Oral Presentations

Major incidents. The past, present and future of training and care

SWEDE, a management system with Internet technology support for the health care system in emergency and disaster situations

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Background: The Swedish National Board of Health and Welfare has introduced SWEDE, a new management system to ensure a high level of preparedness for major emergencies and disasters situations. The system is based on a general doctrine, new routines and a computerized information system, the information system SWEDE (IS SWEDE). The doctrine consists of standardisation of terminology, a structure of management that will enable the medical profession to co-operate and co-ordinate activities in situations of major emergencies and disasters in a more efficient way.

Technical solutions: New equipment has been introduced in ambulances. Information is sent on line to receiving hospitals using the Mobitex system and internet technology. In situations of disasters or state of alert, this system enables the management group to continuously get access to relevant information.

Routines: One important part of the SWEDE-concept is that it is supposed to be used in the daily routine and should be escalated as soon this is needed. Where introduced the IS SWEDE is today used by routine in all situations involving ambulance. The information is sent to a central database from where it is directed to the receiving hospital by encrypted Internet. The hospital will thereby in advance get information about the accident, the patient and the treatment being given at the scene and during transport. In disaster situations the management group can also, by using IS SWEDE, direct the ambulances to those hospitals having the necessary resources.

Spread of concept: The system is up till today introduced in four county councils. Other county councils, as well as the Swedish National Defence, are on their way of introducing the system. An ambition is that at least 75% of all county councils and the National Defence should have the SWEDE-system in use at the end of year 2005.

Major incidents: The future of trauma care

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Despite recent successful prevention efforts, trauma will continue to occur. This appears to be particularly true in the case of natural and manmade disasters. Earlier identification of trauma incidents with improved access to patients, prehospital diagnosis with point of service care, and improved hospital care would each be expected to positively effect survival of all trauma patients. Efforts are underway to make improvements in each of these areas. These include: wireless vehicle monitoring and other vehicle safety improvements, 3D ultrasound, and noninvasive monitoring. Simultaneously, the field of nanotechnology is making it possible to miniaturize necessary devices and components. Future trauma patients will also benefit from the application of computer technology in the operating room, making it

possible for surgeons to see into solid organs. The bioconvergence of medicine and computers will transform trauma patient care over the next 50 years.

Telemedicine in disaster relief

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ECU's telemedicine program personifies the ideal application of technology to serve rural populations by providing education and clinical services to over 1,000,000 people in a 14,400 square mile area. ECU began conducting consultations in 1992 and is now one of the most experienced and mature Telemedicine programs in the world. ECU has the most advanced telecommunications infrastructure for telemedicine and has conducted several thousand consultations in over 30 different medical specialties.

The Telemedicine Center's latest efforts have taken telemedicine into public schools, the homes of healthcare patients, community mental health centers, and to flood victims living in community shelters during Hurricane Floyd disaster relief efforts. Most recently, the Center was involved in a global disaster response exercise with the United Nations and seven Pacific Rim countries.

In June 2000, the Telemedicine Center at the Brody School of Medicine, East Carolina University in Greenville, NC, participated in a simulated disaster response in Pu'u Paa, Hawaii, a lava plain without running water, electricity, or human habitation. During the five-day exercise we evaluated the ability to establish telecommunications and the effectiveness of the infrastructure, services and applications implemented for an operational global emergency response. Scaleable technologies were configured and systematically tested to determine the ability to provide medical and health care in an austere environment. A medical communications matrix was constructed and used throughout the evaluation.

Results show that telemedicine can be an important contribution to humanitarian relief efforts and medical support following disasters. http://www.telemed.med.ecu.edu/strong/whitepaper.htm Additional research is needed to build upon the lessons learned from participation in this exercise.

The Telemedicine Center has developed a Global Telehealth Resource Center to assist organizations in the delivery of medical aid during disaster and humanitarian crisis. The goals of the GTRC will be to build upon existing technological infrastructure and resources within the Telemedicine Center to develop a network of available physicians and healthcare professionals by specialty, listed by language, time zone, and clinical specialty; define protocols for connectivity, IP address's, telecom capabilities, and hardware description for each site; expand the capabilities of the ECU Bridge, an operational communications hub that can provide a vital connection between the point of need and global medical resources; develop low-cost deployable environmental and bio sensor technologies; train clinicians and responders in the effective use of telemedicine technologies and in diverse telehealth strategies for disaster and post-disaster events and build an online repository of reference materials to include best practices, other expert resources and links to appropriate research. Further information on Telemedicine for disaster response is available on the ECU web site at www.telemed.med.ecu.edu

Technology in disaster relief – The refugee experience

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The scale of many refugee scenarios would seem to offer an ideal opportunity to deploy technology to help relieve suffering. There are severe limitations on the deployment of technology including environmental factors, lack of power and poor communications. Properly deployed technology can act as a "force multiplier" enhancing the effectiveness of the limited number of humanitarian aid workers who normally staff these camps. Inappropriate technology, however, can act as an impediment, or a distraction to proper function of the humanitarian effort. It is therefore essential to determine, at the outset, the functional requirements for technology to ensure that any equipment deployed is because of a genuine need and not because of a technological driver.

Experience gained on a joint United Nations/US Navy refugee exercise and from longer term assistance in the developing world will be used to illustrate the uses of simple technology, showing both its limitations and benefits. Simple technological solutions to answer practical clinical problems will be discussed.

Telemedicine in the Baltic and Arctic regions

Telemedicine in rural areas – Satisfied patients and increased medical competence.

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A telemedicine project between two rural primary health care centres Tärnaby and Storuman in Southern Lapland and the university hospital of Umeå was carried out during the period 960901-981232. One hundred and sixty nine consultations were made, dermatology; 40, ENT; 50 and in orthopaedics 40. Furthermore 27 consultations in other specialities (surgery, medicine and gynaecology) were executed. Thirty percents of the consultations were done for second opinion and 70 % (118 patients) were planned for referral. Forty-seven cases of the latter were finished after a telemedicine consultation. The patients rendered a satisfaction score 5,5 on a 6 graded scale of the telemedicine visit. The GP's rated the educational effects to 4,4. A survey of acceptance and rating of future of telemedicine in the health care and it's potential was carried out afterwards with participation of 191 doctors and other health care personals in Västerbotten county. The physicians rated the impact on patient- and quality care of telemedicine higher than it's effects on their working conditions and the organisation efficacy 4,6 ; 4,5 vs. 3,8 ; 4,1. We conclude that distance consultations seem to reduce referrals and increase the competence level of the GP's. It's important to find further fields of applications and ways of working organising the communication network to increase frequency. A holistic and integrated view of telemedicine with society and patients in the centre is important when infusing it in the health care organisation to be able to receive all the potentials.

Experience from the regional pediatric telemedicine network establishing

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Telemedicine was initiated in Arkhangelsk County in 1996 as a collaboration program between Northwest Russia and northern Norway. At the end of Year 1999 we started developing a pediatric branch of the regional telemedicine network. Taking advantage of previous experiences in Arkhangelsk County, the network expanded rapidly. Technology utilized was dial-up access to Internet (only available in some parts of the region) or direct modem connection (Telnet sessions) to Arkhangelsk Regional Children Hospital. Using software developed at the Norwegian Center for Telemedicine (Vida and DORIS) for telemedicine purposes but also other software, we are now in the process of standardizing software used in the regional telemedicine network.

The pediatric network was initiated for further specialization, concentration, convenience, accessibility, and standardization of telemedicine service for children. The main aim was to raise qualifications among medical personnel in the districts (for further medical development) and to reach a wide coverage of the medical professions and features. Two times per year there are professional meetings for our TM-specialists from districts to keep them well informed and to raise their professional knowledge.

The network has also been utilized for second opinion. During year 2000 altogether 48 off-line consultations from the districts involved traumatologists, orthopedists, surgeons, radiologists, cardioreumatologists, genetics and other specialists from Arkhangelsk Regional Children Hospital. The patient's age varied from a few days to teenagers.

Conclusion: Our experience is that telemedicine has been of value to both patients and medical staff. Unique combination of effective administrative decisions and low-cost engineering solutions shall be interesting for our colleagues from abroad.

Telemedicine in Greenland – The first results from the evaluation

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In the spring of 1999 a businessplan for telemedicine in Greenland was approved. This businessplan includes an evaluationplan describing the extent and kind of evaluation that should be incorporated in the project. The evaluation includes the following criteria: expectations and reactions of the users, satisfaction among patients, logistics, organisation and technology, medical outcome, waiting time, travel activity among patients, economy, transferring of competence and recruiting/retaining of staff.

The parameters were defined with a view to what answers it seems possible to obtain in the Greenlandic environment, i.e. factors like geography, staff, economy etc. So was also the case with the methods chosen to collect data: questionnaires, logs and interviews.

Evaluation appears as a health technology assessment and was developed by an economist, a sociologist and a medical doctor in cooperation, with great and valuable help from the National Center for Telemedicine in Tromsø, Norway.

The first results from the evaluation will be presented.

Application of an international telemedicine project for otolaryngology (LITMED)

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The otolaryngological part of the international telemedicine project LITMED is devoted to the establishment of telemedicine training and demonstration facilities in cooperation between the Department of Otolaryngology of Lund University (Sweden) and the Department of Otolaryngology of Kaunas University of Medicine (Lithuania). The project is supported by the Swedish Government through the Baltic Sea IT-fund.

The main areas of the Litmed project in otolaryngology are as follows:
1) cochlear implantation (CI) patients' rehabilitation,
2) phonosurgery and phoniatrics,
3) middle ear surgery.

The main purposes of the project are:
a) to establish a telemedicine environment that is suitable for remote collaboration on live and by use of videolaryngostroboscopic images, voice samples, graphical and CT data,
b) to carry through telemedicine sessions for pedagogical and speech training support and for cooperative work of speech therapists from Lund and Kaunas with CI patients and for pre-operative judgement before middle ear and laryngeal surgery,
c) to establish a technical environment and practical routes for on-line consultations during ear and laryngeal surgery at Kaunas and Lund Departments of Otolaryngology,
d) to develop a technology for remote programming of CI speech processors.

The results of ongoing work will be presented. Detailed information is available on the Litmed web address: www.litmed.net.

From pilot projects to a business plan for telemedicine – Telemedicine in a regional perspective in Västerbotten County, Sweden

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The County of Västerbotten has 255 000 inhabitants. The County Council in co-operation with the municipalties provides more than 95% of the healts care and some 50% of the dental care. The County Council operates tree hospitals of which one is the University Hospital, Umeå (UHU). UHU also servs as a regional hospital for the nothern part of Sweden and its 900 000 inhabitants. It all started in 1995 and to feasibility studies, one concerning telepathology and the other about teleconsultations between general practitioners and hospitals. In September 1996 both projects were operating. The experience was so good that in 1998 it was decided to enlarge both projects. In the same year it was also decided to start a more systematic development of telemedicine and a first development plan was launched. At the same time it was decided to change the technical platform from ISDN (H320) to TCP/IP (H323). In April 2001 there are 35 PC-systems and 15 ISDN systems in operation, operating a multitude of applications. The pathology project is widening towards laboratory medicine and clinical conferences, dental care and

dental surgery has developed fast during the last one and a half year, the consultations between primary care and hospitals is now involving 10 GP-surgeries. Dermatology, ENT, dialysis, gyn.ultrasound, nursing, geriatrics and home care are other examples of clinical work supported by telemedicine.

The functioning of general regional telemedicine network in Arkhangelsk County

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In compliance with the project "Telemedicine in North-West Russia" the telemedicine network is continuing to develop in Arkhangelsk County.

At present time regional telemedicine network includes Regional Telemedicine Center, Regional Pediatric Telemedicine Center (both are situated in the Capital of County) and 12 telemedicine studios in the districts of Arkhangelsk County (including 2 ambulatories). Because of our communication and administrative conditions the most valuable method to conduct telemedicine consultation is transferring of still-images. The high precision of medical conclusions that delivers from still-image analyzing was confirmed by many foreign studies. During year 2000 altogether 153 off-line consultations (including 48 pediatric consultations) was conducted. 30% of them were urgent. We had the 44%-increase in comparison with year 1999. An economical evaluation, made as part of regional telemedicine network development, shows positive financial result in every year of regional telemedicine service functioning.

By the telemedicine information exchange we solve 2 practical tasks in the same time – the increasing of high-qualified medical service availability for the patients and tele-education availability for the medical personnel inside the districts of County. From year 1999 we continuing to develop and implement Mobile Telemedicine Unit as Hardware/Software Complex for conducting urgent and systematic telemedicine consultations from any place in the County and beyond the bounds of region. In this period there was more than 1000 patients consulted using this Unit. Also the chair of telemedicine and medical IT was inaugurated in year 2000 as department of Northern National Medical University. We plane to teach students and medical personnel there by giving them basic knowledge in telemedicine.

Conclusion: Our experience is that telemedicine has been of value to both patients and medical staff. Unique combination of effective administrative decisions and low-cost engineering solutions shall be interesting for our colleagues from abroad.

Electronic patient record

Electronic Health Record a part of the knowledge management workflow

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The Internet revolution in medicine has created an information overload. The doctor has difficulties keeping updated in his field and has not enough time finding relevant information in the vast amount of new information available. At the same time the informed patient has both the time and access to information which influence the way the patient relate to Health Care. Health Care professionals needs new tools to be able to; -challenge the empowered patient-handle the information overload - ensure quality of care.

According to the American Society for Health system Pharmacists 76% of the Internet users are searching for Health Information on the web. Doctors are facing well-educated patients, which have become "specialists" of there own disease. At the same time the doctor authority is challenged. People are less intimidated of the white coat and questions treatment recommendations. The external input of information into Health Care organizations increase exponentially. According to Medline there are more than 6 000 Medical Journals available. Ingenta, a content broker estimates that the number of available Internet journals will increase from today's 6 000, to more than 60 000 in the year of 2003. At the same time the half-life of clinical scientific information is reduced.

The Health Care organizations also produce its own information in an increasing pace. The traditional care giving organization is changing to a patient oriented model. Nurses, doctors, physiotherapists, etc are working together in process organizations and needs to interact closely. The doctor has increasing difficulty keeping updated in his/her area of interest. According to a study conducted by Swedish Medical Society; "Doctors and nurses do not get enough education… in order to learn new methods of treatment." This has led to an information stress among physicians. In a survey from May 2000, 100 doctors from Sweden and 100 from Finland answered questions regarding their relationship to new knowledge and their use of Internet. 74% of the Swedish doctors and 78% of the Finish doctors uses Internet as their primary source of finding medical information.76% of the Swedish doctors and 64% of the Finish doctors felt that the information overload was stressful.

Health Care organizations have to meat this challenge by continuously update their employees and invest in the Intellectual Capital of the organization in order to treat patient according to best practice and increase quality of care. The Intellectual Capital is the most valuable Capital in a knowledge-based institution. It is defined as the combined experience of the organizations staff (human capital) and the (structural capital). Knowledge Management Capture and retain knowledge by putting it into structural capital. In order to continuously deliver best practice health care the hospital of the future has to implement knowledge management tools in work flow pace.

International comparison of EHRs

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Remember the days when people were talking of the computer-based patient record (CPR)? It has been a failure, similar to patient data cards and community health information networks. A new realistic approach has replaced the outdated CPR vision. This new concept has three features: First, the new vision for electronic health records (EHRs) is better understood as a concept (not a system) and as consisting of many components. Second, its focus is on the *enterprise,* whether it be a solo practice, a clinic, a hospital, a health plan, or some other provider organization, and not on the patient, a focus which required interoperability among many provider settings. Therefore, interoperability is limited to the provider enterprise. This is "doable" today or in the near future and does not lead into the morass of trying to create interoperability between any clinic and any hospital in the country (or, in the world). Third, as components are implemented as stepping stones toward that vision, they are selected according to practical ROI justifications. Take the example of clinical workstation systems. As a major systems component of EHRs, they are, of course, dependent on clinical data repositories, their success relies on the data entry system (with speech recognition, templates, transcription, or other data capture components being used), and they have a communication component, a security component, and an order entry

component. MPI applications, results reporting, and many of the decision support components are examples of other components. A healthcare provider's competitiveness, level of efficiency, and degree of quality of care delivered may be in direct relationship to the rate of progress in implementing these steps towards EHRs. The vision of the future is a web-based electronic health record that holds all care documentation in a safe and secure way. This means less emphasis on messaging, syntax, and traditional integration. Rather than sending lab reports, for example to practitioners and departments, the reports will be posted on a provider website. The focus will be on the security infrastructure, which will govern who (including the patient) has access to what information at what time.

Now is the time to take steps toward the vision of a paperless care system that includes digital documentation of all clinical and administrative care processes. Each small step should be analyzed according to its benefits and its return on investment. Hospitals and delivery networks must share information, improve processes, and become more efficient in handling information technology. For some, this may mean merging MPI parts, for another creating a security infrastructure with signatures, and for another a wireless order entry system. In the ambulatory sector, too, providers are seeking practical solutions to overcome current pressures. For example, for small offices and group practices, the systematic problem of fixed or lowered reimbursement for the same care as well as the increasing costs for managing the associated paper-based bureaucracy must be addressed by taking steps toward EHRs. This may result in a combination of a practice management system with an EHR, including electronic referrals, drug management modules, and electronic prescription writing. EHRs should not be viewed as passive documentation systems but as tools for decision support, higher efficiency (think of referrals!), and aids for re-engineering.

Seven distinct areas of progress can be identified in regard to Electronic Health Record Systems. This presentation will be provide an analysis for each area.

The electric patient record: Improving quality of care in health documentation

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Information technology, including the Internet, is changing how patient records are recorded and retrieved. This presentation will review the various data capture and report generation techniques, and how they influence the quality of care. These include handwritten notes, dictation and transcription, speech recognition, templates, touch-screen entry, direct keyboard entry, handheld devices. The benefits and deficiencies of each alternative will be addressed with special emphasis on the recent US Institute of Medicine report calling for the elimination of handwritten clinical notes within the next decade as a means to improve quality of care.

HL7 and the electronic health record – What do they have in common?

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Health Level Seven (HL7) is known almost exclusively for its work in the area of messaging standards. Version 2 of the standard is being implemented worldwide and provides an effective solution to data interchange. HL7's attention now moves to the object-based version of the messaging standard. Version 3 is based on a defined Methodology Development Framework and uses a Reference Information Model (RIM) as the basis for message development. The syntax for V3 will be XML. At the same time, driven both by the needs and interests of its members and the needs of Version 3, HL7 has also broadened its

interests to include vocabulary, clinical structured documents, clinical templates, componentized clinical objects, decision support including the Arden Syntax and clinical guideline interchange formats, and security issues. Most recently, interest in the electronic health record (EHR) is becoming part of the HL7 domain. This presentation briefly provides a general background of HL7 and the Version 2 messaging standards. The other activities of HL7 are briefly presented with the interrelationships discussed. Finally, how all of these activities might fit together and how these standards relate to the EHR will be discussed. How closely related are the present activities of HL7 meet the needs of the EHR? What else needs to be addressed? Does the RIM meet the needs of the EHR, or must a second model be created? The conclusion of the presentation will place HL7 in the context of an international standards body and address the question of "Why HL7".

Using a medical knowledge navigator in order to treat patients according to best practice

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Medical Transcription (MT) is one of the main mechanisms to document and communicate medicine. It has evolved to into a well-defined business process, as well as a significant industry in its own right within the field of healthcare. The MT process includes the workflow of capturing the medical dictation, transcription of the report as well as its distribution. The recent utilization of distributed computing technologies in supporting the MT process opens new opportunities that can positively impact clinical as well as economic aspects of healthcare – it actually yields a form of telemedicine as the element of the MT process (dictation, transcription and distribution) no longer has any geographic constrains.

A physicians dictations can be captured and securely submitted to distributed computing services; these dictations and be accessed and processed by medical transcriptions anywhere in the world who subsequently submits the transcribed reports to another set of distributed computing services. The transcribed report can then be routed as pre-defined, including integration into other clinical information system. The utilization of distributed computing technologies in supporting this process offers other opportunities in coupling other distributed computing services into the workflow support that add value to the clinicians. As a physician access a transcribed report, another distributed computing service can identify the patterns that naturally occur in the body of the report and automatically presents relevant documents from medical journals, best practice databases as well as evidence based medicine sources in the context of the patient.

The Internet revolution in medicine has created an information overload. The physician has difficulties keeping updated in his field and might not have enough time finding relevant information in the vast amount of new information available. At the same time the informed patient has both the time and access to information which influence the way the patient relate to healthcare and a proposed course of action. Healthcare organizations has to meet this challenge by continuously update their employees and invest in the Intellectual Capital of the organization in order to treat patient according to best practice and increase quality of care. The Intellectual Capital is defined as the combined experience of the organizations staff (human capital) and tools that capture and retain knowledge (structural capital).

We will demonstrate a web-based tool that aims to support the physicians' workflow, through the medical transcription process, by supplying real time decision support at point of care, which continuously expands the Intellectual Capital of a healthcare organization.

Virtual reality, trauma and ambulance

The scenario

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2000 in August we demonstrated that it is possible using existing "on the shelf" technology to follow a patient from accident area to rehabilitation at home. The live scenario was performed almost like an play in front of 1200 Surgeons and Nurses at the annual meeting for Swedish surgeons Östersund Sweden.The scenario was planned in collaboration with Surgeons active in Swedish Colleges of Surgeons , Swedish Armed Medical Forces , Surgeons from Pori Finland and Personnel from Karlstad Hospital.Using satellite and ISDN based handheld videoconference at the accident area , a multipointconference unit connecting three parties , two video and one voice (ambulance) we could follow the paramedics work with the patient .Overhearing the conversation between paramedics and Karlstad emergency ward. Therafter we followed the structured ATLS examiniation of the patient in Karlstad, interacting in decisions made. Using both ISDN videoconfernce and ISDN based netmeeting we could interact on the electronic patient record and a CT scan (brain).

Furthermore we followed an laparoscopic diagnsotic procedure performed live in a three partie videoconference including trauma surgeon at a distance (Östersund) Traumasurgeon Karlstad and surgeons In Pori Finland who where performing the procedure. We used POTS for follow up in the patients home. This project showed that it is possible with todays technology for video and audiocomunication to follow and interactively give support at a distance when handling trauma.

In this presentation a live demonstration will be performed showing advanced decision support.

Telemedicine in remote areas

Telemedicine in Algeria: Current status and future prospects

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We present an overview of the current development and the ongoing telemedicine project in Algeria. Telemedicine can broadly be defined as health care services delivered through telecommunications networks. Health services are expensive and complex, needing intervention of diversified specialists located in different sites to exchange information between them. The rapidly falling prices of telecommunications and computer equipment, the concentration of medical resources in the large cities while rural areas and South are suffering a steady decline of health care resources, the Algerian Center of development of advanced technology, plan to introduce telemedicine in medical practice in algerian hospitals for distributing services around the country. An experiment of telemedicine was initiated in Algeria, by this center in June 1996, where the Beni-Messous Hospital of Algiers was connected to an another in the south, the Ouargla hospital. Medical images were transmitted and received via telephone lines between the two hospitals. Further work is made to compress medical images in order to solve the problems of communication channel saturation and storage space as to provide a productive healthcare system compatible with the emerging technologies of the 21st century.

Telemedicine in Romania

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Romania is a new developing country and the rural area is not yet cover by medical specialities. Recently we decided to cover medically the Iasi rural area by developing the first Telemedicine Center in the Gr.T.Popa University of Medicine and Pharmacy of Iasi. This central station is covered 24 hours by cardiologist on duty.

From January 2000 until the end of December 2000 we examined by telephone 285 ECG. 236 were urgent cases and 49 concerning common cheek-up. From these cases 15 patients had myocard infraction, 128 ischemic atacs, 92 extrasystols (58 ventricular and 34 supraventricular). One patient had complete atrioventriculat heart block and 49 had normal ECG's. All patients who suffered from MI, 6 patients with ventricular systols and the patient with the complete atrioventriculat blok were transfer safety to the Hospital in Iasi.

We believed that telemedicine is a useful method to face this patients. We save money and time as the patient is not travelling anymore since the specialist is next to his bed by using telemedicine.

Experiences with implementation of telemedicine as routine services

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This abstract describes how NST has been working to implement telemedical solutions at general practitioners offices in Northern Norway and our experiences so far. The solutions are store-and-forward-solutions within dermatology and ear-nose-throat diseases.

NST employed during summer 2000 four consultants whos main task was spreading solutions. The four of us are three nurses and one radiologist. We are working in a tight cooperation with Northern Norway Healthnet (NH). Their function are to connect the GP's to the net and to install the e-mail system. We are in their footprints with a package of teaching and training in the use of the software, cameras, organization and support.

The main experiences we have made is:
- The "spreaders" should be involved in the pilots as observers and discussion partners on an early stage
- Discussions with the GP's about organisational issues
- Dialogue with the countys IT-responsibles
- Dialogue with the specialists in the hospitals about organisation and continuity
- Mapping the IT-infrastructure in the county to avoid technological crashes
- Information about financial issues
- The importance of establishing a supportservice
- …… and last but not least: Don't be in a hurry when you're out there!

The Cuban national telemedicine program

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The Cuban Ministry of Health provides free universal health care to its citizens. The backbone of the system is a network of 284 hospitals and 2500 clinics distributed in the 15 provinces. 12 Institutes of Investigation and 5 Centers of Reference provide tertiary care and consultation. As a matter of policy, the Ministry of Health (MINSAP) has developed a working plan to implement Telemedicine nationwide. It is the goal of this program to provide consults to rural areas, reduce patient transport costs, provide tertiary care input to critical cases, disseminate medical knowledge and to facilitate cooperation and communication between the hospitals and clinics. Further, it is the intent of this program to increase access to care and provide continuous monitoring of chronic care and disabled patients.

The National Telemedicine Program will generate databases of diagnoses, treatment modalities and digital images. It will facilitate disease management and continuous program monitoring and improvement. The fist specialty to be addressed is Ophthalmology, followed by Radiology, Pathology, Nephrology, Endocrinology and Nuclear Medicine. MINSAP also plans to create a Virtual Medical University and a Virtual Library as critical portions of their long tem plan.

Training of health personnel on "TELEMEDICINE TECHNOLOGY" – A practical approach

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Any technology based development or application can get quick adaptation only when the technology is either user friendly or the users are willing to adapt themselves. In developing countries like India which at any point of time need resources whatever be the technology or application. However, when it comes to healthcare everyone expects the "best"irrespective of societal status and geographical location.

Developing countries are striving to embrace all that the developed countries are producing/developing. However, the real potential can only be exploited by countries like India when the manpower responsible for the delivery of healthcare is adequately trained to use the technology. In case of healthcare delivery system, Telemedicine is catching on in the developing world. The existing manpower in health care field needs to be made technology savvy. As of date, in India, virtually no medical college teaches the use and potential of technology like computer, telemedicine, handhelds etc. to the healthcare providers of tomorrow.

Centre for Electronics Design and Technology of India, Mohali (Chandigarh) is currently developing a programme to train the healthcare personnel which is likely make a difference although at a microlevel, towards the total quality and speed of healthcare delivery system. To make a doctor think of telemedicine as a tool as friendly and as common as a stethoscope, the introduction of a training programme for doctors towards the use of technology of telemedicine is proposed. The following aspects of technology are proposed to be covered: Basics of a computer, operating system, networking basics, communcation technologies, introduction to Medical Informatics, awareness about PC based medical instrumentation & interfacing, overview of global standards pertaining to telemedicine, overview of PACS, operating

procedure & commands to use the technology, current scenario pertaining to the global telemedical issues under consideration.

The paper would discuss the salient features of the training programme and the extent of coverage of the above mentioned topics.

Emergence of telemedicine and e-health services in South Korea

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South Korea is similar to most developed countries in that it has a significant ageing population. In 1998 6.6% of the population were estimated to be over 65, a figure predicted to rise to 13.2% by 2020. Inevitably this fact, together with the existence of a low fee structure and capitation system will place a heavy burden upon the Korean economy with respect to the provision and delivery of healthcare. This problem is further compounded by the fact that in terms of medical personnel there are, on average, only 3.2 primary care doctors per 10,000 persons in rural areas, which suggests an increasing disparity in the geographical distribution of resources.

This paper aims to examine the emergence of telemedicine and e-health services for both South Korea's urban populations (characterised by diseases such as diabetes mellitus, arthritis and hypertension where suitable, cost-effective e-health services can be easily implemented) and rural populations (characterised by chronic degenerative diseases). Furthermore, the paper aims to analyse how the use of telemedicine and e-health services can help bridge the wide disparities between urban and rural healthcare in Korea.

Teledentistry

Telematics in clinical dentistry and remote dental education

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During the last decade, quality development has become a most important issue in oral health care. However, in every day practice, quality development meets a considerable number of obstacles, mainly due to the lack of direct access to the information necessary in a specific clinical work situation. The EU-TAP project ORQUEST [1] has identified different clinical work situations and built up an integrated IT&T-platform composed of different software modules and hardware components for each clinical work situation in order to allow for adequate IT&T-support in specific clinical situations. Evaluation of this dental workstation took place at 12 European pilot sites with different characteristics (private clinics, universities, GDPs) over a 14-month period.

This paper presents the results of the evaluation in different work situations with integrated telematic support for second opinion, dental laboratory communication and retrospective evaluation. In addition, the presentation will focus on the usage of the dental workstation for remote dental education.

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The integrated use of videophones and CD ROMs to overcome bandwidth limitations during videoconferenced lectures

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Call costs resulting from Videoconferences via two channel (128 kbps) ISDN links are relatively cheap. However, such links provide limited bandwidth, which in turn can effect the quality of images received. A technique to overcome this problem, when delivering a lecture by videoconference, is to mail a CD ROM of the images to be used during the lecture to the receiving end of the link in advance of the videoconference. The CD ROM is then projected at the receiving end whilst the lecturer speaks to the audience via an ISDN2 link using a videophone. The lecturer's image is projected on to one screen and the images from the CD ROM on to a second screen. The lecturer can see and hear the audience and vice versa and large images are projected without distortion.

Telematic dental articulation system for remote teaching in collaborative virtual environments

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Diagnosis and treatment of disorders in the articulation of the mandible very frequently requires expert knowledge and, to large extent, highly skilled human cognitive performance in order to interpret the temporal and spatial relationships inherent in the chewing process. Education and training to acquire these professional skills demands high quality multi-media learning tools, which enable the students to visually convey the complex three-dimensional relationships of jaw articulation and which allow for interaction between teachers and learners.

We present a virtual reality based collaborative teaching environment, where real-time simulations of chewing processes are created and where students can interact with these simulations of the dynamic process of chewing. This particular teaching scenario is embedded into a networked virtual classroom environment, which can be shared by a number of students and advisors from remote places at the same time. Apart from the specific dental simulations, it provides a number of conventional teaching tools such as shared whiteboard, projection surfaces, and pointing facilities. The system allows users to explore the dynamics and extent of occlusal interference in chewing, in an anatomically correct context, while at the same time delivering a highly interactive platform for remote learning.

Dental Undergraduate Education by Teleconferencing (DUET): Experiences over the last 4 years

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DUET was born from the need to find innovative ways of teaching 150 students per dental undergraduate year across 3 campuses following the 1998 merger of Guy's, King's and St Thomas's Hospitals. This videoconferenced presentation will portray the experiences, evaluation, conclusions and ongoing development of the project which began by linking a distant dental practice in the Isle of Wight, 150 kilometers from King's College.

DUET included the following assessments:
- Most appropriate type of videoconferencing system,

- Use of peripheral tools such as intra-oral & document cameras
- Educational setting most suited to the medium
- Most appropriate educational material
- Student and staff attitude
- Maintenance and development issues

The methods used for the evaluation such as questionnaires, video recordings and interviews, and the results obtained will be discussed during the live link. The conclusions showed that effective teaching and learning can occur across the medium. With experience, the equipment can be managed reliably and the quality of transmission perceived as acceptable even at relatively low bandwidth. Future developments will be discussed.

Auditing orthognathic surgery through telemedicine

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The evaluation of orthognatic surgery via telemedical technology has been completed. The evaluation has taken the form of an interregional project between the Oral and Maxillofacial Department at Umeå University and the Oral and Maxillofacial, and Orthodontic clinics at Vasa Central Hospital. A number of telemedical conferences have taken place. The telemedical conferences were always attended by mixed-profession teams from Umeå.

Project description: During the first half of the year 2000 the evaluation has been conducted in three ways, in part as a *Retrospective Study* (1) of a number of completed patient-cases, partly in the form of regularly recurring *Therapy Discussions* (2) of new, as yet untreated, patient-cases and finally *Prospectively* (3) as two "live-operations." There has been a total of 30 video-conferences as part of the project, in the course of which a total of 44 patient treatments were discussed.

In general terms the treatment of patients is very similarly organised in Umeå and in Vasa. The care programme in Vasa does not differ in any significant way from that used in Umeå. Notable differences are as follows:

The joint therapy conference in Umeå between orthodontists and maxillofacial surgeons with careful consideration of status, anamnesis and diagnoses, together with joint therapy suggestions. This element is of particular importance to us and complements the existing, continuous contact between individual orthodontists. Practice in Vasa is not as systematic and clear at therapy meetings.

During investigation and follow up, we in Umeå take specific panoramic photographs of the jaw-joints. These photographs give a more reliable picture of hard tissue morphology than OPG. Photographs are taken with the mouth both open and closed so that jaw-joint function can be assessed both before and after treatment.

In Umeå we routinely make maxillary sinus x-rays of patients before and after a maxillary osteotomy, something Vasa stopped doing some time ago. Umeå's method of mounting articulator models using linear marking and magnetic plates is clearer and easier to work with, both in planning and in model surgery. In Vasa segmented osteotomy is a relatively common procedure both posterially in the maxilla and anterially in the mandible. This is very rare in Umeå. In Umeå a vertical ramus-osteotomy is used for setback of the mandible, while in Vasa a sagittal ramus osteotomy is performed for all advancements and setbacks of the mandible.

Despite long and great experience of orthognatic surgery neither Umeå nor Vasa has a good, systematic follow-up procedure in terms of treatment results, patients' "objective" opinions of treatment, proportions of sensory deprivation etc. etc.

Orthodontic advice using Teledent SW

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Teledent SW was a pilot study undertaken to determine the feasibility of providing general dental practitioners with direct access to expert orthodontic advice. A whiteboard was used as the basis of a "store and forward" referral system from 6 UK dental practices. The whiteboard was transmitted by FTP and stored on a secure server at the University of Bristol Dental School. Each case record contained 5 images of the plaster models of the case, appropriate radiographs and a text output of an expert-system-mediated clinical examination, carried out by the referring dentist. The advice was text based and was added to the whiteboard and returned by the same route, usually within 24 hours. Where clarification or a more detailed discussion was required, there was access to videoconferencing.

A total of 158 cases were seen during the 6 month study. Dentists, patients and parents liked the service. Advice took an average of 10 minutes of specialist time to provide, but against this the dentist spent an average of 30 minutes per case preparing the records for transmission. Only 5% of cases required videoconferencing support.

Telemedicine – A tool for global education

Telemedicine is an appropriate tool to improve education and training – also in low-income countries

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Skepticism against the use of telemedicine in low-income countries have been voiced. But there are a number of reasons not to fear the use of telemedicine and information technology in low-income countries. First, there is a rapid increase in connectivity, which eliminates many of the previous problems. This means that connection is not the problem but if you want large bandwidth it is going to be more expensive. Therefore, there are a number of narrow-bandwidth solutions available, e-mail list-servs and SatelLifes satellite e-mail service that can be used to overcome these problems. Another solution is to have the training material packed on shipped CDs which also decreases the need for a broad bandwidth connection. Capacity development to decrease the lack of "peopleware" seems to be the most pressing action to be taken. These issues will be reviewed with practical examples.

Computerized health information systems for increased local training and responsibility

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In computerized programme for handling of health information called "Health Information System Program" (HISP) has been developed in collaboration between University of Western Cape, South Africa and Uniersity of Oslo, Norway. This program has been designed to empower the district medical staff so that they can take direct action based on the data collected, rather than being sent upward in the hierarchy without any action. A distinct difference in responsibility for the collection of data and huge improvement in the quality of the data have been noticed. This will be highlighted in this presentation.

Information Technology in the Advancement of Nutrition in Africa (ITANA)

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African professionals in the field of nutrition face enormous challenges in their tasks of dealing with diverse and complex nutrition problems of the continent. The opportunities for collaboration and sharing of experiences and information on new approaches, concepts and findings are limiting and the resources for translating new scientific into locally adopted community-based action oriented programs are scarce. To help alleviate some of these problems a program was started three years ago by the Department of Medical Sciences, Nutrition section, Uppsala University funded by Sida. The program trains senior University personnel from Africa and Asia in the field of Nutrition and Information Technology. After the Uppsala IT-training a group of 26 African academic teachers in Nutrition have launched the idea of holding a Pan-African Conference on the Uses of Information Technology in the Advancement of Nutrition in Africa as part of the capacity building process in Africa.

CD–based nutrition material for undergraduate training in Africa

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CD–based, case-focused nutrition material which is locally adopted for undergraduate training in Africa was developed by African scholars who were on a Sida-sponsored Global NutrITion 2000 Programme. The scholars from 17 African countries were on a 5 – week course in Uppsala University, Sweden on Information Technology and update in knowledge of global nutrition issues. They began the development of the material, which was later put together into a CD by a student from Africa. The CD is for use by students in medicine, nursing, food science, home economics, agriculture and nutrition and complements normal classroom teaching. The CD contains six modules. Each module gives a description of a case study, illustrated with pictures that simulate a community's/patient's problem. This gives the student an opportunity to comprehend and identify with the varying nutritional problems and helps in the learning of the concepts of basic and applied nutrition science. The program then allows the student to make decisions on how to manage the problem at hand. The learning is enhanced by pop-quizzes, tests and illustrations allowing for immediate feedback and interactive learning.

Can computer-based training programs be usefully used outside the country of origin?

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"Nutrition in Medicine®" (NIM) is a computer-asssisted course designed for pre-clinical training of physicians in the United States, by Professor Steven Zeisel, University of North Carolina at Chapel Hill. It incorporates biochemical, clinical and epidemiological elements of nutrition science, and includes preventive ant therapeutic prespectives of nutrition. The experience of using such a programme outside the country of origin will be highlighted.

Quality assurance

Literature search on clinical trials in telemedicine

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Involved in setting up a telemedicine program for the Chinese University of Hong Kong in the mid-1990's, the authors found that studies addressing the time-honored requirement of applying randomized controlled trials to determine the efficiency and effectiveness of telemedicine applications were almost absent in the available literature.

Recently, using the search term "Telemedicine" as an entry point of searching MEDLINE, a total of 4389 journal citations was revealed but a more specific search using the search term "clinical trials on telemedicine" produced only 34 citations or less than one per cent of all citations. In viewing the relevant journal articles, one might conclude: that telemedicine or teleconferencing facility are proposed offering accessibility or saving time for physicians and patients for clinical consultation, the cost and technology of tele-conferencing facilities still in a state of flux.

However, there is also evident that there are many constraints to conduct controlled clinical trials on telemedicine in contrast to evaluate other medical devices and therapeutic modalities. These constraints are in part due to shortage of time and lack of incentive to include such study along with the implementation of a Telemedicine initiative. The shortage of time for evaluation studies is caused by the rapidly changing technology for Telemedicine technology as the same system often is not used by the same institution for more than a couple of years. The lack of incentive is caused by not having a proper infrastructure dedicated to conduct proper evaluative studies as well as a lack of public funding to support such studies.

This literature search clearly indicates that more work will have to be carried out on quality assurance of telemedicine applications.

[*] Formerly US National Library of Medicine

The expressivity of the virtual patient

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In a conventional consultation, health professional base decisions on information gathered by the use of four senses (touch, sight, sound and smell), clinical experience, the type of patient, and the nature of the disease. In a tele-consultation, health professionals apply much the same general approach to decision-making but limited to using two senses (sight and sound) only. A further limitation is that a virtual patient is observed.

To anybody with experience of telemedicine it is obvious that the sensory qualities of virtual patients, their expressivity, differ to some degree compared to observing them directly (1). Could such differences influence clinical decision-making? Could for example signs of jaundiced skin, neuro-motor dysfunction and mental depression be distorted to such an extent that they are missed at tele-consultations?

At present, there is scanty information about differences in levels of expressivity in actual and virtual clinical constructs and their potential effect on decision-making. However all indications are that erroneous decisions are made (2), which will be addressed more in detail in another presentation in this session (3). This is not surprising as studies so far is what can be carried out at a particular quality of transmission dictated by financial and technical constraints. The minimum quality of transmission required for to arrive at correct clinical decisions has usually not been determined. However such data are needed before tele-consultations can be safely recommended for use within a health-care system and ensuring that health professionals can still apply, and apply at least equally well, their basic clinical tools of interpreting sensory input for clinical decision making when using this new communications technology.

How should such data be collected? In principle in the same way as for any other new technology proposed for use in health care, i.e. by carrying out clinical trials comparing direct and virtual observations in different clinical situations. This is a vast task, which should be undertaken as multi-centre trials. It would be much simplified is it is undertaken initially within hospitals and then "rolled out" to peripheral parts of a health-care system for further trials. In addition to establishing the efficacy of tele-consultations such data would provide the IT industry with much needed specifications for improving their products better to meet proven clinical needs.

[*] Formerly US National Library of Medicine

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The human factors in telemedicine

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Telemedicine is often investigated for its benefits in providing improved access to medical service for those in remote areas or its cost benefit in replacing an existing service. The AIDMAN project also investigates a telemedicine service connecting remote islands in Greece with a main hospital in Athens. The virtual consultation has been developed within the project to bring together patient, doctor and

specialist. Most comparison of telemedicine assumes that like is replaced with like. However, the virtual consultation differs from the normal patient-specialist consultation in having the doctor present with the patient. The doctor may act as advocate for the patient. This changes the dynamic of the consultation and can bring numerous advantages. We have video-recorded a series of teledermatology sessions and analysed them to determine the important changes in the dynamics.

Most obvious is the mediating role of the doctor, providing medical detail, prompting the patient, giving explanation and generally conducting the consultation. This can be reassuring and calming for the patient, so allowing the patient to take best advantage of the consultation. We observe many other factors not present in the conventional consultation. The virtual consultation offers a unique opportunity for education for patient, doctor and consultant. It also allows a patient-specific care plan to be negotiated between the consultant and the responsible doctor. This means the specific knowledge of the doctor about the patient can be used to advantage (e.g. family history, other medical conditions) and the doctor can be certain of the treatment that he will administer. In many cases, this will remove the need for the patient to make a subsequent visit to the G.P.

In our paper, we analyse our recordings in order first to identify the various activities that constitute a virtual consultation. We further make a quantitative analysis of the proportion that these separate activities occupy within the consultation.

Professional mobile IT-tool for physicians

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Background: The need for professional IT-tools for physicians is considered to increase in the future due to a number of factors, e.g.: a) the continuous introduction of new diagnostic and therapeutic strategies, b) the trend of sub-specialization within each speciality creates a potential need for updated guidelines to assist the individual specialist to work in a broader context, c) the progressive requirements of quality assurance standards driven by patients/employers, d) the increased focus on costs.

Method/Results: The medical literature was reviewed with special reference to diagnoses occurring in primary care and emergency clinics, including: dermatology, ear-nose-throat diseases, emergency medicine, gynecology and obstetrics, infectious diseases, internal medicine, ophthalmology, orthopedics, pediatrics, psychiatry, and surgery. Clinically focused documents (n>500) were written and validated by experienced specialists for each of the above mentioned specialities. All documents were imported in an advanced IT-tool, reachable via the Internet and in a synchronized mobile version (Palm OS).

Conclusion: A professional mobile IT-tool providing physicians with easy accessible, updated, and clinically orientated guidelines for more than 500 diagnoses was released in 1Q 2001.

Telepsychiatry

Telepsychiatry in the UK: An overview

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This presentation will trace the development of Telepsychiatry in the UK. It will cover the use of videoconferencing for clinical psychology in Scotland and projects linking primary and secondary care services in the north of England and in London. It will also outline the NHS Plan for Mental Health and how communications technology will be required to implement that. Data will be presented from all projects discussed.

Telehealth in rural and remote mental health – A review of the use of telepsychiatry in education, training, treatment and discharge planning.

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Objective: The outcomes of implementing a comprehensive psychiatric service provision to rural and remote patients in South Australia using the interactive technology of Telemedicine is reviewed.

Method: A review of the use of Telemedicine in Mental Health promotion, education, prevention, case identification, early intervention, treatment, discharge planning and after care for rural psychiatric patients of South Australia. Research studies in treatment outcomes, satisfaction of patients, clinicians and economic evaluation in the use of Telemedicine are reviewed.

Results: The review suggests that Telemedicine has successfully been used to offer a comprehensive psychiatric care to the rural and remote psychiatric patients of South Australia. Telemedicine has been successfully engaged in education and training of rural mental health practitioners, thereby improving the quality of local psychiatric resources. Satisfaction studies have shown high satisfaction with the use of Telemedicine by rural mental health consumers and rural mental health practitioners. Health economics evaluation of a service for acute psychiatric inpatients treated with telemedicine resulted in superiority over the traditional forms of service delivery for rural South Australians. There was Efficacy, Efficiency and Effectiveness with the use of Telemedicine.

Conclusions: Telemedicine can be useful in offering comprehensive mental health care for this group of patients, whose psychiatric needs have traditionally been poorly met. The South Australian experience aims at offering best practice based on best evidence, which would result in best outcomes for rural and remote psychiatric patients.

TELEMEDICAL NESTING: New technology – New treatment paradigm

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Implicit in telemedical writings is the belief that long distance virtual visits must be inferior to face-to-face care. Physicians, conservative by nature, embrace the idea that a health care model with physicians

at the hub is ideal. Computer technology will soon allow for a patient centered health care system with treatments rendered on demand from a virtual medical center. Both patient and physician will have geographic mobility. Such care, with new analytic tools appropriate to a centrifugal system, must be equivalent of office- based care, or even superior. New techniques for delivery will be developed to bring sufficient diagnostic information to the doctor for excellent service to be rendered. Standards of care will not be compromised. Innovative examining tools will be invented by clever biomedical computer engineers. Data lost by virtual contact, of necessity, will be gained elsewhere. Eventually even long distance palpation and other touch sensations will be routine.

The treatment of neurological behavioral illnesses will be the first experiment in computer driven healthcare. Alas, today's therapies permit a high suicide rate as a "natural" consequence of serious illnesses. Telemedical nesting for fragile patients will be a delivery system superior to current delivery models, and promises to significantly lower mortality. Therapies now have a boundary between therapist and patient that often does not benefit the patient. The distance between doctor and patient is inherited from a psychoanalytic model that believed in fostering the understanding the patient's "regression" and dependence while protecting the analyst from annoying intrusions. These ideas are antithetical to the treatment of seriously ill patients.. The internet will allow for a delivery system that nurtures patients as adult birds protect nestlings. Vigilant therapists will hover close by.

Seriously disturbed patients will usually be treated with short frequent videoconferencing visits sometimes many times a day. Thus careful pharmacological monitering will be feasible. With improved observation, nearly all patients will feel safe outside walled hospitals or day hospitals. Ideally, one to three prescribing therapists, who know the patients well, will be available 365 days a year. Today: emails, instant messaging, and chat rooms allow for improved monitering. Without reimbursement for the time spent delivering electronic healthcare, such contact tools will not be embraced by therapists paid for office visits.. Once internet 2 allows for universal videoconferencing, virtual home care will be ubiquitous. Insurances must recognize the long term economy for such delivery.

The internet, developed to its full potential, will revolutionize the treatment of psychiatric disease. Eating disorders will have 24 hour chat rooms with scheduled therapist participation. Truly global videoconferencing will be a boon for flying phobias as a reassuring therapist can fly with the patient. Anxious patients will have round the clock reassuring guidance in a virtual emergency service. PTSD will be prevented via immediate virtual treatment for disasters of all kinds. Nearly any illness will have novel virtual therapies.

The presumption of an inferior system via telemedicine is faulty. Telemedical nesting will be an improvement over present office based delivery for most psychiatric illnesses. Virtual care need offer no apologies.

Outcomes of a pilot tele-education and training programme for rural and remote mental health clinicians in South Australia

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Background: There have been difficulties attracting and retaining professionals in remote and rural areas. Studies have suggested the causes in part to be a perception of isolation, Lack of available professional development incentives, lack of available peer consultation and the need to combat the tyranny of distance to access these. The National Rural Health Strategy set out as a priority commitment for education, training and supporting such activities for remote and rural workforce, delivering education

and training as close as possible to the workplace and maximising potential for use of interactive technology.

Objective: To develop a tertiary consultation service that fulfils the educational and training needs of the rural and remote mental health teams and general practitioners. To employ telemedicine for the delivery of this service thus alleviating the need for travel. To study the outcomes of this pilot programme.

Method: A series of educational and clinical modules were developed in consultation with the rural mental health teams and general practitioners. These modules were tailored to be delivered by telemedicine and to be delivered in 60 minute blocks at times that were mutually suitable. A satisfaction questionnaire was developed and used to evaluate this programme after six months of delivering the service.

Results: 46 rural mental health teams and 20 general practitioners from 9 rural regions in South Australia participated. There was high satisfaction with this pilot programme with both groups of professionals. Both groups found the programme reduced isolation, fulfilled in part their academic needs, useful in peer consultation and helped in their confidence and competence in managing mental illness.

Conclusions: Tele-Education is certainly a tool that can be used to attract and retain professional resources to remote and rural areas. This will help care more effectively for the rural and remote patient. This will reduce ongoing morbidity, dysfunction and there by improve the quality of life and outcomes for this group of patients.

Social support in a wired world – Use of online mental health forums in Norway

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An exploratory study of the use of the four major Norwegian mental health related online discussion forums is presented. The objective was to provide a basis for proposing relevant research questions and issues for public policy attention.

The respondents (N=492), predominantly women (78%) and in the age range of 18-35 years, found forum participation useful for information, and social contact/support. A majority (75%) found it easier to discuss personal problems online than face-to-face, and almost half say they discuss problems online that they do not discuss face-to-face. A majority would not have participated had they not had the option of using a pseudonym. Respondents perceive discussion groups as a supplement rather than a replacement of traditional mental health services. A clear majority wanted professionals to take an active role in these types of forums.

Online interaction can have unique benefits for persons suffering from mental disorders. Professionals will need new knowledge and perceptions of their roles. Public authorities will need to decide their role in influencing the quality of services offered to those who seek help through the Internet.

Health economic evaluation of a tele-mental health service for Australian remote and rural psychiatric patients

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Objective: To evaluate the economics of a telepsychiatry service for remote and rural Australian patients This cost analysis compares the cost of treating psychiatric patients using telemedicine versus treatment without telemedicine. The two groups will hereafter be referred to as the with-telemedicine group and the without-telemedicine group.

Method: The costs associated with the with-telemedicine patients were based on actual resource use as reported in the pilot study. The costs of the without-telemedicine patient group were based on estimated values of resource use. The perspective taken for the costing was predominantly the health care system. It is this category of costs where the most relevant cost differences occurred. The study involved assessing telemedicine based treatment of 28 acute psychiatric inpatients from 15 rural hospitals. The patients were initially interviewed daily using telemedicine. The frequency of teleconsultations lessened as the condition of the patient improved. The patient was interviewed along with a hospital nurse and their family GP where possible. Not all patients could be managed or treated effectively using telemedicine, either due to concern for their safety or in the interest of the other patients at the hospital. This resulted in the transfer of 6 (21.4%) patients to a psychiatric facility in Adelaide (4).

Results:

Cost item	With telemedicine	Without telemedicine
Videoconferencing equipment	$298	$0
Equipment installations	$18	$0
Telephony	$265	$0
Equipment maintenance	$55	$0
Service administration	$202	$0
Total telemedicine service	$837	$0
Inhospital stay	$3,722	$7,207
Transport	$161	$749
Total cost per subject	$4,719	$7,956
Differential cost per subject		$3,237

Conclusion: The results from this costing study show the significant savings possible by treating rural psychiatric inpatients with telemedicine support. This service goes a long way to help address the problem of the shortage of psychiatric support for patients living in rural and remote areas of Australia. This study highlights the cost saving arising from shorter hospital stays which can be attributable to telemedicine use and the substantial transport costs averted. The videoconferencing equipment costs used in this study somewhat overestimate the present prices for videoconferencing equipment. This is due to the overall trend of decreasing prices in computer equipment in general. So the cost of telemedicine use

will continue to fall with additional advancements in technology. It is also likely that service utilisation will rise over time in addition to an expansion of alternative uses for the equipment in other areas. This will lead to lower per service costs through more efficient usage of the telemedicine network. This costing study did not include the out-of-pocket expenses incurred by family members and friends of patients in this study. These costs are primarily concerned with airfares and accommodation when traveling to Adelaide to visit patients during their hospital stay. These costs are greatly reduced for family and friends of patients treated with telemedicine support.

Telepathology

Keynote: **Telepathology – The networking of pathology diagnostic services**

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Telepathology is the practice of pathology at a distance, viewing images on a video monitor rather than directly through a light microscope. There are seven (7) classes of telepathology systems. Human performance studies and diagnostic efficiency data show that hybrid dynamic store-forward telepathology (HDSF telepathology) may be the methology of choice. Options for telecommunications systems include T1, ISDN, and the Internet.

Proven applications of telepathology include: routine surgical pathology; intraoperative frozen section services; teleconsultation; telemicrobiology; telehematology; tele-electron microscopy; and telementoring. Addition applications being evaluated include telecytology, teleimmuno-histochemistry, and the use of telepathology for assessing adequacy of FNAs, proficiency testing, "virtual" tumor boards, and others. Advanced uses of telepathology include third generation applications such as diagnostics and quality assurance for complex molecular pathology laboratory testing.

Telepathology may decrease the need to centralize complex molecular pathology testing. The technology may prove useful for implementing the laboratory component of tailored therapy strategies for the treatment of cancer patients and others.

Human performance studies have shown that telepathology can achieve high levels of diagnostic accuracy.

Telepathology networks have been implemented in 25 countries worldwide.

Digital cytology

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During the last 2 years, all cases having a positive cytological reports have been documented by attached microscopic images (1-10) in the 'Pathology system' (Doculive-Siemens). To date 30,000 images are available in our archive. These images are easily available for comparison with new cases, education and quality control. Digital photographing aids in focusing on diagnostic criteria. We have e-mailed attached digital images for consultations and furthermore used telecytology for evaluation of representativity and diagnostic purposes. Circulating slides prior to workshops are no longer necessary as demonstrated in the recent meeting of the Norwegian Society of Clinical Cytology (available at http://www.norcyt.org). We have used different web-techniques for training in cytology.

Our experience with handling digital microscopic images enables us to use techniques for communication and teaching. The challenge is to train cytologists in handling digital cameras and of images, in order to incorporate this technique for the benefit of communication, education, proficiency testing and quality assurance.

Telepathology in Central and Northern Sweden – A broad and global approach

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Most parts of Sweden are characterized by long distances, low population density and many small or medium-sized hospitals devoid of local surgical pathology services. We have developed telepathology routines based on static and dynamic image transfer (ISDN, LAN and Internet). Four main activities have been infused: (1) "instant" diagnosis based on frozen tissue sections, fine-needle aspiration samples, exfoliative cytology, blood- and bone marrow smears; (2) rounds with an expert panel (e.g. oncologist, gynecologist, surgeon) guiding colleagues at the remote hospitals; (3) teaching sessions on selected or requested topics and (4) consultations for second opinion or diagnostic help on special problem cases by use of a special consultation platform developed by one of us. We also have a central server with case libraries to support education and standardization.

Experiences, including results from validation of frozen-section, cytology and hematology diagnostic work, demonstrated good accuracy rates. Follow-up studies of clinical rounds showed a number of positive effects such as an increased quality of health care, appreciated knowledge-transfer and, paradoxically, reduced costs for the society (tax payers) and patients.

A multifunctional telepathology network in the Uppsala region linked to Norway

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A multifunctional Telepathology network has been built up in the Uppsala region connecting 6 Departments of Pathology and linked to a seventh in Norway (Tromsø). The network is based on a work station, Migra, (Bildanalyssystem AB, Sollentuna , Sweden) and can use either broad band, LAN or ISDN. The *first level* is a *dynamic, binodal or multinodal* video conferencing mode, permitting real time discussion of macro- or microscopic images and sending of high resolution static images in a few seconds. Thus, the technique mimics a conventional twin- or multiple- headed microscope discussion. During the conference the case may be saved to a file and transmitted to other consultants worldwide. The case discussed can also be saved as a file before the consultation and mailed to the participants for preview. During the dynamic discussion both previously sent and new real time transmitted images cane be utilized. The *second level* is the *mailbox function* permitting sending a case to several participants in

advance and the either wait for written comments or initiating a real time conference as above. The *third level* is *a server designed to provide an image data bank*. Its design allows saving of the cases discussed during consultation excercises or during teaching seminars with multiple participants. Organ based image banks are also planned for quality assessment purposes including consensus for classification and grading systems This functionality is expected to become a powerful continuing educational tool.

PatNet - THE NORWEGIAN PATHOLOGY NETWORK - www.patologi.net

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PatNet is a closed interactive Intranet for employees at the departments of surgical pathology in Norway.

To develop PatNet a project was established in 1998, and organised in a project group, an editorial office and a steering committee. The idea was that a dedicated professional network based on Internet technology could be useful. A questionnaire was forwarded to residents and consultants in pathology. The great majority of those who answered were in favour of such a network. They thought continuing medical education, case archive and consultation facilities would be the most interesting activities. Consequently, the goal became «to secure and improve the quality of pathological anatomical services by connecting pathologists and other employees at the departments of surgical pathology together in an Intranet». The goal was then divided into different operative main tasks. PatNet should have an interactive bulletin board, a case archive and consultation service, and a conference solution.

The project was founded by the Norwegian Industrial and Regional Development Fund. PatNet is technically a tailor-made adaptation of Intranett Sentral 2000 (www.intrasys.no). PatNet was launched in October 1999. The members can instantly publish news on the home page. They can publish information about new courses, projects they participate in or papers they have published. This information is organised in separate chapters. Discussion groups are available. Further, PatNet has chapters with procedures, quality assurance and also a member archive. A case archive and case consultation facilities are one of the most important content in PatNet. Finally, PatNet has public pages in Norwegian and English.

The project was terminated 30. November 2000. DNP has now taken the professional responsibility of PatNet, while the National Centre of Telemedicine has the technical responsibility. Ownership and organisation will discussed in the further.

A important success constraint today is that employees at only a minority of the18 departments of pathology have access to the Internet from their work-desk. The majority of the departments do however have a stand-alone PC connected to Internet. The success of PatNet will however mainly depend on the ability of the editorial office to fill it with content and to update the content.

Finally, a network such as PatNet emphasises an increasingly important challenge that professionals have to take seriously today. This is the necessity of professional collaboration, of identifying necessary knowledge, of sharing knowledge and of standardisation.

Laboratory medicine at a distance – A new and extended approach in Northern Sweden

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Umeå University Hospital (800 beds) is the most northern located Swedish regional hospital providing hospitals in four neighbouring county councils with highly specialised support and health care. It is the primary referral site for all hospitals and smaller health-care units within a catchment area corresponding to the size of Great Britain. In our organisation all laboratories now merge into a mutual division - Centre for Laboratory Medicine (CLM) which includes anatomical pathology, cytology and the clinical branches of chemistry, genetics, immunology, microbiology and pharmacology. In addition of giving rapid microscopical diagnoses (frozen section, cytology, hematology) by a validated PC-based telepathology system, we are now expanding the field of distant diagnostic service to the other specialist areas covered in our division i.e. a service called Laboratory Medicine at a Distance (LMD). Communication is performed via LAN but ISDN connection is also available. A central server with databases facilitates handling of e.g. images from histological sections, photos of patients with genetic external deformities or results from PCR analyses. Developing systems for LMD adds to our ongoing ambition to provide equal health care in a sparsely populated region.

Effective implementation of a telemedicine application – From idea to routine service

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The lack of an expert in anatomical nephropathology at Umeå University Hospital has been solved by sending biopsies to department of pathology, Karolinska Hospital, Stockholm (650 km distance). Two or three times/year, the expert pathologist from Stockholm has travelled to Umeå and brought the slides from patient cases for a full day clinical round. The idea to have regular and more frequent rounds by use of telemedicine equipment (videoconference) was presented. A short-term (5 months) pilot project was designed with careful and immediate follow-up studies. If the results showed positive effects on health care quality and the costs were kept within "reasonable" limits, an agreement should be signed between the two university hospitals for a continuation of this service.

The results showed a positive impact on quality of health care and staff competence at the same time as money was saved. In addition, the rounds became popular among medical students and physicians under specialist training which was a positive "side effect".

An agreement was made and without delay the project turned into a routine service.

Organisational and juridical aspects

The UK Telemedicine Information Service

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Telemedicine is an important, and increasingly utilised, mode of healthcare delivery. The UK government is keen to disseminate information about telemedicine practice and to build an online community. The British Library and the University of Portsmouth have been commissioned to create the Telemedicine Information Service (TIS) – the main part of which is a website supported by an email distribution list. As of February 2001, the database contains 1267 entries covering telemedicine projects, companies and other organisations providing telemedicine goods and services, people working in telemedicine, publications on the topic, and equipment used by telemedicine projects. Since its launch, approximately 36,000 visits have been made to the website, and the related mailing list has 296 subscribers.

TIS is aimed at clinicians, managers, information technology professionals and researchers, but it is expected that it will also be of interest and relevance to patients and the public. One of the aims is to monitor in demographic terms who actually is actually reading it. It is intended that the service be continuously developing and that it would be pro-active in seeking out new information, ensuring the validity of existing information, and in providing facilities for users.

Disneyland and the future of healthcare

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The development of the modern healthcare organisations at the end of the 19th century was strongly influenced by a military paradigm. An organisational hierarchy was created with the patient at the bottom and the medical profession at the top. An information monopoly was established.

The situation gradually changed during the end of the 20th century. The introduction of new information media such as radio, TV and Internet has contributed to a diffusion of medical knowledge and information to new groups outside the medical profession. In combination with a more educated population, this development has definitely broken the medical information monopoly.

A modern healthcare organisation must adapt to this new situation. Demanding and well-informed patients will set new standards for healthcare. An organisation that continues to look at the patient as an object will fail.

The entertainment strategy of Disneyland may be a winning concept for the healthcare in the near future. The core of that strategy is the belief that it is possible to entertain all visitors regardless of age, religion, education or wealth. The bottom line is the satisfaction of the individual, a satisfaction that will guarantee a new visit.

Branding may be an important part of a healthcare concept that is based on maximal positive experience for the individual patient. All aspects of Internet will be used to create "stickiness" to the organisation. Intelligent information management will create individual solutions based on individual

demands. 24 hours availability for questions and second opinion will be established. Sophisticated advertising via the Internet will be an important part of this 21st century healthcare concept.

The law and politics of telemedicine in rural America

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Telemedicine and cybermedicine (the use of the Internet to provide medical services) offer myriad opportunities to dramatically improve the access of rural populations to health services. However, legislators and regulators at the national and local level are faced with balancing the need for such improvements with the need to protect the public from unqualified and unscrupulous practitioners. Furthermore, prior to entering a rural market, potential telemedicine service providers must be confident that rural residents will accept and adopt these new technological means through which to receive care. This presentation will describe a community-oriented collaborative approach to rural telemedicine system development. It will also dissect current and proposed approaches to regulating telemedicine and cybermedicine, and their impact on improving rural care.

The legal aspects of telemedicine: The developing drama

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Converging technologies in the areas of telecommunications, computer hardware and medical peripherals have made possible in recent years the development of new tools for collaboration that extend the reach of healthcare professionals around the world. These include the benefits realized through telehealth care delivery to developing and under-developed nations.

Although telemedicine holds out tremendous advantages, the development of a telemedicine program is fraught with pitfalls that may easily negate the advantages of such a system. One of the most critical areas often overlooked, is the legal aspect of such application development. During this presentation, the speaker will discuss some of these issues as they have occurred in Canada, as well as new concerns that are developing within the industry.

Alternative futures of worldwide healthcare systems: The impact of globalization

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This presentation will review alternate scenarios for the evolution of healthcare systems worldwide. It will begin with the four existing healthcare system archetypes: 1. Socialized medicine as is Britain and Sweden; 2. Socialized insurance as in Australia, Canada and France; 3. Mandatory insurance as in Germany, Brazil, Japan, Malaysia and Singapore and Voluntary insurance as in the United States and South Africa. All of these systems will undergo great change in the next 10 years. Some drivers of change will vary in developed and developing countries but the driving force of globalization will impact both. Traditional boundaries are rapidly disappearing and boundaries between geopolitics, culture, technology, finance, national security and ecology. This is being accelerated by the defining technologies

of globalization including digitization, satellite communications and the Internet. The worldwide healthcare market place will not be exempt for the democratization of technology, finance and information, which are transforming all businesses. The Internet specifically will break the information monopoly of the healthcare system and the medical profession.

The system of an Electronic Patient Record (EPR) – A logical and functional design

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The contribution shall show, that with an available infrastructure of tools for the obligatory "movement" in an electronic world (Chip cards with public-key-infrastructure for patients and physicians), the concept of an electronic patient record will be *only* a question of an intelligent information management. The logical and functional design describes the involved persons, the procedures, the used tools and the data content in teamwork of a basic model.

1. Definition of an "electronic patient record" how it will be seen in the design:
   - distributed data storage at the physician under his responsibility
   - multimedia data
   - logical data merging or view at the electronic patient record
   - automated processes

2. Definition of the general conditions for the design:
   - voluntariness of the participation on the telemedicine processes for patient and physician
   - patients right of self-determination of his social and medical data
   - best conditions for data protection and data security
   - acceptance for the new technology - the main challenge

3. Differentiation and Focus:
   In general the medical communication with telematic processes will increase. Usually it will be an *addressed* direct communication between two physicians. In such a communication the legitimation for the transmission of the patient data is clarified in the business case. These communication processes are not object of the system-design of an electronic patient record. The focus is the system of an electronic patient record. This system has his own quality conditioned on the automated processes, which shows the real explosiveness. It will be described a basic model to create a system of an electronic patient record on which other services can be put on. These services are not object of the basic model in this presentation.

4. Description of three relevant processes:
   Get the *information about treatment places and patient documents into the system EPR:* Who decides, if the patient, the physician and the individual documents take part in an EPR system? And how do we can that the automated procedures will be shaped according to this decisions? Storing individual documents or treatment places? ...
   Legitimation of the physician through the patient to make an inquiry for patient documents in the system: How can we ensure that a legitimation of a physician can be used in automated processes? How can a patient restrict his legitimation against his physician? ...
   The inquiry processes for patient documents in the system and the response processes: How does it work in automated processes?

5. An example for stored information on a patient chipcard:

History of treatment and documentation on a patient chipcard stored with pointers and additional informations.

6. Discussing the thesis:

"With an available public-key- infrastructure, the concept of an electronic patient record will be *only* a question of an intelligent information management"

Web based healthcare and education

Evaluation of web based healthcare and education

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The value of web based or tele activities in healthcare and education is based on the quality of content and design as well as the transmission and technique. The interactivity, ie. two-way communication, on the web can be classified as synchronous or asynchronous communication between user/patient/student and instructor/consultant/teacher. Much of the web based activities is so far based on one-way communication when the user reads texts or look at images. The user must be able to rely on the web resources and the communication. The results of some studies will be presented:

- The identification and application of quality criteria for evaluation of web based resources in healthcare.
- The integration of the web in the curriculum in a course for medical undergraduates.
- The experiences of web-consultation for the patient and the physician.

In conclusion, the success factors for web based healthcare and education seemed to be an optimal combination of organisation, pedagogy and media with emphasis on user friendly interface, easy access to quality stamped data and feed back.

Distant learning via videoconferencing

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The development of net-based education and training is highly prioritised within the Norwegian Centre for Telemedicine (NST). A priority area, 'Net-based Education', has been established aiming to ensure the availability of education and training for all involved in the health sector, including health workers, patients and their relatives. Currently, there are three full-time workers employed to develop this service, one area manager and two educational coordinators.

Since the activity commenced in 1994, 'Net-based Education' has gained considerable expertise concerning education via videoconferencing. The training, organisation and co-ordination required for running the videoconference activity have been thoroughly tested and formalised based on feedback from current users throughout this period of practice.

Currently, we have active users in all groups of health personnel. All over Norway the hospital departments use videoconferencing on a regular basis to conduct remote medical consultations and for

training and meetings with colleagues. For several years, distance teaching to the Archangel County in Northwest Russia has been conducted regularly. Twice a year, the Norwegian Centre for Telemedicine issues 'The Norwegian Catalogue for Videoconferencing'. The catalogue advertises distant teaching educational opportunities for all branches of the health sector. It is available both in paper copy and on the Internet at the address www.telemed.no. NST also issues another catalogue containing names, addresses, telephone numbers and fax numbers for all health institutions in Norway conducting videoconferencing. A strong network of cooperating partners in Norway has been established over the years. This network is beneficial for all participants who can seek advice and exchange experience with relevant partners. However, the Norwegian Centre for Telemedicine is the only organisation in the Norwegian healthcare system aiming to gather all distance teaching into one system. We participate in a project called "Nordunet 2" with six other Scandinavian countries. Nordunet is focused on network utilization and network-based applications within four key areas: Distance education and lifelong learning, telemedicine, digital libraries and infraservices.One of the purposes of the project is to find methods of collaboration concerning distance teaching across the borders.

A web-based solution to distribute educational video-on-demand accessible to people with disabilities

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New technologies develop continuously to simplify people's life. But unfortunately they often progress taking in small consideration the needs of a special kind of users: people with disabilities.

In particular the new multimedia technologies gives us the possibility to create new tools and services overcoming both personal (hardness of hearing, partially or totally blindness, etc…) and technological (use of special devices, network with limited bandwidth, not always reliable connections, not up-to-date client software, etc…) drawbacks that could affect the use of them by this people. The Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) already has defined the guidelines for an accessible approach to the utilization of web technologies.

Our work has started from these guidelines and from the above considerations and has been finalized to create a service for the distribution through the Web of educational multimedia contents fully accessible to people with disabilities. This kind of information spreading can be very useful both for the personal assistants and, largely, for the people with disabilities themselves and for their families. A servlet engine permits to authenticate users and to distribute the multimedia contents, furnished by the SIVA (an organization for assistance and information of disabled people), adapting the presentation to their needs: for example using subtitles for not hearing people or audio description of images for not seeing people. This engine assemblate the media used to present the content using both HTML and SMIL languages. The structured documents are then delivered to the user by a web server and a media server.

Results are now visible on the web (http://www.cefriel.it/siva) and we intend them to be the starting point for the creation of more educational and non-educational services accessible to people with disabilities.

XML-based language for teleeducation

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Implementation of Internet resources for distance learning is becoming more popular than classical forms, due to easy access to the Internet, potential ability for attractive knowledge presentation and ease to gather interested students. To fulfill requirements for creating professional education materials for students, it is profitable support a lecturer with a set of tools for making a new generation course of lectures with extensive use of multimedia facilities. These tools would also be used for self learning.

We have developed a MUltimedia Lecture description Language (MULL) for implementation of a teleeducation system consisting of Creator and Browser tools. The language is based on XML. Creator is a MULL generator while Browser is a MULL interpreter. The system is written in Java 1.1.

The MULL language consists of several elements, like objects, messages and events. There are six kinds of objects: audio files, video movies, text blocks, pictures, answer blocks, timers. These objects are independent of each other. Each of them has 'ports' to communicate with other objects. Communication is based on the message passing model. The message is sent only when an event is encountered. This event activates an appropriate 'port' which sends the message. The messages are responsible for defining objects actions. For example, in the 5-th second of a movie another, i.e. the second movie can be started or a required picture can appear. In the above example the event is the 5-th second of the movie, while the messages are: start the second movie and the picture presentation.

The language makes possible among other: displaying text, pictures during playing audio/video file, building simple multiple-choice tests, synchronous starting, stopping, playing audio/video files, synchronous displaying pictures, creating simple animations, building the course which depends on user preferences, actions, state of the knowledge, etc. It is possible to create a file with a multimedia course in the MULL language using any text editor, but if one is not familiar with the MULL syntax or prefers some additional assistance then Creator would be a choice. It is useful for defining outward appearance of the course, for example layout presentation, element positions and reproduction and interactions between individual elements. Creator is a Java application because it needs to store the file with the course on a local disk. To view the course Browser (being a Java applet) is executed by a WWW browser. In Java 1.1 there are no standard classes for video movies or audio files reproduction and for XML files parsing. Because Browser and Creator need these possibilities, we applied additional Java classes from Java Media Framework for reproduction of multimedia files and from Xerces for XML parsing. Xerces contains two interfaces: SAX (Simple API for XML) and DOM (Document Object Model) for access to parsed data. Access to data in SAX is possible only during parsing and in DOM after parsing. Due to the required functionality of the MULL system, consisting in (optional) moving back to previous slides of the presentation, the DOM interface is used.

In the future, courses for medical students will be prepared with MULLtools. The data will be retrieved from virtual database created within the framework of the PARMED project.

PEBBLES – Providing Education By Bringing Learning Environments to Students

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Telbotics has developed a telepresence robotic device useful in connecting hospitalized children from their sick beds or from their home to their school classrooms. For Telbotics telepresence is achieved

through the combination of robotic and videoconferencing technologies that creates interaction between physically separated parties accomplished through the amalgamation of current videoconferencing technology with robotic design elements. The development work resulted from an ongoing collaborative research partnership by Telbotics with University of Toronto and Ryerson Polytechnic University. The technology allows chronically ill and disabled children full communication and unrestricted participation in their "home" classroom events. PEBBLES technology by connecting children to their social network has the potential to:

- enable children to uninterrupted educational processes,
- learn in an environment that closely resembles a "normal" classroom setting,
- social integration,
- decrease levels of anxiety during hospitalization, and
- promote increased healing rates, shorter hospital stays and recovery periods at home.

PEBBLES has had three years of pilot hospital-based trials at Toronto's Hospital for Sick Children, and local schools. To date PEBBLES has had a broad-based acceptance in the medical and educational communities, as well as the telecommunications industry thanks to its significant advancement in electronically mediated learning technology.

PEBBLES is created for the purpose of connecting hospitalized and medically homebound children to their regular "home school" classroom. Its purpose is to electronically mediate learning under difficult and unavoidable living conditions.

How it works: PEBBLES accomplishes its goals through highly developed, yet simply operated, technology which provides nearly seamless video conferencing. By using two robotic stations, with the primary unit controlled by the child, it allows the child to interact with the "home" classroom activities, communicating directly with the teacher, and speak in real-time with friends and classmates, throughout the school day. The child's control mechanism, based on the technology of Nintendo, is usually familiar to the child user.

The need: PEBBLES is currently ready for an extensive demonstration and dissemination project which will bring it to national attention and full use within a reasonable time period. The availability of PEBBLES is critical to children everywhere; children whose medical needs prevent them from attending school and from maintaining healthy academic and social connections.

The partnerships: An element critical to the successful use of PEBBLES is the creation of partnerships between hospitals and participating schools. This project will organize these partnerships and will create the appropriate entry pathways, operational protocols, teacher and medical personnel training workshops and technical use training.

Who will benefit? Clearly the greatest benefactors of this technology are the children facing long-term hospitalization and those who are homebound with long-term medical disabilities. In addition to the obvious gain of experience in learning, educational and social opportunities inherent in attending school, there is an even more dynamic positive outcome for PEBBLES users. The medical benefits, in terms of healing rates and lowered anxiety among child patients, may be shown as shorter hospital stays and as more rapid return to normal life and school attendance.

Teleradiology and -cardiology

Breast imaging and the Internet

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World Wide Web, as in many other areas of medicine, will have an indisputable impact on the area of breast imaging [1,2,3]. It is a challenge for all radiologists to learn how to use all Internet applications available now and in the future. Information management will improve due to the use of logistic internet-based systems that integrates PACS with other Hospital Information Systems (HIS) [4]. Internet allows networking with colleagues in other hospital by the use of interactive applications such as shared-screen software, e-groups and ICQ. Intelligent search-engines as well as dedicated breast imaging portals are already available. These applications will be able to present relevant information to the right person at the right time and to the right place. The Internet will play an important role in both breast-imaging education and research [5].

The possibility for patients to access qualified information from Internet will change the doctor-patient relation due to increased transparency. It will be easy for patients to compare different breast imaging departments. Patient demands for more interactive services are already changing the breast imaging organisations.

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Still image teleconsulting for interventional cardiology in Georgia

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More than 800 coronary arteriography procedures have been performed at Emergency Cardiology Center (ECC), Tbilisi, since 1998, when the CathLab with GE ADVENTX LCV+ angiography machine started. Since 1999 more than 120 coronary intervention procedures (PTCA, stenting) were successfully performed without surgical backup. NILC cooperates with ECC to gather second opinion from qualified western specialists - ECC's angiography files are scanned (HP Scanjet 5P or Olympus D-620L digital camera) and sent as e-mail attachments to ECC's foreign partners - Prof. H. Roskamm (Bad Krozingen Heart Center, BKHC, Germany) or to Dr. I. Dindar (Kosuyolu Heart and Research Hospital, KHRH, Istanbul, Turkey). During 1999-2000 angiograms of 62 patients' (4-12 images per patient) have been sent for teleconsultation. In 46 patients the diagnosis was confirmed and the optimal intervention (PTCA, stenting) was suggested to be performed at the ECC; 14 patients were advised to apply to BKHZ or KHRH for more serious intervention – CABG operation. Still-image teleconsultancy in coronarography assessment is valid and cost-effective method for newly emerged interventional cardiology centers. In

cases, when the bypass operation is thought to be performed in a western clinic, telemedicine usage makes referral process more time- and cost-effective.

Implementation of a web-based cardiac rehabilitation program to cardiac patients in regional, rural and remote areas of Canada

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Heart disease has a high prevalence in all areas of North American, and cardiac rehabilitation is an integral part of the reduction of mortality and morbidity in patients with heart disease. Cardiac patients living in non-urban areas of Canada have reduced access to hospital and community-based cardiac rehabilitation programs. New communication technology offers potential new routes to access to cardiac rehabilitation services. Providence Health Center is the heart center for the province of BC. We collaborated with the University of Wisconsin to offer a web-based patient education and support program (CHESS) to rural patients with heart disease. Enrolled patients (n=118) were randomized to receive access to the program or usual internet access. The program was implemented using existing infrastructure (patients' own computers; community internet providers; POTS access to the internet). Patient utilization of different parts of the program was tracked through the server use: highest use was measured in health tracking software and interactive elements of the program. Difficulties with infrastructure were identified and described, and their impact on patient use of the program measured; and patients completed questionnaires at three and six months to describe their health-seeking behaviours, quality of life, self efficacy, and depression. Patients expressed a need for increased personal contact; increased individualized support for lifestyle change; and solid interest in continuing in a web-based outreach program.

Telecardiology: A diagnostic tool for reduction of unnecessary hospital admissions for suspected cardiac events

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Aim: To define the role of telecardiology in reducing unnecessary hospital admissions of patients with suspect life-threatening cardiac event (CE), evaluated by general practitioners (GP).

Methods: From June 13 to July 12, 2000, 456 consecutive patients (mean age 64.8±18.8 years) complaining of typical (10%) or atypical (42%) chest pain, palpitations (19%), dyspnoea (19%) or syncope (10%) were enrolled. Before teleconsultation, GP had to express his own opinion (based on clinical evaluation only) about the presence of a CE. Data were compared (McNemar test) with those obtained by cardiologist's evaluation, after ECG transmission.

Results: The GP identified a CE in 134/456 patients, whereas the cardiologist diagnosed a CE in 106/456 patients. Concordance of diagnosis was reached in 316/456 patients (p=0.022). In 84/134 patients, judged having CE by GP, telecardiology avoid the hospitalization; on the other hand telecardiology identified a CE in 56/322 patients judged not having CE by GP.

Conclusion: Telecardiology is a useful tool to reduce unnecessary hospitalizations in patients with suspect life-threatening CE.

Prehospital thromolysis and decision support in emergency ambulances in Uppsala – Experiences using mobile telematics

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Background: In many countries, like Sweden, paramedics or nurses constitute the main part of the prehospital personnel. In systems were skills usually performed by doctors are performed by personal with less formal medical training, there is a need for guidelines and triage in the handling of medical emergencies. Personnel working in the prehospital environment also need backup and help with diagnosis (i.e. telemedical support) in certain cases, like in the diagnosis and trombolytical treatment of myocardial infarction. This calls for an improved communication between ambulances and receiving hospitals. By tradition, ambulance records are often hand written after the assignment and are often based on recollection of input data. The aim of our project was to integrate in the ambulance organisation an information management system for communication, documentation, triage and transmission of medical information.

Material: The ambulance service in Uppsala County covers a population of 290 000 inhabitants and an area of 6622 square kilometres. The ambulance crews have mixed medical training, 12% are nurses and the rest have training as paramedics. There is a total of 29-30 000 missions on a yearly basis for the service, 7500-8000 of these are alerted as high priority (red alert).

The telemedicine and data-communication system Mobimed™ (Ortivus AB, Sweden) was used in this setting. The system is intended for use in ambulance and prehospital care, and is designed for use both in acute emergency care situations and during non-acute journeys. Therefore vital signs monitoring and data (ECG etc) as well as various forms, two-way messaging, and trend-data are integrated in the system. In this setting the packet switched mobile data-network Mobitex (Ericsson) is used.

Results: An information management system was implemented were in most cases, data input is performed during the care of the patient. The information is collected and stored together with data automatically received from the dispatch centre. The latter information, including the criteria for dispatching and advice given to the patient, are wirelessly transferred to the ambulance and integrated with the record in the ambulance. Medical data as records and ECG´s are wirelessly transferred from the ambulance to the receiving medical facility and used to assist the ambulance crew in performing prehospital thrombolysis and prepare the receiving facility for the arrival of the patient. All transferred data is finally also collected in a database for statistics and follow-up.

Conclusions: It is possible to integrate a complex, interactive information management and telemedicine system in moving ambulances. There is a clear potential for further development of data forms for decision support and triage in different medical emergencies. The uses of telemedicine for handling AMI patients significantly reduces the call to needle time.

Home care and remote monitoring system allowing expert advice to be generated ex situ

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Overview of a low cost, easy to use and simply understandable interactive home monitoring arrangement enabling the patients to understand how to regulate themselves. The proposed system will

give the patient a sense of control and allow medical personnel to stay ahead of acute critical conditions. Attention will be paid on the cardiovascular use of the system with attention to remote ECG registration with a handheld device.

Guidelines how to utilize the system for providing education about the disease and risk factors with the aim to support lifestyle modification strategies will be analysed. Evaluation results of the system will be presented as well as the proposals how to enable transformation of episode driven health services into a relationship-based continuum of care.

Tele homecare

TelemediCare –Homebased hospitalisation

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New ways of giving care have been investigated in many settings for many years, and some of the ideas have shown promising results. One of the success stories is the SABH project at Astrid Lindgren Children's Hospital that makes it possible to care for seriously ill children at home. The project has up to now proven the concept, and shown that it gives a better quality of life for sick children and their families. But one part is still missing – the concept has been proven without the telemedicine solutions that it deserves. In the RTD project telemediCare, telemedicine solutions specialized for care of hospitalized patients at home is developed. Wireless sensors connected to a local patient computer with evaluation algorithms and telecommunication to a control center gives the opportunity to round a clock monitoring at home. Apart from the monitoring facilities the system also support planning activities for medication, monitoring, consultation etc. and communication facilities like videoconferencing, email, alarm triggering and contact request. The first prototype will be finished in April 2001, and will be tested at the Karolinska Hospital.

The hospital without walls – A home telecare system incorporating wireless monitoring

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For some groups of patients, home telecare may require more continuous monitoring than that provided by intermittent measurements or videoconference links. To minimise disruption of a normal lifestyle normally associated with continuous monitoring, we have developed an ultra-low power wireless and sensing system which may be installed in the home, permitting remote clinicians access to a patient's vital signs. The system is built around a two-way, 2.4 GHz radio system including miniature patient-worn units. A PC and small base station in the home collect and upload information to a monitoring centre at regular intervals, or in response to defined events. The system is designed to be installed in a home for periods of monitoring as a replacement for more expensive institutional care. The initial clinical application is a group of elderly patients who have presented following a number of idiopathic falls. In order to both detect a fall and to determine its cause (which may be cardiovascular), the wearable radio

system is equipped with accelerometers and equipment for measuring heart rate. A web-based distributed information system for caregivers incorporates automatic recognition of events or trends requiring intervention. The system is currently undergoing preliminary clinical trials.

Tele homecare service system – A challenge for family doctors' practices

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Telemedicine presents profound opportunities and challenges to general practice. In the primary care settings it offers an enhanced community-based care without the need for the physical presence of the primary care team members (especially in rural areas). The increasing tendency to discharge chronic patients from hospital and the growing expectations of improved quality of life for elderly and disabled people at home are another motivating factors for the development of a home telecare management system. The system allows to perform remote monitoring of vital signals, biochemical parameters and other data via the public telephone network as well as to manage different emergency situations arising at home environment.

In Poland the development of tele homecare service system is at an early stage. There are a few independent systems of cardiologic survey (i.e. transtelephonic ECG) that some family physicians are involved in. There is also the regional project of developing of telemedicine service system for family doctors` practices in the south-west of Poland. The aim of the project is to implement a primary care teleconsulting system between academic family medicine centre and selected family doctors` practices.

Mobile medical telemonitoring system

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Ageing of population and huge growth of health expenses requires new models for health care policy, which are to keep elderly and ill people at home as long as possible or to leave hospital at the earliest and to limit convalescence at a maximum. However, to allow people to stay at home or to go to work earlier without putting them in danger requires highly reliable security systems based on sounding and continuous evaluation of the medical status of people.

CSEM has worked out a new system, which corresponds to a coherent set of interacting devices meeting these requirements, while preserving mobility and independence, and bringing optimum assistance to medical support.

It is composed of various miniaturized modules spread over patient's body allowing to measure parameters such as activity (and in particular, to identify falls, which are one of the most injurious risk for old people alone at home), pulse/electrocardiogram, oxymetry, temperature, etc. Extensions towards other categories of patients such as diabetics, is under study. These modules are linked by a Wireless Personal Area Network to base stations able to achieve data fusion and pre-diagnosis for alarm generation based on a multi-parameters analysis, and to establish a connection with an arbitrary set of intervening people such as physicians, nurses or medico-social centers for remote auscultation and intervention (the system comprising also a remote controlled medication dispenser). Two base stations are available in a same time: a home base station linked to the cable public phone network, and a body worn gateway allowing to connect people to the GSM/GPRS mobile network, when they are living their apartment. The portable base station allows also localizing people for rapid interventions. The system is able to manage

communications in such a way that the switching between cable and mobile networks is made seamlessly. Specific tools and strategies are proposed to offer the required quality of service, autonomy and user friendliness.

Telemedicine and home care – A SWOT-analyses

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In the county of Västerbotten, North Health Care Region of Sweden a joint venture started between the municipality of Umeå, the county council of Västerbotten, the Umeå University, the telecom company Telia AB and a provider of technical solutions and equipment Biosys/Ortivus AB. The aim was to develop a system prototype to proof the concept in home care and to evaluate the efficiency of the system and the consequences for providers and users. Tools were developed to ensure information regarding each encounter on line and the immediate experience of users (five questions) and providers (eight questions). In addition, interviews before and after with providers and users were done with 6 to 8 weeks intervals using the SWOT-technique, i.e. the strength, the weaknesses, the opportunities the threats of the system. Findings from seven users and two providers will be presented.

Realization of personal telemedicine in the interface point of emergency services and preventive care

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SHL provides personal telemedicine services in several fields of care, both acute emergency ones as well as preventive programs.

In the acute aspect, the company's primary service is the cardiac emergency response system. Subscribers of the service are able to contact a dedicated medical call center 24 hours a day via any regular or cellular phone while also transmiting a complete 12 lead electrocardiogram simultaniusely. By evaluating subscriber's subjective description of symptoms, computerized medical record and current ECG transmitted data Vs. previous ECG transmissions, the nurse or physincian may diagnose the situation, provide immediate guidance and if necessary, contact and dispatch an ambulance.

In the disaese management / preventive care areana, SHL's provides sevral services. An example for such type of services cab be demonstrated by the CHF telemedicine disease management program. Member of the CHF program, use a system that collects automatically and noninvasivly relevant personal data that includes weight, blood pressure, oxygen saturation and pulse rate and stores it in the subscriber's personal medical record. When data deviates from the regular values, the system prompts the monitor center staff to immediately contact the subscriber and provide care (such as adjustments of medications). SHL experience with the CHF monitoring program validate that it can dramatically reduce hospitalizations and consequently healthcare costs.

Administration and economics

Economic aspects of telemedicine: Some prospective views

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Telemedicine has been tried in various parts of the world for more than 40 years. Telemedicine is still in its infancy, but its development is very rapid. There are still several strong barriers against telemedicine: legal, technical and political. Unrealistic expectations from enthusiasts of what can be achieved in the short run and scepticism among third party payers who have been reluctant to finance telemedicine have contributed to this situation. Multiple uses and joint costs, constantly changing technologies, lack of appropriate study design to manage the frequently inadequate sample sizes and possible expansion of indications for use are example of difficulties when evaluating telemedicine. The cost-effectiveness of telemedicine is rather uncommon in the evaluations but has increased during the latest years. It is also important to distinguish between cost-effectiveness for whom: society, third-party payers, health providers or patients? It is rather common that the economic benefits of telemedicine favour the patient rather than the health-care provider. Therefore it is important to take a societal approach in the evaluation process. The paper will be based on a critical review of the literature and end up with some suggestions how to overcome the still existing barriers towards increased use of telemedicine.

Information technology support in health care and social work – An interdisciplinary course

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The early phase of implementation of telemedicine projects often heavily rests upon enthusiasts. However, the transfer of a telemedicine project into something useful in routine needs involvement of a lot more skilled people working in the medical field. In Västerbotten county several distance consultation projects linking all levels of health care service; home care, primary health care and hospital clinics, have been successfully established. In order to attract and engage people in the telemedicine work on a broader basis the University of Umeå has developed and started a 10 p academic course in "Information Technology Support in Health Care and Social Work". The timetable was composed as an interdisciplinary joint project between the Faculties of Medicine and Odontology, Science and Technology, and Social Sciences. Sixty students, mainly nurses, applied for participation in the course and 35 were accepted. The course, comprising five 3-day periods and an elective task, is supposed to create the basis for new working methods and integration of information technology in the participant´s own working condition.

Information infrastructure for health care

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Studies of society's infrastructural technologies, in particular information infrastructures, may provide valuable insight also for design and development of telemedicine networks and services. From this perspective the emphasis would be on a long-term development perspective, a holistic approach (technical and non-technical issues), and a broad, cross-organisational view.

Some of the lessons learned are summarised and the implications for telemedicine sketched. This includes:
- How do networks emerge, through rational design or evolutionary growth?
- Heterogeneous networks with both social and technical elements. The importance of the installed base (previously existing technology, institutionalised working patterns etc.).
- The virtues and problems of standardisation. The tension between universal solutions (standards) and local problems (demand for flexibility).
- Possible strategies for influence and intervention in networks, where no single actor is in control. Exploiting the network dynamics and capitalising on network externalities.

Substitution of doctors by nurses in telemedicine

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The professions in health care have both complementary profiles of competence and some common knowledge. The question of who should do what has actuality. A general principle is that work tasks should be performed by the profession able to perform them at lowest costs without reduced quality. In substitution experiments one profession substitutes another in the work with tasks. In telemedicine physicians may be found on both sides of the electronic network. This implies relatively high costs. To investigate substitution in telemedicine qualitative interviews were performed of personnel involved in telemedicine. The question asked was: 'Could nurses substitute doctors'.

Methods: The present paper is a part of a larger study and material and methods have been described previously [1]. The sample was obtained by contacting a local hospital where telemedical work was being done. The personnel involved in telemedical work gave the details of persons and organizations with whom they had a telemedical co-operation and about others working with telemedicine. These people were then contacted. This process was continued until the present sample had been obtained. The contacted persons were asked to participate in qualitative interviews. Each of the interviewees co-operated telemedically with at least one of the others in the sample. The data were collected in the period from September 1998 to April 1999. The interviews were tape-recorded and then transcribed.

Results: Two of the 32 contacted persons refused being interviewed owing to lack of time giving a response rate of 94%. The 30 respondents worked for 13 organizations (seven hospitals, four municipalities, one county- owned health centre and one private general practice) all found in the five northernmost of Norway's 19 counties. The respondent's distribution on the four types of telemedical work was:
(1) 12 worked in psychiatry - three psychiatrists, one general practitioner (GP), three psychologists, four psychiatric nurses and one assistant nurse with training in psychiatry;
(2) six worked in dermatology - three dermatologists, three GPs;

(3) 10 worked in the frozen-section pathology service - four pathologists, three surgeons and three laboratory technicians;
(4) two worked in otolaryngology - one otolaryngologist, one GP.

'Could nurses substitute doctors?'

In the present study 50% of the respondents had a positive attitude to substitution with the greatest negativity among the medical specialists.

In dermatology all three GPs questioned the use of GPs in remote consultations. But one of them said that a nurse with especial training in dermatology could only partially replace a GP during remote consultations. All three dermatologists questioned substitution and one specialist expressed: " - The GP writes prescriptions. - . The GP can palpate the skin. The GP can answer questions which a nurse cannot".

In psychiatry 10 of 12 told it unnecessary that a GP followed the patient to the studio and that this could be done by a nurse. Seven of the ten said that a psychiatric nurse could only partially substitute the GP. Five told substitution to be dependent on what authority the situation required (in Norway doctors are needed for hospital admission without patient consent). The two who did not find that a nurse could substitute the GP were a psychiatrist and a psychologist. Of the psychiatric nurses two told meeting in the studio with the patient worked well and one that they often did so. The assistant nurse with training in psychiatry said: « - at the mental hospital psychiatric nurses sometimes replace the psychiatrist».

In the telepathologic frozen section service the surgeon leaves the operating theatre after removal of the tissue lump to hear the pathologist's evaluation. All surgeons told that a nurse should not replace the surgeon in the studio because: the surgeon was anyway awaiting the pathologist's evaluation, and direct communication between pathologist and surgeon is important. Three were of the opinion that laboratory technicians at the local hospital could be substituted by unskilled labour to make frozen sections.

In otolaryngology both respondents were negative to substituting GPs with nurses.

Discussion: The issue is important for cost-effectiveness analyses and because supply of GPs may be limited. When substitution is proposed to give lower costs the possibility that nurses use more time should be considered. Substitution of GPs by nurses may also result in less learning for the GPs. Compared to some substitution experiments outside of telemedicine the role of the nurse in telemedicine is professionally quite simple.

Teledermatology may cost more than ordinary referral. If a nurse could substitute one of the two doctors the costs would decrease. Prescriptions can be written by the dermatologist and e.g. faxed the pharmacy. Also during an ordinary visit the dermatologist is without the aid of a GP to answer questions. If palpation by the dermatologist is necessary the patient can go to the hospital.

In parts of Norway the supply of psychiatrists is difficult. It is a common opinion that nurses can follow the patients to remote consultations. If follow up can be done in the local community by nurses with telemedical support from psychiatrists this may cut costs and improve patients quality of life. Patients may also be alone in the studio for a consultation. Doctors are required for hospital admissions without patient consent.

In the telepathologic frozen section service it is an advantage that the surgeons themselves hear the pathologist's evaluation. The possibility of misunderstandings is reduced and the surgeon is anyway inactive. The technical preparation of sections for microscopy is a work easy to standardise and can be done by unskilled labour.

In teleotolaryngology both respondents were negative to substitution. But the question can be asked if a nurse can hold the endoscope and the examination performed under the guidance of the otolaryngologist. Prescriptions can be written by the specialists.

Conclusion: Positive attitudes to substitution are quite common and the arguments against substitution can be discussed. The investigation gives reason to propose more systematic evaluation of substitution in telemedicine.

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Infusion of telemedicine in Västerbotten – Some critical aspects after five years experience

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After five years experience of a telemedicine consultation project between the rural Tärnaby sjukstuga and the University hospital of Umeå, it may now be concluded that there are, in addition to many positive effects (reported elsewhere), also some difficulties of technical, organisational and human nature in the process of infusion.

The technical platform is of main significance and has to be of good quality, reliable and easy to use in order to be accepted by all involved parts. Moving from a traditional and reliable ISDN connection to our present ALAN-technique has resulted in various complications. The image and audio quality was impaired and connectivity became unstable partly due to unpredictable variations of accessible bandwidth.

Furthermore, the interest from the "players" varies e.g. the Swedish healthcare organisation does not encourage new techniques for collaboration between primary and secondary care. The personal incitement is not visible in the short run, only the extra workload is counted. Conservatism and sticking to the old way of handling patients is the normal conduct and therefore the easy way out. A power game is also identified between doctors and different referral sites. It is not always that apparent but nevertheless plays a considerable role in the infusion process.

In summary, introducing telemedicine is more complicated than foreseen and may be disturbed by different and sometimes unexpected interactive forces.

A system for telemedicine and medical consultations at sea

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Background: The Maritime Medical Consulting System establishes a direct contact from a ship to a designated hospital ashore over a satellite link. The system transfers video images, sound, medical data, and provides direct video-conferencing and medical consulting facilities in order to improve the medical care at sea.

Materials & Methods: The test site is located on M/S Stena Germanica – a ferry with a capacity of 2200 passengers sailing between Göteborg, Sweden and Kiel, Germany. Travelling time is 14 hours. In conjunction with illness or an accident on board, a direct contact is established with the Sahlgrenska University Hospital/Östra. Together with the videoconferencing facilities medical data, including EKG (12- or 3-lead, NIBP and SpO2 data) is registered by a telemedicine terminal (Mobimed® PWS-1000) and transferred through a virtual RS-232 channel mixed with the videoconferencing. Patient information can also be entered into various forms in the telemedicine terminal. The video camera generates high-

quality images of the patient, and two cameras can be used alternatively. The system communicates via satellite (Inmarsat B) and ISDN (64 Kbit/sec) with a corresponding system at the hospital.

Results: Data from one year of follow-up is presented. The naval officer in charge decided in 22 cases of severe illness to activate the telemedicine system for consultation. Doctors using the telemedicine equipment have been given an opportunity to comment on the technical quality and the usefulness. A satisfaction index was recorded in 14 cases; 10 correspond to perfect function and 1 to non-functional or failure. Mean index for video and sound quality was 7.5. Concerning the question of impact on decision-making and treatment the index reached 7.3. The system has also been tested on the 79 feet sailing yacht Skandia on its trip from New York to Gothenburg, Sweden, last summer. Other installations are now being discussed.

Conclusions: Based on the video images, medical data and other transferred patient information the physician ashore can function as a mentor and guide to the crew in the treatment of the patient. The result has been an improvement in diagnostic accuracy and in making medical decision at sea.