - Functionality
  - Ease of use
  - Training

  The aim was to clarify what was required for the project to be implemented in large scale the operation.

Overall assessment: The current project was of the entire work group ranked with scores 0-10. This is to give a priority order.
Table 17  Distribution of points between the different areas that were chosen for large-scale implementation of telemedicine services.

<table>
<thead>
<tr>
<th>Area</th>
<th>Need</th>
<th>Cost/benefit</th>
<th>Point</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max score</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teleradiology</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Communication</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Distant education</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Telediagnosis</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Prehospital thrombosis</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Telepsychiatry</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Teledermatology</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Pediatric</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>District medicine</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Teleophthalmology</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Ear-Nose-Throat</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

After an examination of the different telemedicine projects, the expert group decided to organize the four thematic areas into four groups in accordance with priority:

**Group 1 – Must be implemented:**

- **Teleradiology (incl. solutions for neurosurgery, orthopaedic, different kinds of surgery, nuclear medicine, acute traumatic and oncology):** Teleradiology is a high volume service and is an important basis for the regional service of several areas of medicine. Digital images have largely ousted former technology and have a good quality. It also has clear cost-benefit gains. The deployments of units outside the hospital (Alta, Sonjatun, TMS, etc.) in addition to already well-established integration between public hospitals and private institutes have interesting aspects in this context. This gave teleradiology the top priority in the review project.

- **Digital communication and integration of patient data:** This topic has a large volume and includes the whole health-care system. Multimedia attachments to electronic health records (EHR) incorporate into the telemedicine solutions are demanded by a number of disciplines (such as heart sounds, still images of skin lesions, etc.). The need for an improved common platform for digital communication gave this issue top priority.

- **Distant education:** Education of health-care personnel is one of the main topics of Norwegian hospitals. The review revealed that many communities had adopted telecommunications solutions in teaching, and some had their own videoconference room. The expert group concluded that the lack of telecommunications facility was a limiting factor. However, they expected that this problem would be eliminated with the introduction of PC-based video conferencing.
Group 2 – Should be implemented:

- **Teledialysis**: Teledialysis is a service with great potential and the investment costs are dropping and the reimbursement structure is good. This service is very welcomed by the health professionals.
- **Pre-hospital thrombolysis**: This service has a large volume, and a lot of resources have been invested in the service. There are currently two different services operating. They should be compared and the best one chosen for further escalation.
- **Telepsychiatry**: Psychiatry has been characterised by a lack of specialists. It is an area given priority by the national health authority and has a large volume of patients. Videoconferencing should be employed more.
- **Teledermatology**: The volume is dropping, but the videoconference and the still image based service offer significant benefits.

Group 3 – may be implemented:

- **Paediatrics**: The review group concluded that transmission of heart murmurs and the ‘eczema service’ only reached a low volume of patients. The service could benefit from improved digital communication and integration of patient-data.
- **District medical centre (DMC)**: DMCs have been the focus of the regional health authority, but they obtained a low ranking. The expert group argues that it is limited evidence on the benefits of telemedicine DMC efforts. Thus, they suggest a gradual escalation within this field to gain experience.
- **Teleophthalmology**: The expert committee argues that this field has shown exciting results in terms of screening of diabetics. The disease has high prevalence, which gives it the opportunity for a larger volume. However, they argue, it seems somewhat unclear how the service should be designed.
- **Teleotorhinolaryngology**: The expert committee argues that telemedicine services in ear, nose and throat diseases were among the first services were developed. Several sites acquired high quality equipment for imaging, but the service has failed to gain any volume. This can have various causes. Future development of improved digital communications with multimedia solutions for EHR, may establish a more sustainable basis for this service.

Group 4 – not recommended:

- The expert group did not find any reasons to give priority to projects within emergency medicine (excl. pre-hospital thrombolysis), cardiology, endocrinology, geriatric, gynaecology/obstetric, pathology, and nursing/caring, except for the general improvement gained through the use of digital communication and distant education.

### 6.1 Actions to motivate health care personnel to use telemedicine solutions

The expert group also discussed how to motivate health care workers to use telemedicine services. A number of actions were discussed. They argue that the equipment should be simple, user friendly and functional and that the reimbursement rates are in proportion to the total use of resources. In total, eight different actions were discussed. These are addressed below. (The text is more or less a direct translation of ((Helse-Nord 2006), pages 32-34.)
Support team / super users

Experiences among clinicians indicate that telemedicine solutions often involve technical errors or user errors. As a result, many clinicians have resisted using such solutions. To avoid such a development, “super users” of telemedicine systems and a support team that quickly respond to problem calls and alarms must be connected to the departments.

The responsibility for the equipment must be clearly identified. Clinicians often report that they avoid using telemedicine solutions because of technological problems. Such inconvenience must be reduced to an absolute minimum.

Training – client participation – codetermination

We can expect the entry level among clinicians to be low as long as the service has a volume that implies regularly use and identifiable profits for the patients, their relatives and the clinicians themselves. This requires that all clinicians get adequate training. The training must focus on the user’s needs. A more comprehensive training must be offered to the “super users”.

It is very important that all equipment upgrades and modifications are notified in advance and that all users receive additional training, if needed. The good relationship between support personnel and clinicians is very important. Client participation when changes are considered is important. Net-based support functions should also be considered. Users groups / forums must be established, and clinicians must be able to participate in those. Codetermination in processes is important factor for a good work environment and motivation.

Customer-oriented

Requests for inspection, copies of and access to medical data and documents from patients and their relatives are increasing. Their experience with IT systems varies a lot. This means that the possibility to get access to and copies of their medical data / patient data must be as easy as possible.

Continuous operation must be ensured

When telemedicine equipment are purchased we must ensure that proper maintenance agreements are made, and that our requirements for continuous operation are made clear to contractors and industry (very high MTBF). Only solutions that have proved to be reliable should be chosen.

Empirical knowledge has shown that it is the clinicians that must improvise and find emergency solutions. It is the clinicians that must “carry the can” in meetings with frustrated patients, relatives and health care personnel when the technology fails. Reduced operation time is de-motivating and frustrating and can “kill” good solutions.

Participations in development projects in the industry

Especially at university hospitals, the interests for participation in research and development projects are huge. This type of activities is important motivation factors for many of the clinicians. The hospitals should enable cooperation between contractors/developers of telemedicine equipment and groups of clinical specialists.
“Up-to-date” solutions

A characteristic with IT systems is the process of continuous development and improvement. The length of life for such equipment is limited. A plan for continuous upgrade and replacement must be made.

An example of this is that many telemedicine services are based on the use of videoconferencing equipment. This is expensive equipment with limited access. Within short time, PC-based videoconferencing equipment is expected to replace the studio-based approach. Today's plans must take into account the solutions of tomorrow.

Identifiable profits - tariffs (reimbursement)

A large-scale operation of the most profitable areas (Groups 1 and 2) will imply considerable investments for the hospitals. The reimbursement system must reward the hospitals that invest in the most prioritized areas (groups 1 and 2).

When a clinician’s daily routines are changed, they often ask “What is in this for me?” Telemedicine systems often result in less ambulatory work and increased opportunities for further education. This can strengthen professional and collegial networks. Such profits must be visualized. Use of telemedicine systems can be time consuming and require increased recourses from both general practitioners and specialists, while cost reductions only are reduced transportation costs. This must be reflected in the tariffs/reimbursement system.

Goal-oriented research

Along with patient treatment and education, research is very important for the region/hospitals. We must ensure that research recourses are allocated to the fields that are most relevant for telemedicine research. Research grants from Helse Nord RHF should be coordinated with large-scale implantation of telemedicine services.

6.2 Bringing telemedicine into routine service - prerequisites and actions

In 2011, the Ministry of Health and Care Services commissioned the Norwegian Centre for Integrated Care and Telemedicine to recommend telemedical services, which are ready for large-scale implementation in the health service, both in the short and the long term, as well as required actions necessary to secure successful dissemination. The Ministry requested that all inputs should be based on economical, legal and organizational considerations. A first attempt to respond to this challenge was presented in (Normann, Breivik et al. 2011).

Normann et al. (Normann, Breivik et al. 2011) argue that “Local needs and requirements are unique and telemedical services are therefore highly contextual. Our recommendations are not based on findings and results from isolated pilots or routine services, but on categories of services and technologies, which have been assessed and found appropriate for large scale implementation.”
In their report, (Normann, Breivik et al. 2011) present five recommendations (modified trans-
lation of page 9 in their report):

1. **Increased use of videoconferencing for clinical, educational and administrative pur-
poses:** “In the short term NST recommends that the Norwegian authorities focus on in-
creased utilization of video conferencing solutions. Videoconferencing can be used as a
collaborative tool for outpatient consultations, before admission to treatment, en-
suring quicker discharge from hospital, as well as teaching and supervision of primary
health care. Videoconferencing can be used to realize the coordination reform's
(Norwegian Ministry of Health and Care Service 2009) intention to strengthen the lo-
cal medical centers, district medical centres (DMSs), intermediate units and hospitals.
Increased use of videoconferencing in collaboration around patients may contribute to
equal services and better patient care.”

2. **Strengthen the national initiative on electronic messages:** “NST recommends that the
national efforts related to message-based interactions should be intensified. In the
short term, the Norwegian authorities should support the development of messaging
that is more interactive and allowing for better processing and decision support, and
provides opportunities for dialogue and attachment handling. Electronic booking of
medical examinations, and notifications by SMS can streamline patient care and im-
proving logistics in the health service.”

3. **Focus on dynamic solutions to support complete and standardized patient paths:**
“NST recommends that the government also should focus on testing and research in
dynamic collaboration solutions that can support more comprehensive and standard-
ized patient care. Services that allow for greater patient participation are requested and
such solutions can help to realize the interaction reform patient-oriented focus. Health
portal can be the gateway to these services.”

4. **Initiate a national effort to develop a methodology for the implementation of telemedi-
cine:** “NST recommends a national commitment to develop a good methodology for
telemedicine. (…) The emphasis is on requirements for strategic agreements between
the players, management involvement, adaptation of the framework in the form of in-
centive and financing systems, as well as legal and security aspects. The technology
must support the overall patient care and provide access for multiple services using the
same technology. The instruments should be reviewed and adjusted so that the risks
and benefits are distributed appropriately.”

5. **Clarify roles and responsibilities for operation and maintenance of telemedical solu-
tions:** “NST recommends that the roles and responsibilities related to operation and
maintenance of telemedicine solutions should be clarified. Telemedicine involves a
‘package’ of technology and services with fragmented ownership. The transition from
project to operation is a general challenge, and there is a substantial risk that no one
takes responsibility for the total package offered to the users, operated and maintained.
The Norwegian Healthnet will be able to undertake such a role.”

Normann et al. (Normann, Breivik et al. 2011) argue that “web-based dynamic solutions will
be able to solve disciplinary collaboration challenges that arise when parties from different
legal entities shall cooperate in all or part of patient care. This is not resolved through the
core journal. The future of web-based solutions should have a gateway through the national
health portal and allow mobile access. To achieve this, the authorities must look into the reg-
ulations pursuant to the System Act § 6 a. It should also be considered the patient-oriented
services with authentication mechanisms that properly can be provided with security level 3.”
Furthermore, Normann et al. (Normann, Breivik et al. 2011) argue that “The health service is in a paradigm shift from traditional ways of organizing health services, to more patient-centred organization where technology has had a central place to achieve this (...). Telemedicine can help solve healthcare challenges in the interaction field and be a tool for efficient functions of the work of several actors who belong to various businesses and levels of function.” They (Normann, Breivik et al. 2011) argue that the coordination reform should support more patient-centred services where the patient and primary health services have a more pronounced role in the treatment with an informed, active patient in collaboration with a treatment team in conjunction with specialist services.

According to Normann et al. (Normann, Breivik et al. 2011), technology will change the public sector in Norway over the next few years. The changes will mainly be to better exploit existing technology. More standardized and compatible technology can open up for more services on the same technological platform. This supports efficient organization and operation, more routine use, less equipment investment and greater economic savings.

Although a telemedicine service is piloted in one health thrust it is not simply so that other hospitals can implement it without organizational and technological adaptations. Good concept descriptions can help make it easier for others to copy all or part of the solution. Telemedicine involves a “package” of technology and services with fragmented ownership. As many solutions require integration between multiple systems, it can also be multiple operating organizations to deal with. The transition from project to operation is a general challenge, and there is a substantial risk that no one takes responsibility for that the total package offered to users is operated and maintained.

Health professionals need to find relevant information when they need it. The planned number of such solutions that will give health professionals access to critical information, such as prescriptions, immunizations, individual plans, health card for pregnant women, personal health records and core health records.

For this not to be perceived as separate solutions and many sources to deal with, it is essential to have a common point of contact, as the National ICT recommendations (Gjølstad, Bergem et al. 2010).

Prioritisation and implementation of telemedicine services require thorough analysis and assessment of legal and security aspects. Not infrequently it turns out that solutions can be customized so that they lie within the current legal and security requirements. It may also prove that in some cases raised questions and issues should be resolved at the national level. These questions related to the future of web-based solutions, such as authentication solutions, secure mobile access to patient information (Normann, Breivik et al. 2011).

The EU-funded project MOMENTUM is a thematic network for distribution of knowledge and experience in implementing telemedicine services into regular care. One of the results from MOMENTUM is a list of 18 critical success factors for deploying telemedicine (Jensen, Knarvik et al. 2015):
“The context:
1. Ensure that there is cultural readiness for the telemedicine service.
2. Come to a consensus on the advantages of telemedicine in meeting compelling need(s).

People:
3. Ensure leadership through a champion.
4. Involve healthcare professionals and decision-makers.
5. Put the patient at the centre of the service.
6. Ensure that the technology is user-friendly.

Plan:
7. Pull together the resources needed for deployment.
8. Address the needs of the primary client(s).
9. Prepare and implement a business plan.
10. Prepare and implement a change management plan.
11. Assess the conditions under which the service is legal
12. Guarantee that the technology has the potential for scale-up.

Run:
13. Identify and apply relevant legal and security guidelines.
15. Ensure that telemedicine doers and users are privacy aware.
16. Ensure that the appropriate information technology infrastructure and eHealth infrastructure are available.
17. Put in place the technology and processes needed to monitor the service.”
The keys to telesuccess\textsuperscript{175}
By Jan Fredik Frantzen  (20 May, 2010)

What are the key to getting telemedicine set in routine operation in the health care system? Minister of Government Affair Rigmor Aasrud wanted to have the answer when she visited the Norwegian Centre for Telemedicine. And the feedback was not long in coming.

Telemedicine has been in use around the world for decades. And in Norway, the Tromso community has delivered research and experience-based knowledge since the Telemedicine department was created at the Regional Hospital as far back as 1993.

But despite all the knowledge that is produced and documented, and the services that are tested in the course of the 17 years that is gone, we still struggle with that it is slow to get the health care system to adopt the technology. Aasrud said that she very much should like to know the reason for the slow adoption. Because, she said, over the next years Norway will need 120,000 new health care workers, so it is clear that labour must be used in the best possible way. This includes the use of telemedicine.

“You must change the way you work. It must be as natural to see the patient on the screen as get her through the door. The routines must be changed,” noted director Toralf Hasvold. Health care must be willing to change their working practices, because new technology does not fit well in the old structure. Otherwise, the result will quickly be that the new technology is not used, or it may just be perceived as an additional burden of a hectic workday.

He received support from, among others, dermatologist and researcher Thomas Schopf, who has extensive experience as both GP and specialist.

“It’s the way you organize your job is most important. To introduce an electronic discharge summary does not solve the problem of sending discharge letters quickly and efficiently to the doctor, when the specialist does not have time to write it.”

Former leader of the NST, Steinar Pedersen, kicked the ball right back to the politicians when he once again pointed out that there is no economic incentives to adopt telemedicine. It pays just nothing to use telemedicine. “Firstly, charges for using telemedicine must be as good as or even better than to work the old way, and secondly, both GPs and specialists must get paid for their share of the job. You cannot reward the one but not the other.”

\textsuperscript{175} This article was originally written by Jan Fredik Frantzen, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/noekler-til-telesuss.4785444-150024.html (Last accessed: 5.2.2013.)
Telemedicine improves integrated care\textsuperscript{176}
By Ellen Rygh (29 November, 2007)

Daily use of videoconference has led to that doctors in six municipalities in Fosen in South Trøndelag County can work more efficiently. “This communication is particularly useful for acute medical problems,” says the municipality doctor in Fosen, Morten Jensvold.

The Department for observation and treatment in Fosen has since the spring of 2006 used VC to shared daily morning meetings with the medical department of Orkdal hospital. The department has 8 beds, where 2 of them are observation beds reserved for acute admissions from the emergency services. At these morning meetings patients’ conditions will be discussed before they are transfer from hospital and continue in the course of treatment by a rehabilitation unit.

“The telemedicine communication is especially useful when there is interaction around emergency patients who are admitted to observation beds and acute medical problems in rehabilitation patients,” says municipality doctor Morten Jensvold in Fosen. The added value of video meetings compared to only confer by telephone, is that it establishes a joint team of therapists at Fosen and Orkdal. The 5-10 minutes spent on this joint morning meeting, saves the doctor in Fosen for multiple phones to individual specialists during the day.

Municipality doctor Jensvold says that these joint meetings have been an absolute prerequisite for being able to accept fast discharges of ill patients, and also that they have had opportunities to keep patients in observation beds. These are patients who would otherwise have been directly admitted to the hospital as emergency patients. “Many patients have complex problems. The fact that the entire therapeutic group at the medical department can provide input to the treatment is a big advantage,” says Jensvold.

Intermediate departments based on telemedicine services have increased in numbers. The wards in Hallingdal, North Gudbrandsdal and Valdres have long been offering telemedicine services in routine operation. In Northern Norway, NST has established test services at several existing hospitals. And last but not least, Haugesund Hospital has recently received funding for local hospitals to establish telemedicine services in a new intermediate unit in Sauda municipality modelled from Fosen and wards in Finmark.

It was recently demonstrated in a study from Trondheim that the final treatment in an enhanced nursing homes in the extension of emergency admission to hospital gave better results than the follow-up in a hospital. Good medical care, coupled with a close dialogue with the patient and his/her local network in the municipality, actually gave better survival than treatment in a more specialized level alone.

\textsuperscript{176} This article was originally written by Ellen Rygh, NST, and later translated into English by the authors. URL to the original: http://www.telemed.no/telemedisin-styrker-samhandling.566200-80451.html (Last accessed: 5.2.2013.)
Lessons learned from 25 years with telemedicine in Northern Norway
7 NST’s advisory service

Telemedicine is, easily explained, the use of ICT for health purposes. It is largely about moving or exchanging patient information between health professionals who contribute to the treatment or follow-up of patients. Telemedicine can also give patients the opportunity to have direct contact with health professionals from home via computer, mobile phone or TV.

These principles have gained support from health organizations around the world. And to meet some of the knowledge demand has NST organized a counselling service that offers advice to health care by the introduction of telemedicine solutions. NST can offer advice and support throughout the implementation process in different areas of law and security, economic consulting, organizational consequences as well as the type of equipment that is most applicable.

7.1 Information security and law

In the bottom of all safety work is risk assessment and analysis. NST arranged, in cooperation with HIT Northern Norway, until 2008 a series of annual forums in Tromsø. The purpose of these were to examine and debate issues related to security and law in connection with accessing and sharing patient information across agencies and levels within the health care sector. The target groups for the seminars were national and regional decision makers, local authorities, health professionals, vendors and developers, researchers and patients/users.

Legal issues and questions relating to information security is a recurrent theme when new telemedicine services will be developed and/or put into use. A significant part of the information that follows the patient in a treatment situation is sensitive. This information must be protected from unauthorized access and from unauthorized changes (safeguarding the confidentiality and integrity).

NST has its own lawyers considering legal issues and special advisers in information that perform risk assessments relating to the development, implementation of telemedicine and electronic collaboration in health care. Information and knowledge on this topic is a central concern in the health care system. It is particularly important as electronic commerce and telemedicine is becoming an integral part of health services at all levels. The NST advisors in information security and law have experience in assessing legal issues and conduct risk assessments with the use of ICT in health care.

NST has two employees with a primary focus on security. They work closely with NST's lawyers, who specialize in law relating to telemedicine and e-health. Competence in information security (computer security) is specifically aimed at health sector's needs and requirements. NST has a good knowledge of legislation and technical solutions. The NST also has good knowledge of legal aspects related to security (for example, relating to compliance with the confidentiality of communications across enterprises).

An example of a service for secure communication between patients and health care personnel is minDoktor.no that was developed at NST in early 2000. The service was later commercialised by DIPS and Profdoc. Figure 319 shows the main page of minDoktor.no. On the website minDoktor.no the patients could in a secure way:
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- Order prescription.
- See answer to the prescription order.
- Make an appointment with their GP.
- Unsubscribe doctor's appointment that is booked through this service.
- Send and receive messages to their doctor or health care institution.
- Order a new certificate.

Due to a limited market interest, the service minDoktor.no was terminated in 2011.

![minDoktor.no](image)

*Figure 319 The web-page minDoktor.no*

NST has developed a simple guide to the implementation of risk assessments and a simple report template to use for documentation of risk assessment:

- Enkel rapportmal for risikovurderinger. (“Easy report template for risk assessment”) (Henriksen and Skipenes 2005)
- Enkel veiledning for gjennomsføring av risikovurdering. (“Simple guidance for the implementation of risk assessment”) (Henriksen and Skipenes 2006)

### 7.2 Organisational development

Telemedicine is as much about the new organization and new tasks as the introduction of new technology. The introduction of telemedicine services must often be followed by changes in
the organization of health services and health personnel to perform tasks. But it is also important to remember that there can be a big difference in which solutions might work best at one place in the health care system compared with another. Both the organization and infrastructure can be planned in a completely different way. Thus, the different parts of the health care system will face different challenges – and it requires a “tailor made” solutions to local circumstances.

One of the benefits of telemedicine lies in better coordination between institutions and across levels of government. It's about technology supported communication, both within the hospital and across geographically separate parts of the health authorities and between local health services and specialist. Access to documentation of change processes and organizational issues are good.

Below is a selection of studies done by the NST and other institutions that deal with organizational and telemedicine services. These studies summarize some experiences that might be useful to your organization as input on the opportunities and challenges to be aware of (in Norwegian only):

- “Implementering av telemedisinske tjenester: hemmende og fremmende faktorer” (“Implementation of telemedicine services: inhibiting and promoting factors”) (Larsen, Gjerdrum et al. 2003) (In Norwegian)
- “Elektronisk henvisning” (“Electronic referral”) (Jacobsen 2004) (In Norwegian)
- “Nettbasert høreapparatjustering. En evaluering og kartlegging av økonomiske, sosiale og organisatoriske betingelser for tilfredstillende bruk av tjenesten” (“Web-based hearing aid adjustment. An evaluation and assessment of economic, social and organizational conditions for the satisfactory use of the service”) (Nilsen and Breivik 2004) (In Norwegian)
- “Innføring og konsekvenser av elektronisk pasientjournal og mobile enheter i Vindafjord kommune” (“The introduction and impact of electronic medical records and mobile devices in Vindafjord municipality”) (Engeseth 2005) (In Norwegian)
- “Omfang og potensial for telemedisinske løsninger i Helse Vest” (“The scope and potential for telemedicine in the Western Health Trust”) (Rygh, Jacobsen et al. 2006) (In Norwegian)
- “Hvilke utprøvde og egne telemedisinske tjenester bør prioriteres for storskala implementering? Rapport fra prosjektgruppe nedsatt av Helse Nord RHF som oppfølging av vedtak i Helse Nord-styret av 22. juni 2005 i sak om ”Desentralisering av spesialisthelsetjenester” (“What tested and appropriate telemedicine services should be prioritized for large-scale implementation? Report from the project team set up by Northern Norway Regional Health to follow up the decision in Northern Norway Regional Health Board of 22 June 2005, the case on ‘The decentralization of specialist health care’.”) (“Helse-Nord 2006) (In Norwegian)
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Organizational issues are also addressed by (Larsen, Gjerdrum et al. 2003).

7.3 Technology and telemedicine systems

Telemedicine technology involves far more than video conferencing equipment, PC and mobile phones. In order to make use of telemedicine equipment and new technologies in health care, we need an infrastructure that facilitates the use of this type of modern technology. It is important that there is sufficient capacity online, that it is quality and reliability that meet the communication requirements, that safety is maintained and that there are local practices and expertise to the technical operations.

Telemedicine equipment is regarded as medical equipment, according to a clarification from the Board of Health. It must thus fulfil the requirements for medical devices (IEC 60601-1). Video conferencing equipment is classified as computer equipment and there must be an isolating transformer between the videoconferencing equipment and power networks for the equipment to be used in rooms where patients are diagnosed and treated.

The technological development is constantly changing, leading to the constantly emerging new equipment, new standards, better communication lines, etc. The requirements for technical equipment and communication must be carefully weighed against the needs, availability and price. Equipment must be considered in the context of the need analysis.

Selection of equipment and communications should also be seen in the context of existing equipment in the country, region or company so that the desired functionality in the telemedicine solution is ensured.

Relevant issues in relation to the technical evaluation include:

- How is the technical infrastructure (health network) in the region?
- How much of the necessary technical equipment (e.g., computer technology and medical equipment) in the region or institution, including medical offices and administrative units, are available?
- Consider whether existing equipment or new investments in technology comply with applicable national and international standards.
- Who is responsible for maintenance of technical equipment, workstations, etc., at the institutions and entities?
- Who provides training in the use of telemedicine equipment supplier, medical technical staff or IT personnel?
- Is broadband critical for the selected telemedicine services?
- How is security handled by suppliers and internally at the institution?

7.4 Benefits of telemedicine

Telemedicine has contributed to the health authorities' efforts to renew, reorganize and streamline public administration. Telemedicine can be both economically profitable and pro-
vide qualitative gains in public health, conclude researchers from NORUT Social Research and the NST in a 2006 study, gains of Norwegian telemedicine (Johnsen, Breivik et al. 2006) (See also the previous chapter).

Documented benefits such as fewer hospitalizations, timesaving for health care and reduced travel costs are among the benefits the researchers found in this study. Benefits from the introduction of electronic health records (EHR) and messaging can be less duplication and errors. Resources are released and the procedures are simplified and communication is faster. The results of the report are based only on documented studies. Several potential benefits of using telemedicine and e-health have not been adequately documented yet.

The main purpose of economic evaluations is to find out how new ways to deliver health services can give people a better health care by making limited health resources more accessible to the population. Economic evaluation is done by comparing and analysing at least two different ways to deliver health services (e.g., a traditional meeting between doctor and patient in hospital and a meeting where the doctor and patient are together with the use of telemedicine equipment at a distance).

One identifies and assesses the values and compares the consequences of different ways to provide health services and measures the costs and consequences. This information can help health authorities to prioritize in a sector with limited resources.

Most economic evaluations conducted have compared the costs of telemedicine with the costs of conventional ways of delivering health services. The gains have been limited to travel costs. Whether telemedicine services are profitable depends on various situation-specific situations. The most important is patient volume. Other things like investment costs and other costs associated with the service and the distance between the local health centre and specialist health services (hospitals) will also influence the result. Decisions about whether to implement telemedicine based on economic arguments must be made in a local perspective.

The list below gives the range of economic analysis of telemedicine services that have been carried out in Norway:

- Samfunnsøkonomisk analyse av elektronisk meldingsutveksling i norsk sektor (“Socio-economic analysis of electronic messaging in the Norwegian health sector”) (Aanesen, Moilanen et al. 2006) (In Norwegian)
- Benefits from telemedicine in Norway: An examination of available documentation. (In English) (Johnsen, Breivik et al. 2006) Norwegian version: (Johnsen, Breivik et al. 2006)
- Sammenligning av kostnadene ved stasjonær og mobil røntgenundersøkelse av sykehjemspasienter. (“Comparison of the cost of stationary and mobile X-ray examination of nursing home patients”) (Randers 2005) (In Norwegian)
- Økonomisk evaluering av EPJ og mobile enheter i Vindafjord kommune. (“Economic evaluation of EMR and mobile devices in Vindafjord municipality”) (Breivik 2005) (In Norwegian)
- Telemedicine in radiotherapy: a study exploring remote treatment planning, supervision and economics. (Norum, Brueland et al. 2005)
- Teleradiologisk oppfølging av pasienter behandlet med stenotraft i aorta. (“Teleradiological follow-up of patients treated with graft in the aorta”) (Pedersen, Aasland et al. 2005) (In Norwegian)
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- Telemedicine in haemodialysis: a university department and two remote satellites linked together as one common workplace. (Rumpsfeld, Arild et al. 2005)
- Er overføring av hjertebilyder via e-post kostnadsberegne? (“Is e-mail based specialist assessment of heart murmurs cost saving?) (Bergmo, Dahl et al. 2004) (In Norwegian)
- Er teleradiologi i primærhelsetjenesten kostnadseffektivt? (“Is teleradiology in primary health care cost-effectively?”) (Johansen and Breivik 2004) (In Norwegian)
- Elektronisk henvisning – lønnsomhetsanalyse (“Electronic referrals – Cost-benefit Analysis”) (Moilanen and Olsen 2004) (In Norwegian)
- Nettbasert høreapparatjustering. En evaluering og kartlegging av økonomiske, sosiale og organisatoriske betingelser for tilfredsstillende bruk av tjenesten. (“Web-based hearing aid adjustment. An evaluation and assessment of economic, social and organizational conditions for satisfactory use of the service”) (Nilsen and Breivik 2004) (In Norwegian)
- An economic analysis of screening for diabetic retinopathy (Bjorvig, Johansen et al. 2002)
- A cost-minimization analysis of a realtime teledermatology service in northern Norway. (In English (Bergmo 2000)
- Vil bruk av stillbildehenvisninger være kostnadsberegne? (“Will the use of still image referrals be cost-saving?”) (Bergmo, Breivik et al. 2000) (In Norwegian)
- An economic analysis of teleconsultation in otorhinolaryngology. (Bergmo 1997)
- An economic analysis of teleradiology versus a visiting radiologist service. (Bergmo 1996)

An important task for the NST is to reuse all this knowledge in their international commitments and in particular the task World Health Organizations Collaborating Centre for Telemedicine and e-health (cf. Chapter 10).
8 NST and the health consumer

One way telemedicine has changed the way health care services are delivered is through the already described pattern of sending medical information about specific patients between health care professionals instead of referring the patient him/herself. But other big changes are surfacing in line with development of new technology. Two examples in this respect are the possibility for patients to monitor themselves and send health information’s directly to health care providers and thus to communicate with them directly. The other is the development of the health consumer marked and their access to health related information, and advices about treatment, via the web. This is in coherence with both the philosophy that it is for the better that each individual take care of it own health based on solid information, but also the will of several patients group to be able to handle their own illness independent of doctor and nurses.

Several medical monitoring devices, such as ECG, blood glucose measuring device, oxygen saturation measurement and blood pressure instrument, have been equipped with Bluetooth technology to communicate data from the patient to health care providers on a PC or mobile phone. NST is heavily involved in developing this kind of technique and services to patients with diabetes. Cf. (Årsand and Hartvigsen 2005, Årsand, Walseth et al. 2005, Årsand, Walseth et al. 2005, Wangberg, Arsand et al. 2006, Årsand and Demiris 2008, Årsand, Olsen et al. 2008, Årsand, Tufano et al. 2008, Årsand, Tatara et al. 2010, Chomutare, Arsand et al. 2011, Chomutare, Fernandez-Luque et al. 2011, Lee, Tatara et al. 2011)

Through the automated measurement of blood glucose NST has developed a solution to make life easier for children with type 1 diabetes and their families by having the results from blood glucose meters wirelessly transmitted from patients to family members and health professionals (No-touch wireless transfer of blood glucose sensor data). The system gives children and young people more freedom, their family greater safety and health professionals a better basis to provide advice on medication to those who have diabetes to achieve better health.

In the first version of this solution to the software on mobile phone tailored because of the lack of standards. Today's cell phones are more standardized and many mobile phones support communication with medical sensors. An important reason for this is that short-range communication standard Bluetooth is common in most mobile phones.

The solution for automatic and wireless transmission of glucose data NST designed and tested in the period 2001-2004, was selected as a “reference application” by the international Bluetooth vendor connectBlue. Bluetooth SIG (Special Interest Group) exhibited it as a Business Case Study on their web page, and as a reference e-health application during a marketing tour in Asia during the autumn of 2004 and Europe in the spring of 2005.

Even if the Internet penetration, and use, is very high in Norway, there still are groups that are not very well used to this technology. This is particularly true to some groups of elderly patients. To be able to communicate to the home of these patients NST has developed, in cooperation with the research institute NORUT IT, an easy-to-use solution called MyHealthStation. MyHealthStation is in reality a pretty advanced PC who’s functionality is hidden in a small “invisible” computer connects the patients ordinary TV. The program of the PC is run by the TVs ordinary remote control. This is familiar to the patients, and in this way sending of

179 connectBlue AB claims to be the leading Bluetooth provider in areas such as medical, industrial and instrumentation sectors. They have headquarters in Sweden and among the partners will find HP, Ericsson, Compaq, DHL and AXIS.
patient’s medical information and videoconference is made possible from the patient’s home to the health care providers. In addition, MyHealthStation can automatically communicate, without the patients having to do anything, critical medical information from sensors on the patients to the doctor or nurse’s computer (Burkow, Vognild et al. 2008).

The system has been tested by two small groups of patients. These were patients with chronic obstructive pulmonary disease (COPD) and patients with diabetes. (In Norway, around 250,000 people have COPD and around 200,000 have diabetes.) The patients measured their state of health and submitted blood pressure and pulse data via the TV to the hospital. And the COPD patients have run through a follow up exercises program with the physiotherapist at the hospital. This program was designed both as individual and as group training program. Thus the patient can take part in rehabilitation programs without being transported to a health care institution. In this way the hospital can offer an adequate service to more persons, and that chronically diseased patients may improve their quality of life and avoid delayed injuries through tighter control.

Both COPD and diabetes affects very many patients. On a global scale 2.7 million patients die every year because of COPD. For diabetes the equivalent figure is 194 million so this kind of solutions is very promising both from a patient’s perspective, but also from a health economic perspective.

But equally import is the emerging principles around the consumer health thinking. In NST, we have tried to increase the awareness of patients and the public's needs and experiences regarding the use of health IT. Some of the knowledge base acquired through the management and coordination of, and participation in, the European e-health consumer trends survey. This is a survey conducted in 7 European countries where the objective is to examine the European population's use of, attitudes to and wishes to use information and communication technology for health purposes, e-health. The study focuses on the “new patient” or the consumer and the digital divide in Europe. The first survey was done in October-November 2006, and was repeated in 2007 (Kummervold, Chronaki et al. 2008). The survey was done with support from the EU, the area of Health (DG Sanco).180

Researchers at NST have developed www.HelsE-vett.no (Figure 320). This is a site with guidance for people who use the Internet for health purposes. This web service makes NST’s knowledge of Internet use for health purposes accessible and usable. The target group is first and foremost users of health services on the Internet, but also providers, government agencies and others seeking to evaluate the quality of online health care service use. Guidance and tips on how to safeguard their own interests to help the users to be critical when they make their choices. The providers of health services on the Internet will benefit from the same information, as well as an overview of what's on the agenda in relation to your health in the media, including public bodies, the R&D environments and in academia.

Researchers at NST (which also stands behind the Helse-Vett (Health-Wits)) combined figures from two large European studies that were done in 2005. The study shows that those who use the Internet for health purposes are people with higher education and who feel they have better health than those that primarily relate to TV, newspapers and radio. A particularly interesting finding is that those who use the Internet for health purposes is more social than others who do not, both on and off the Internet. The explanation for this may be that the Internet

Another project developed a service for quitting smoking with the help of the Internet (Opptur). Hans Giljam and Preventive Media Sweden AB (PMAB) developed the CD-ROM Dr Smoke-Free. This was developed by the Swedish Cancerfonden for the online program “Pepper”. The Norwegian Cancer Society made it a Norwegian version called “Opptur” in cooperation with, among others, Ministry of Health and Social Affairs. The program was in 2004-2005 tested in several large companies. The experience of this was so good that the Norwegian Cancer Society and Health and Social Affairs required further developing the ups and offering it free to all Internet users. NST was the project manager for the development and evaluation in cooperation with the above. The final system was named “Slutta.no” and is available for free for all who want to quit smoking.

In addition to information about smoking cessation and more tests, Opptur offers diary, guest book, discussion forum where participants can share experiences and get support from others in the same situation. Information that is entered into the smoking cessation program is encrypted and stored on a secure server, so it is not possible for others to attach information to each user. Smoking cessation program adds up to a 14-day preparation phase before the actual quit date. (More information can be found at www.slutta.no)
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In the project Mobile e-health services NST tried to improve mobile access to e-health services for the disabled and chronically ill, with special emphasis on blind and partially sighted. The project was funded by ExtraStiftelsen Health and Rehabilitation and the Norwegian Blind Association. In the final report, Nilsen et al. (Nilsen and Burkow 2004) argue that “The project has (...) conducted tests with users to determine how patients with visual impairment can access health information on mobile phone / SMS”, and that it “was developed a service based on the redirection of users’ SMS (text-health) and conversion to speech on a central server. The solution is functional and can be demonstrated. The aim is to make the developed software available as open source.”

NST, together with the Sørlandssykehuset, have since 2005 developed a closed conversation forum on the Internet for young people between 15-18 years, who have parents with mental health problems. This is a service where young people can meet like-minded in the same situation and get help and comfort each other. The chat room is available 24 hours a day the year round. The closed chat forum has been a part of the site Morild, run by the Department of Child and Adolescent Mental Health at the Southern Hospital (Sørlandssykehuset). Now the hospital has formally taken over the operation of the talking room and continues it on the Internet – after strong urging from users. The system is studied as part of a doctoral work at NST. The impression is that it means a lot for young people to speak to others in the same situation and learn that they are not alone with their thoughts and difficult challenges. Several of the young users said that they through Morild have dared to speak to someone about these things.
9 NST and international cooperation

Since its foundation, NST has been involved in projects in many countries, including Sri Lanka, Kirgizstan, Russia, Greenland, Afghanistan, Georgia, Albania, Bangladesh, South Africa, Botswana, Poland and Korea.

9.1 WHO Collaborating Centre in Telemedicine

NST was appointed as the first Collaborating Centre of the World Health Organization in the field of telemedicine and e-health (Figure 322). The appointment as WHO Collaborating Centre was made on the basis of cooperation with WHO since 1997. The designation was made by the WHO Regional Office for Europe\(^{181}\) and its department in Barcelona, the WHO European Centre for Integrated Health Services.\(^{182}\) Like all WHO collaborating centres, NST is also a collaborating centre for the WHO headquarters in Geneva.\(^{183}\)

![Course leaflet for a joint WHO/UNN telemedicine training course in Tromsø, 16-20 November 1998.](image)

\(^{181}\) http://www.euro.who.int/en/ (Last accessed: 5.2.2013.)
\(^{183}\) http://www.who.int/en/ (Last accessed: 5.2.2013.)
A WHO collaborating centre is a national institution designated by the Director-General of the World Health Organization to form part of an international collaborative network carrying out activities in support of WHO's mandate for international health work and its programme priorities (Figure 323). The agreement was renewed in 2006 and again in 2010 and runs until September 2014.

Figure 323 From 17 to 21 May 2004, delegates from 192 member countries of the World Health Organization (WHO) gathered at the annual general meeting in Geneva. E-health was the theme for this year's congress. As the only WHO Collaborating Centre in telemedicine, the Norwegian Centre for Telemedicine was invited. NST was clearly visible with information materials and good ambassadors for the NST and Tromsø represented with director Steinar Pedersen and Tove Sørensen (right) during the WHO meeting in Geneva. In the middle, WHO e-health contact Irma Velazq. (Photo: NST)

As a Collaborating Centre in telemedicine and e-health, NST assists WHO and its member countries in establishing, developing, monitoring and evaluating telemedicine projects and services, including distance learning (Figure 321). This means that NST acts for and on behalf of WHO on issues and projects related to telemedicine and e-health (Figure 331). WHO has over 800 collaboration centres in more than 80 countries. These centres perform tasks for WHO. The intention is to use the best national institutions to carry out international tasks. Institutions such as research institutes, universities and colleges have been appointed as WHO Collaboration Centres. The centres cover areas such as nursing, infectious diseases, general health, diet, mental health, chronic diseases and health technology. The first centre selected in 1948 (Government Serum Institute, Copenhagen).

Guidelines for undertaking a country feasibility study have been prepared by NST at the request of the WHO Regional Office for Europe (Figure 324). The guidance is based on research, development and literature studies over the last decade. The target users are those involved in all stages of telemedicine projects, services and applications.

NST offers some information and facts about telemedicine for health authorities and institutions that want to get started with telemedicine (Figure 325). The fact sheets are available from NST’s web page. In addition, some of NST’s reports are available in English from the same web site.

Figure 324  NST’s “Guidelines for a country feasibility study on telemedicine”.¹⁸⁵

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¹⁸⁵ http://www.telemed.no/guidelines-for-a-country-feasibility-study-on-telemedicine.64916-7398.html
(Last accessed: 5.2.2013.)
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Some examples of NST's commitment to the WHO Centre is Telemedicine and e-health to combat HIV/AIDS. This is collaboration with South Africa and the organization The Constellation for AIDS Competence (Figure 327). NST has joined 'Constellation' in Thailand and has developed an online training program for coaches affiliated with the organization. In collaboration with Cell Life / University of Cape Town and Medical Research Council of South Africa, NST helped to develop a concept of integrated ICT solutions in AIDS treatment, 'e-health toolkit'. This includes an overview study of e-health in AIDS treatment and a needs assessment. The goal of the HIV/AIDS e-health initiative was to:

- Develop a knowledge base on ‘proven practise’ on ICTs for HIV/AIDS.
- Develop an e-health toolkit, a replicable concept for ARV-treatment.
- Facilitate international R&D collaboration and research exchange programmes.

The 46664 Arctic initiative wanted to promote e-health management for people living with HIV/AIDS (Figure 326). This includes:

- to explore the potentials for telemedicine and e-health in health management for people living with HIV/AIDS in the developing world.
- to create an international platform for collaboration and sharing information.
- to develop a list of joint actions to be presented for WHO and international policymakers.
On 11 June 2005, the 46664 Arctic Concert was held in Tromsø, Norway. Nelson Mandela himself was present at the conference. (Photo: NST)

The aim has been to strengthen the “Constellation” in Thailand by improving the training of coaching teams. The photo shows a similar meeting in India. (Photo: Constellation)
9.2 Examples of international projects

NST has been involved in establishing a Telemedicine rehabilitation network in Palestine, together with the Norwegian Association of the Disabled\footnote{186} and Sunnaas hospital\footnote{187}, and with support from the Norwegian Ministry of Foreign Affairs (Figure 328). Four rehabilitation centres are linked together using ICT to improve interaction between health professionals and provide a better quality treatment for patients.

In the evaluation report of the Palestinian Telemedicine Programme, Braaten (Braaten 2013) concluded:

“The report concludes that the work to develop a telemedicine programme within the Palestinian rehabilitation field has come a long way since the first telemedicine project was established in 2006. Taken into consideration especially the extremely difficult political, humanitarian and economic situation the four involved rehabilitation centres have had to deal with and still are facing, significant progress has been made to realise the objective of obtaining sustainable and institutionalised telemedicine services in Palestine. The report therefore concludes that the efforts that have been made to connect the four national rehabilitation centres in Palestine to each other and to relevant institutions abroad indisputably constitute a valuable contribution to improved health care for disabled persons in Palestine. At the same time the technology, infrastructure and the organisational set-up are vulnerable, making the future of the programme somewhat uncertain.” (Page 4)

\footnote{186} http://www.nhf.no \footnote{187} http://www.sunnaas.no
The health specialities are divided between the hospitals. Since the political situation has made it impossible for Palestinians to travel or to send patients between the hospitals, other means had to be deployed. This includes installing tools for cooperation and continuing education, which is essential to maintain professional skills and give optimal patient treatment (as illustrated in Figure 329 (on-line courses) and Figure 330 (VC)).

At the request of WHO-Euro, NST participated in a preliminary study in Albania in July 2007. The purpose of the visit was to examine whether Albania was ready for and implement ICT/e-health, a so-called 'e-health readiness assessment'. NST was also asked to consider the possibility to use hand-held PC (PDA) in emergency departments in the country. There was
some interest in telemedicine and e-health in Albania. The greatest interest and need were for electronic health information systems and electronic patient records. More advanced telemedicine services will require very large initial investments in infrastructure, hardware and software.

In collaboration with the 'Institute of Tropical Medicine' (ITG) in Antwerp, Belgium, NST arranged a telemedicine course that was offered to doctors from the 3rd world who had taken a three-week course of treatment of HIV/AIDS at the same department (Figure 332). It was a practical introduction to telemedicine/e-health and covered most areas of telemedicine. NST and ITG have signed an agreement in which the aim is to organize annual courses.

Figure 331 NST’s WHO office visits a rural health centre, Balia Health Centre in Dhamrai, 60 km outside Dhaka (in 2004). (Photo: NST)

Figure 332 Telemedicine/e-health and e-learning workshop at Institute of Tropical Medicine, Antwerp, Belgium. (Photo: NST)
With support from the Atlas Alliance, NST conducted a feasibility study on net-based education for orthopaedic engineers in Cambodia (Figure 333). The intention was to develop educational modules for orthopaedic engineers in the third world. Cambodia was chosen as a case-country as it has a large number of people who have lost arms and legs in accidents due to landmines as well as road accidents. The educational modules were developed according to the standards and requirements of the International Society of Prosthetics and Orthotics (ISPO). This was a joint collaboration between the NST, Norsk Dysmeliforening (Norwegian Association for Dysmelia) and Sophies Minde Ortopedi AS at Oslo University Hospital.

In addition to WHO activities, NST has cooperation projects in several countries, several of which are funded through the EU research program. The most important of these is given in Table 18.

<table>
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<th>Table 18 Some of NST’s international projects 1996-2007.</th>
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<td>Telemedicine network in Arkhangelsk</td>
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<td>Telemnedicine in North-west Russia</td>
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<td>Arctic Telemedicine Project</td>
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<td>Videoconferencing connection to Archangelsk</td>
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<td>CORAS - A platform for risk analysis of security critical systems</td>
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<td>Mobile telemedicine unit for use in Northwest Russia</td>
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<td>Project</td>
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<td>Nordic Telemedicine Network</td>
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<td>TELmedicine ANYwhere (TelAny)</td>
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<td>eHealt in the Northernmost Regions of Europe</td>
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<td>I-Discare</td>
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<td>Tuberculosis Network in Northwest Russia</td>
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<td>KIM: Space, Power and Communication</td>
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<tr>
<td>Medical Peace Work – a new European field of expertise in health work, violence prevention and peace building</td>
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<tr>
<td>Online education of orthopaedic engineers – pilot project</td>
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<tr>
<td>Sustainable rural health care networks</td>
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<tr>
<td>Technology supported family interventions</td>
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<tr>
<td>Telemedicine in Afghanistan</td>
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The project provided for the establishment of telemedicine services among the Croatian islands and hospitals in Split and Zagreb. NST’s mission was to provide advice and evaluation in connection with the implementation processes.

The European project “Cogknow” aimed to develop technological solutions that could help people with mild dementia, a stronger sense of autonomy and participation, and in addition provide an experience of a better quality of life.

This project would establish the first telemedicine rehabilitation network in Palestine. The network will link the four national rehabilitation centres with each other and with relevant rehabilitation centres abroad.

The purpose of the Nordic Telemedicine Collaboration Forum is to contribute to the further development and increased use of telemedicine in the Nordic countries. The forum is being held on the initiative of the Nordic Council of Ministers.

Municipalities in Iceland, Greenland, Faroe Islands and northern Norway participated throughout the project West Nordic countries in a skills program on the theme “Mental retardation” with the use of new technology.

The European project PERSONA aimed to develop sustained and affordable technological solutions that would promote social inclusion and independence for seniors. The goal would be achieved through harmonization of the so-called “Ambient Assisted Living” (AAL) technologies and concepts.

The project was to test whether there was a market to establish a virtual European marketplace for radiology services.

9.3 European projects

NST has been partner in many European projects. This sub-chapter presents some of the many EU-funded projects NST has been a partner in.

The goal of the Regional Telemedicine Forum was to deliver innovation at regional level (Figure 334). The motivation for the forum was that, despite the benefits and technical maturi-
Lessons learned from 25 years with telemedicine in Northern Norway

ty of the applications, the use of telemedicine services was limited in Europe. For NST, it was
evident that actions had to be taken at regional level by developing policy recommendations
addressing the main barriers that hinder the wider use of telemedicine.

The project was a partnership of 9 European regions. The project aims:

“to release the potential of wider implementation and deployment of telemedicine ser-

vices at the regional level. Over the three years the partners will organise workshops,

four study visits and virtual meetings to focus on telemedicine services related to three

major chronic diseases: diabetes, smokers’ lung disease, and cardiovascular disease. The

project results in policy recommendations, developed on the basis of identification

and analysis of barriers and facilitators at clinical, strategy, and market levels. This

contributes to releasing the potential of wider implementation and deployment of tel-

emedicine services at the regional level, and hereby to innovation within patient care

and healthcare system efficiency as well as market development for regional

SMEs.”

The goal of the Renewing Health is to establish a

“large-scale real-life test beds for the validation and evaluation of innovative telemed-

icine services by means of a patient-centred approach and a common rigorous assess-

ment methodology.”

According to the project’s web-page, Renewing Health

“involves 9 of the most advanced regions in the implementation of health-related ICT

services, inside a local system where service solutions are already operational for the

tele-monitoring and the treatment of chronic patients suffering from diabetes, chronic

obstructive pulmonary or cardiovascular diseases.”

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188 http://regional-telemedicine.eu/project (Last accessed: 5.2.2013.)
189 http://www.renewinghealth.eu/ (Last accessed: 5.2.2013.)
190 http://www.renewinghealth.eu/ (Last accessed: 5.2.2013.)
FI-STAR (Figure 336) aims to find:

"Applications, which could revolutionize the way healthcare is delivered by professionals and informal carers. These new technologies are set to increase the degree of freedom and independence for patients who self-care, for instance in remote and rural areas."\(^{191}\)

![FI-STAR future Internet Social and Technological Alignment Research project](image)

NST has also been involved in several international projects with Russian partners, e.g., the KITENPI project (Kolarctic-IT-Education-Partnership-Infrastructure). The three years project was initiated in 2011. The project’s goal was according to the final report of the project (Bye 2014):

“KITENPI strengthens the region’s competitiveness in the area of ICT for the increasingly growing global market, and promotes a solid competence in cross-border collaboration. KITENPI has three specific cross-border objectives:

- Academic integration, working towards creating a common pool of jobs and highly-trained human resources in ICT, and tapping into the potential of promoting more female students in ICT education. KITENPI will improve graduate education opportunities in advanced ICT areas, primarily in Mobile Systems, Pervasive Computing, Wireless Networks and E-health, and stimulate student and staff mobility within the KOLARCTIC region.

- Innovation facilitation that increases industry involvement in education and research, and exchange of best practice among the involved ICT regions. The ICT industry in the KOLARCTIC region shall get a better supply of new ideas and innovations to commercialize, and more options for joint activities among SMEs.

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- Infrastructure with an extended all-KOLARCTIC open IP network, and ICT tools that make distance education and collaboration easy to accomplish.

KITENPI takes its starting point in the identified European objectives to use ICT to address health issues, the aging population and inclusion of marginalised groups. This challenge for mankind is even more in focus in the KOLARCTIC area, so there is an opportunity for the KOLARCTIC region to jointly build strong positions in this area.

KITENPI builds on collaboration models previously used between each university and their local ICT industry.

Another example of a project in Russia deals with qualitative improvement of health services for indigenous people in remote areas in the Nenets Region (Bye, Hagen et al. 2015).

9.4 International visitors

NST has over the years many international visitors who have come to learn from NST’s comprehensive experience with telemedicine services (Figure 337). The majority of visitors are researchers, policy makers and health managers, and they are mainly interested to know more about telemedicine and e-health in Norway and to learn from the centre’s experience and development. In 2008, approximately 200 people visited the NST. In addition, 285 delegates from 21 countries participated at at TTec 2008 in Tromsø.

![Figure 337](image-url)  Article from UNN’s internal news magazine “Pingvinen” (The penguin). The article presents the international attention that NST gets.
The article (Figure 338) tells that a delegation from China will visit Tromsø to get help to establish a health IT centre in Beijing.

Figure 338 "Travels to Tromsø to study telemedicine". Dagens Næringsliv, 19. September 2006.

Figure 339 Headline in "Tromsøflaket", newspaper at University of Tromsø: “Cuba learns telemedicine by Norway”

The picture in Figure 339 shows the Cuban doctor Israel Borrajero sitting in Havana and considering what is wrong with the beating heart of a patient at the University Hospital in Tromsø.

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so. The photograph is transmitted via satellite. On the right, the Norwegian telemedicine expert Øyvind Snyen. The article presents how Cuban doctors can be online with Tromso:193

“It was the second Spanish American conference on telemedicine in Havana in June that medical researchers from Latin America and Spain got demonstrated what limitless possibilities telemedicine opens for cooperation between hospitals in different parts of the world. Former sales manager in Europe for the radio relay division of the Norwegian company Nera and current director of the Spanish telemedicine company New Bits, Øyvind Snyen, was responsible for demonstrating telemedicine to the conference participants. He did so by establishing contact between the Cuban doctor Borrajero Israel and Steinar Pedersen who is head of the Telemedicine Department, University Hospital of Tromsø.”

9.5 ESA Ambassador

In June 2010, NST launched the Ambassador Platform for Integrated Application Promotion (IAP)194 in collaboration with the European Space Agency (ESA) (Figure 340). The goal of this platform is to spread the knowledge of stakeholders in the field of e-health, and particularly in the areas of telemedicine support in inaccessible areas of the world, emergencies, and e-learning.

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Figure 340  IAP flyer, March 2010.
The objective of the Ambassador Platform for e-Health in Inaccessible Regions (eHIR) is:

“to assist the IAP programme in spreading awareness among stakeholders in the domain of e-Health, with main thematic focus on telemedicine support to inaccessible regions, emergency situations and e-learning and human resource development.

- Telemedicine support in this context provides healthcare services across geographic barriers where distance is a critical factor, enabling exchange of information for diagnosis, treatment and prevention of diseases and injuries. In regions with limited infrastructure, space assets can play an important role for realizing such services, whether for day-to-day healthcare or for emergencies.
- eLearning in this context is remote learning, development, and competence monitoring for healthcare professionals and health workers in general.”

9.6 Tromsø Telemedicine Conference

NST defined conferences as an important arena for the dissemination of research results and knowledge about telemedicine and e-health. Each year, NST’s staff members present their work at international conferences. For many years, NST also organized its own conferences (Figure 341). Due to budgetary reasons, in the last years, these conferences have mostly been national and Scandinavian conferences.

The international telemedicine conferences in Tromsø have been well received by the delegates. The following comment was received after TTeC 2008:

“I enjoyed the excellent scientific programme, the perfect organization and the great hospitality.”
- Katrin Mueller, Motorola GmbH

The Scandinavian conference “Free flow of patient information – fiction or fact?” focused on practical, legal, security and ethical challenges of sharing patient information between different agencies and levels of health care in the Scandinavian countries (Figure 342). All speakers were invited. The conference was collaboration between NST, MedCom in Denmark, Tromsø municipality, HIT North Norway and the Norwegian Hospital and Health Services Association (NSH). Primary target groups for the conference was the medical staff, personnel who work closely with the health sector in the establishment of comprehensive services, patients, providers of electronic communication and record systems to the health care sector, decision makers at all levels and central health authorities.

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196 Norsk sykehus- og helsetjenesteforening (NSH).
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In 2010, NST organized the conference “Out with the patient!” , a conference on telemedicine, collaboration and decentralization - with a focus on ethical, legal and security aspects.

Figure 341  Examples of telemedicine and e-health conferences held in Tromsø: eHealth 05 (Health Ministers of the European Union), Tromso Telemedicine and eHealth Conference, 2006, 2007 and 2008.

Figure 342  In 2009, the international TTeC conference in Tromsø was replaced by a Scandinavian conference on the theme: “Free flow of patient information – fiction or fact?”
Developers from Tromso in Norway can become key actors when people in Tanzania, Malawi and Cambodia need prosthesis and other orthopaedic tools. In a shack in the Angolan countryside, Miss Landmine 2008 is having a cast made on her leg stump. The Norwegian orthopaedics engineer Rune Nilsen then uses the cast to make her very first prosthesis. “But we cannot make Norwegian prosthesis to everyone who needs it. The solution is to help educate more orthopaedic engineers locally,” he says.

Together with the Norwegian centre for integrated care and telemedicine (NST), as well as the International Society for Prosthetics and Orthotics (ISPO), he is about to get started on a large project, where they aim at educating more orthopaedic engineers. On a world scale, there is a huge shortage on workers with skills within this field.

NST is contributing to the project with their Net-based education group, which has great experience from work with health education on the net. “Even though this project is directed towards countries in the south, these courses might be of use for engineers throughout the world. ISPO’s quality standards are very high, so it is exiting to be a part of this,” says Line Lindstad, head of the advisory department at NST.

Estimates shows that there are about 650 million disabled people in the world today, and the number is increasing. 200 million of them are children, and some 80 percent live in poor countries in the south. Many of them need prosthesis or other orthopaedic tools.

Only a few years ago, disabled people in many parts of the world were society's outcasts. This has changed – at least on a government level. Sepp Heim, founder and former president of the ISPO, describes a world where the rights of the disabled, to a great extent, are included in the countries laws and guidelines. “But there are still huge challenges when it comes to the level of education and the access to technical aids,” he says. This is where eLearning, or net-based education, can make a difference. “eLearning is a good and suitable tool to increase the quality of the work that is done out in the field”, he says.

Head of net-based education, Kirsten Eriksen, is looking forward to get started on a line of work where she has wanted to contribute for a long time. “We experience the work with this project as very interesting and important, as we now can support the worldwide education of orthopaedic engineers”, she says. What will be the greatest challenge? “To standardize an education with high quality, that can be successfully used despite of cultural and organisational differences between all the countries and continents, where it is to be put into use.”

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197 This article was originally written in English by the authors. URL: http://www.telemed.no/aiding-the-worldas-disabled-online.4644164-117531.html (Last accessed: 5.2.2013.)
Full of energy after workshop
Jan Fredrik Frantzen (27 July, 2010)

After five days at "Sustain and Scale", a WHO workshop in Tromsø on telemedicine and e-health, the participants were full of determination and enthusiasm. One of them was Fassil from Ethiopia, who went home to devote an intensive effort to mobile e-health services.

Fassil is a doctor, and for the past eight years he has worked with telemedicine in his home country. Among other activities, he has been involved in implementing projects in radiology, dermatology, paediatrics and eLearning with simple "store-and-forward" technology such as digital images sent by email to specialists to provide a basis for guidance.

Aims to focus on mobile services
But he does not want to stop there. In meeting telemedicine professionals from other parts of the world, he has been inspired by suggestions, ideas, and expertise to launch new initiatives in his homeland.

"We are in the process of building up a very large infrastructure for communication in Ethiopia. For example, our authorities have made a strong commitment to fibre optics for Internet connections," he says. Now, he plans to return home and establish eLearning and clinical support for doctors and health professionals who work with HIV and AIDS patients. "We have few doctors and wide geographical variations. With mobile solutions and the Internet, it will be easier to stay up to date professionally and to provide guidance to nursing staff in rural areas. We hope that this will help us."

Ethiopian health professionals have become enthusiasts
Just as in Norway, they have experienced difficult times, they have made mistakes, and they have achieved successes. And just as we do, they often experience resistance to new ways of working in the public health service. But this has changed since they started trying out the telemedicine solutions. "65% of the doctors and an even higher proportion of the nurses are now enthusiastic about using telemedicine, according to a survey that we conducted recently," he says.

In addition, using simple technology has proved very important, as well as combining several technologies such as videoconferencing and email. "Local adaptation is also very important. We had a software provider who created an email system that needed a lot of bandwidth. Instead, we decided to program our own system, which compresses images and sends the emails much faster because it does not need such fast connections."

A lot to learn from the participants
Since 2002, Tove Sørensen has been the NST's coordinator for its activities as a WHO Centre. She is highly satisfied with the week that has passed, and is impressed by the breadth of everything that is happening in this field internationally.

"There are many countries that have come a long way now, and it is very exciting to see presentations and discuss the projects and services in the various countries.

"And although it is the NST that organizes the workshop and offers our competence to the participants, it's amazing how much we learn from the participants about what is happening outside Norway. There is no question that this is a two-way and highly informative process," she says in conclusion.

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198 This article was originally written in English.
10 Commercial spin-offs from telemedicine in Tromsø

In the early days of the NST's existence, the proof of concept was the primary goal for the activities. Then there was a period where the primary goal was to produce results for peer-reviewed journals, to produce PhDs and through this reach a higher scientifically level. These goals still exist, but a blowing wind, calling for innovation, calling for more commercialisation of the result, has dashed over the landscape. And NST has not been unaffected of these signals.

The first commercial spin off from the Tromsø activities came into existents before the NST was founded. It was a result of the early TF (Telenor Research) activities in cooperation with pathologist at UNN. The company’s business idea was to build pathological workstations for telepathology as described in section 4.5.199

Based on NST’s work on offline request and reports, the next spin off company was Well Diagnostics AS, established in 1999. This company’s primary goal was to facilitate cooperation and the secure exchange of information within the health care sector. Well Diagnostics worked towards its goal by developing and deploying applications within the areas of: Medical Multimedia handling, systems integration and secure communication. The company was a preferred business partner for several leading electronic patient record (EPR) companies, research institutes, hospitals, laboratories, nursing homes, doctor’s offices and other health care institutions. The company was in the end 2007 bought, in a friendly takeover, by the EPJ company DIPS.200

The next company to surface was Norwegian Healthnet, a company that takes care of the infrastructure for all the units in the Norwegian health care system. The birth of these activity is described in section 2.3.201

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199 The company still exists today and more information can be found on http://www.osioptoelectronics.no/ (Last accessed: 5.2.2013.)

200 More information can be found on: www.dips.no

201 More information can be found on: www.nhn.no
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The next company, RisCo, did not come from NST, but from related activities at the Radiological department at UNN (Figure 347). The company has developed The Tromsø Radiology Information System (TRIS), which is a booking, scheduling and reporting system for radiology departments. It is built to handle the overall workflow in the department. The system is based both on a client/server solution and a web interface.²⁰²

The company iMED was a direct spin off from NST, and founded in 2001. The business idea was to help customers find their way in the jungle of technological, medical and organisational issues that emerges when telemedicine and e-health is introduced in a health care organisation. iMed gradually evolved to be a supplier of products and services for improving emergency medicine in remote places. They introduced merMaid, a maritime telemedicine solution. The company was in 2007, in a friendly takeover, bought by the Dualog as.²⁰³

Another result of the telemedicine activity in Tromsø is company is Exponor. The company’s ambition is to offer Norwegian telemedicine and e-health know-how to the new member states of the EU, especially Poland.

The last spinoff from the NST is Tromsø Telemedicine Consulting AS (Figure 348). The company provides consulting services to private and public actors in telemedicine and e-health. Tromsø Telemedicine Consult Ltd. started 1 February 2011.²⁰⁴

Figure 348  Tromsø Telemedicine Consult Ltd. was established by the found and first director of NST, Dr. Steinar Pedersen.

²⁰² More information can be found on: http://www.risco.n (Last accessed: 5.2.2013.)
²⁰³ More information can be found on their website: http://www.dualog.com (Last accessed: 5.2.2013.)
²⁰⁴ More information is available at www.telemedicineconsult.com (Last accessed: 5.2.2013.)
In addition to this, the NST has become an important meeting place for exchange of information between researchers and business. In 2006-2009, NST arranged 17 conferences and workshops in this area. Until 2009, NST has, together with industrial partners, had 42 projects in which 8 prototypes have been developed. And in addition to this, the partners have also developed and adapted 19 products.

And far off from the research activities, but nevertheless money in the pockets for local travel and tourist industry, the number of visitors to NST premises and visitors to the Tromsø Telemedicine and eHealth Conference (TTeC) and other conferences and workshops has over the years contributed to that more than 30,000 accommodations.

In helping the process from research to business, NST, funded by Innovation Norway, created Health information Northern Norway (HIT). This is a forum for health, innovation and technology. Its primary objective is to create a foundation for collaboration between enterprises and demanding public-sector customers, as well as collaboration with R&D communities to develop and commercialize existing and new solutions within ICT in the health sector.
11 UNN into the future with telemedicine

According to Dr. Tor Ingebrigtsen (Figure 349), director of UNN, the hospital will put a lot of effort into telemedicine services over the next years.205 The Coordination reform (“Samhandlingsreformen”) has been important input to this process. While the past reforms have been structural reforms, the Coordination reform is a content reform. It suggests changes to the content of the services and the way they will be delivered. Collaboration implies coordination and performance of activities in a process where no single person or institution has total responsibility. To work in the health care service implies working in dynamic teams, across organizational and geographic boundaries. This also means breaking with traditional understanding of the medical profession, i.e., leaving thinking in different levels.

UNN’s vision is to give the best patient care. Only results count! To achieve this vision:

- UNN will continuously evaluate and document the outcome so that the patient knows what to expect after treatment with us!
- UNN shall be the Norwegian university hospital in the North!
- UNN has competent staffs that enjoy working at UNN!

Figure 349 Tor Ingebrigtsen, director of UNN (from Fall 2007) (Photo: UNN)

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205 “Organisation, skills and technology for interaction” (Organisasjon, kompetanse og teknologi for samhandling), lecture by UNN’s director, prof. dr.med. Tor Ingebrigtsen, NST, June 2011.
Lessons learned from 25 years with telemedicine in Northern Norway

- UNN, in cooperation with the University of Tromsø and the University Colleges, shall educate motivated and skilled health workers!

Ingebrigtsen argues that: “At UNN, we base everything we do on our core values: Respect, quality, safety and care.”

The starting point for the Coordination reform in the Ofoten area and Troms County is:

- Superior liaison body with the municipalities (OSO).
- Well-developed district medical centres (DMS) structure.
- Ambulant services, organized from UNN.
- Network organized university with strong research groups in Health Sciences, ICT, telemedicine and e-health.

In 2008, UNN and the northern health region, were already well prepared for expanding the use of telemedicine services:

- All primary care physicians, all municipal nursing and care services, and all health authorities are using EHR.
- Referrals, discharge letters, requisitions, laboratory and X-ray responses are sent electronically between GPs and hospitals, and anything between Tromsø/PLO (care) and hospitals.
- All Regional Council in Troms and in northern Nordland counties, OSO and UNN are involved.

According to Ingebrigtsen, the challenges are:

- Lack of network and platform of the PLO service.
- Loosely rooted in UNN-management.
- Lack of coordinated service for increased competence using the Internet and video conferencing.
- Lack of ease of use of technical solutions.
- Obstacles of legal and financial character.

UNN has figured out that around 7,000 consultations each year can be replaced by videoconferences. UNN’s vision is that it must be as natural to get into the consulting room through the PC or videoconferencing equipment than through the door. To do this, VC equipment must be in place in all outpatient clinics’ rooms. In addition, the VC equipment will be used for educational purposes and meetings.
12 Final remarks

The first organised work on telemedicine services in Norway was initiated in 1987 by visionary politicians and researchers who saw the potential of using telecommunication to improve the accessibility of health care specialists to the rural areas of Northern Norway. The establishment of an office of the Norwegian Telecommunications Administration’s research department in Tromsø, with a mandate of working with telecommunication solutions to improve the health care in North Norway, was the starting point of a more than 25 years adventure. Medical doctors and other staff members at the University Hospital of North Norway (UNN) were soon involved in different telemedicine projects. At UNN, senior doctor at the ENT department, Steinar Pedersen, took the initiative to establish a telemedicine office at UNN, which later became the Norwegian Centre for Telemedicine.

The Norwegian Centre for Telemedicine has, since the centre was established in 1993 as a telemedicine department at the University Hospital in Tromsø, Norway, continuously focused on the implementation of telemedicine services in specialist health care in Norway. In the 1990ies, the focus was gradually widened to include primary care and nursing homes. From the beginning, the goal has been to implement telemedicine and later, e-health, services for the Norwegian health care sector. Thus, most of the work has been documented in Norwegian only. In 2009, NST changed its name to Norwegian Centre for Integrated Care and Telemedicine.

With its experimental approach, NST soon got both national and international attention for its many operational telemedicine services. International activity increased even further when NST in July 2002 when NST was appointed as WHO’s first Collaborating Centre for Telemedicine.

Figure 350  Ilias Iakovidis, deputy head of the e-health unit at the European Commission.
(Photo: European Commission)
An important goal for NST has been to maintain a good relationship to the European Commission. The following is an e-mail-based interview with Ilias Iakovidis (Figure 350), deputy head of the e-health unit at the European Commission:

**Q**: What is the potential for telemedicine in Europe and the peripheries such as Northern Norway in the years to come?

**Iakovidis**: At the level of the individual, telemedicine has the potential to support improvements in a patient’s health and quality of life, particularly for those with chronic diseases, by enabling safer monitoring at home resulting in fewer hospital visits. E.g., a review of 14 random controlled trials involving 4264 patients showed that remote monitoring programmes reduced rates of admission to hospital for chronic heart failure by 21% and all causes of mortality by 20%. (Clark, Inglis et al. 2007)

Telemedicine is the combination of tools and services that give patients the “responsability” for their health conditions. They can monitor their disease(s) and manage their lifestyle more effectively. Telemedicine can retain patients in their familiar environment and community networks, thus minimising the social disruption that patients may suffer, in addition to the impairment of their health.

E.g., in Scotland it has been estimated that over the periods 2006/7 and 2007/8 the Telecare Development Programme would allow to “increase the number of persons able to maintain themselves at home through receipt of a telecare service [by] 3,800”, and to generate core efficiency savings of £43 million over the period 2007-2010. (Joint Improvement Team Scotland 2008).

For healthcare systems, telemedicine can help to address the shortage of healthcare professionals, particularly in sparsely populated areas such as Northern Norway (e.g., by providing remote consultations) and it can improve efficiency, quality and timeliness of healthcare service provision. Savings are generated by shorter hospital stays and lower hospital admissions. Cutting waiting lists and travel times through teleradiology procedures and saving costs by enabling remote checks of implantable cardiac devices are some of the most commonly quoted examples.

A Norwegian study has shown that, due to a teleradiology service linking a general practice in rural Norway to the local hospital in the nearest town has, on the basis of data for 3006 patients, an estimated annual NOK 1.4 million (€170,000) were saved on travel costs and by patients or their employers because of working hours not lost. (Johansen and Breivik 2004)

Telemedicine also has the potential to contribute to the growth of the European economy. Telemedicine is a global market that is expanding rapidly and is expected to continue growing at a fast pace in the coming years. European industry, which includes numerous SMEs in this sector, is in a good position to benefit from this expanding market. (Fauchier, Sadoul et al. 2005)

**Q**: What is your opinion of the work and expertise of the Norwegian Centre for Telemedicine in Tromso?

**Iakovidis**: We consider the Norwegian Centre for Telemedicine as a centre of excellence in the field of telemedicine. To my knowledge it is the largest centre of a kind with long history and knowledge. I personally learned a lot already since 1994 when I

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206 E-mail interview with Ilias Iakovidis, deputy head of the e-health unit at the European Commission. Sent to NST 19th November, 2008, by Iakovidis himself. The e-mail was a respond to questions submitted by NST-journalist Jan Fredrik Frantzen, 11th November 2008.
first saw and discussed the centres experiences such as the O-R-L tele-consultations with general practitioners in Northern Norway. During its fifteen years of existence, the centre has produced high quality work for both research and development and dissemination of telemedicine solutions. We hope that the impact of the centre is global since it also acts as WHO centre (“ambassador”) in this field. The centre is currently leading very ambitious projects, in particular in Tromsø County and the Commission will be monitoring the results with great interest.

In recent years, NST has struggled a bit to find an optimal organization. Being part of a university hospital has also led to a stronger focus on research. However, all employees at NST and the rest of the telemedicine community in Tromsø are working hard to promote telemedicine as an important part of modern health care, both in primary and secondary care.
New NST research leader wants to solve “The Big Question”

Jan Fredrik Frantzen (14 December, 2009)

Why haven't we succeeded in building and maintaining large-scale telemedicine services? That is the main research issue that Richard Wootton intends to address as head of research at the Norwegian Centre for Integrated Care and Telemedicine.

After 20 years as a researcher in both Great Britain and Australia, the renowned editor of the Journal of Telemedicine and Telecare has recently taken up the position as the leader of some 50 researchers in Tromsø, Northern Norway.

During the last two decades, Wootton has worked extensively with telepediatrics in Queensland, Australia, high-speed medical networks in the UK and planned big-scale services in Scotland. So what brings him to the outskirts of northern Europe?

“NST in Tromsø is by far the world's largest telemedicine centre in the world. With such a large staff of highly competent researchers it should be possible to overcome the challenges and succeeding in building large-scale national telemedicine services”, he says.

Sociologists hold the key

The big issue in telemedicine is why we haven't really succeeded with telemedicine yet, some twenty years into the effort. It is a fact that apart from successes like teleradiology, arguably the exception that proves the rule, the big impact has yet to come within this promising field. So what needs to be done now? Wootton thinks that sociologists might have the answers, because in 2009, it is no longer a question of technology.

“Today you can get hold of more or less any technology you want to. But getting that technology into routine use is an organisational and human challenge. The NST has several sociologists and I think they, together with big-scale trials and research, can unlock this situation.”

Telemedicine hotline for developing countries

Richard Wootton's experience with telemedicine is undoubtedly extensive. Since 1998 he has even been involved in using low-cost telemedicine to support doctors in developing countries around the world, extending expert medical advice wherever it is needed.

On a secured server in the UK, medical staff from poor countries can upload their questions, pictures, CT-scans and x-ray images. When Richard and his colleagues have forwarded the question to one of the 450 specialists on call, doctors at some 100 hospitals in developing countries can get specialist advice on difficult patient cases in just a day or two.

“I have worked with the Swinfen Charitable Trust on this since 1998. Now I am hoping we can somehow use our experiences and improve this service through NST's role as a WHO Collaborating Centre”, Wootton says in closing.
13 References


Lessons learned from 25 years with telemedicine in Northern Norway


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About the authors:

**Gunnar Hartvigsen** is since 1994 professor at the University of Tromsø – The Arctic University of Norway (UiT), Department of Computer Science, and head of the Medical Informatics and Telemedicine group. Dr. Hartvigsen is since 2000 Professor at the Norwegian Centre for Integrated Care and Telemedicine, University Hospital of North Norway (part time). Hartvigsen has an MSc and a PhD degree in Computer Science (Artificial Intelligence) from UiT. In 2005-2009 he was Vice Dean at the Faculty of Science, University of Tromso. He has held several honorary posts at the Department of Computer Science, including Head of department. He has been member of several boards and committees at the University of Tromsø. In 2007-2014 he was research manager and director of Tromsø Telemedicine Laboratory (TTL), one of Norway’s first centres for research-based innovation. Dr. Hartvigsen has written two books and more than 300 papers and reports on telemedicine, electronic disease surveillance, electronic health records, self-help systems for people with chronic diseases, social media & social games for people with chronic diseases, intelligent homes, distributed applications, software agents, adaptive user interfaces, educational software, knowledge-based systems and ethics.

**Steinar Pedersen** is a MD specialized in ENT and founder and director of Tromsø Telemedicine Consult AS. Dr. Pedersen was the founder and leader of the Norwegian centre for Telemedicine for 16 years. During his leadership the centre became the first WHO collaborating centre for telemedicine an e-health. The centre also became the Norwegian Research Council’s Centre for research-based innovation. The centre had approximately 110 research fellows and staff members when he left his position at the end of the year 2010. The activities from Norwegian centre for Telemedicine have resulted in 7 spin-off companies. Dr. Pedersen has experience as member of numerous committees of inquires within the EU and WHO system. He has served as a member of The Norwegian Minister of Government Administration and Reforms advisory board for the future ICT policy in Norway. He has been a member of The British Telecom Global Advisory Board. He was the founding President of The International Society for Telemedicine. He is an advisor to the Catalonian Minister of Health through the TicSalut Scientific Council, Barcelona, Spain. He also serves on the international advisory committee of the research centre at Asia-Pacific Ubiquitous Healthcare Research Centre (APuHC) at the University of New South Wales, Sydney, Australia.