

MC-S115

MedCom - the Danish Health Care Data Network

Image
communication
Information
systems
Text
communication

TeleMed



December 1999

Background to the TeleMed project

MedCom has been working to develop and expand electronic communication between the parties in the health service since 1995. Efforts have been largely focused on the types of text message that occur most frequently in the form of EDI communication (Electronic Document Interchange). However, work is in progress in several places on projects that meet other communication needs within the healthcare sector.

The expansion of the Internet makes it easier to fulfil these communication

needs. Because it is easily accessible and has a flexible graphical user interface, the World Wide Web (www) is particularly well suited to healthcare information. At the same time, e-mail makes it possible for text, images and sound to be communicated electronically between employees in the healthcare sector. In the longer term, the Internet will also provide an alternative communication channel for EDI-based communication.

The TeleMed project was implemented in 1998-99 alongside the expansion of EDI communication. The aim was to critically examine the need for and opportunities presented by the new forms and techniques of communication.

The TeleMed group

The TeleMed project was carried out between January and November 1999 by a working group under MedCom, consisting of:

**Kjeld Erbs, Head of Section,
Århus County Council**

**Lars Hulbæk Fog, Consultant,
MedCom**

**Anny Føns, Project Manager,
Frederiksborg County Council**

**Jens Grønlund,
Principal Administrative Officer,
Viborg County Council**

**Henrik Bjerregaard Jensen,
Project Manager, MedCom**

**Finn Klamer, General
Practitioner, Øster Jølby**

**Tove Lehrmann, Deputy Chief
of Section, FynCom**

**Finn Lindhardt, Head Physician,
Viborg Hospital**

**Jørgen Nepper-Rasmussen,
Senior Physician,
Odense University Hospital**

**Tove Charlotte Nielsen, Head of
Section, Vejle County Council**

**Poul Sigh, General Practitioner,
Viuf**

**Lonnie Wroblewski, Project Co-
ordinator, Elsinore Hospital**

MedCom - a presentation

MedCom is a project involving co-operation between authorities, organisations and businesses linked to the healthcare sector. The purpose of MedCom is to establish and continue the development of the Danish healthcare data network.

During the first MedCom project period from 1995 to 1996, EDI standards were developed for communication between medical practices, hospital departments, radiology departments, laboratories, pharmacies, on-call services and the national health insurance scheme.

The focus in the second MedCom project period from 1997 to 1999 has been on the large-scale expansion of electronic communication. At the same time, new pilot projects involving EDI standards have been implemented in relation to the local-authority healthcare sector, specialist practices, dental practices and physiotherapists.

The parties behind MedCom are the Ministry of Health, the Ministry of Social Affairs, the National Danish Board of Health, the National Association of Local Authorities in Denmark, Copenhagen Hospital Corporation, Copenhagen and Frederiksberg Local Authorities, the Danish Pharmaceutical Association, the Danish Dental Association, the Association of Danish General Practitioners, Kommunedata and Tele Danmark.

Published by MedCom
December 1999

Edited by
Lars Hulbæk Fog, MedCom

Text
arki-tekst kommunikation

Translation
Interpen Translation A/S

Layout/dtp
Christen Tofte Grafisk Tegnestue

Printed in Denmark by
Expres-Trykkeriet, Odense

Print run
2000

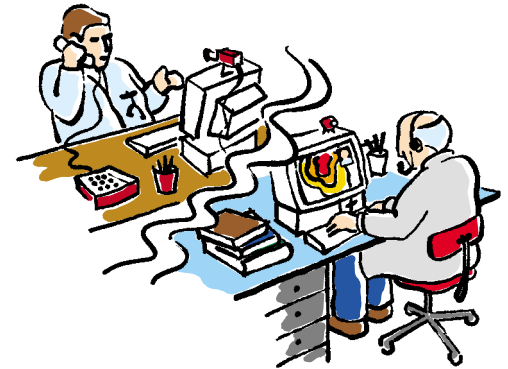
10 sub-projects

An agreement was reached in relation to the TeleMed project between MedCom and project managers for 10 sub-projects on three-month pilot operation in the areas of image communication, information systems and text communication. Among other things, the agreements contained guidelines for documenting the effects of the individual solutions.

Technological development is constantly opening up new opportunities for improvement in the case of all 10 projects. Image quality is being improved, speed is being increased and security solutions are being incorporated as a natural part of future communication

programmes. The description of the projects consequently only provides a snapshot of operational experience of the solutions.

Reports from the 10 sub-projects can be requested from MedCom, telephone +45 6613 3066.



General	Background to the TeleMed project	2
Image communication	TM1: Telemedical transfer of skills Opportunities and benefits in the area of dermatology	4
	TM2: Telemedical solution involving two hospital departments in the area of pathology	5
	TM3: Transfer of CT and MR scans between hospitals	6
	TM4: Teleradiological homeworking	7
Information systems	TM5: Booking GP appointments via e-mail and the Internet	8
	TM6: Web-based national health insurance scheme data warehouse for GPs	9
	TM7: VISINFO Internet	10
Text communication	TM8: The developing co-operation in healthcare - secure e-mail	11
	TM9: External X-ray information via intranet-WEB module	12
	TM10: Encrypted and digitally signed EDI via the Internet	13
General	The overall need for electronic communication	14

TM1

Image communication

Telemedical transfer of skills. Opportunities and benefits in dermatology

To the skin specialist via the Internet

Expansion

The following are necessary for the expansion of tele-dermatology:

- Agreements on payment for tele-medical services.
- Legal clarification of where medical liability lies.
- Integration of image storage and patient database.

Until a few years ago, telemedicine from general practices was considered unrealistic in a country like Denmark, where there is extensive medical cover and geographical distances are short. However, technological development is making telemedical solutions between general practices and specialised parts of the healthcare sector a practical possibility.

A three-month trial on the transfer of skin images between the practice of Dr Finn Klamer on Mors and the specialist Birger Knudsen Nissen in Skive has shown potential gains in the form of:

- Readily available acute specialist support in complex dermatological conditions.
- Better service for patients as a result of rapid specialist assessment, fewer visits to doctors, no extra transport, waiting time and absence for the patient.
- Improved quality of treatment.
- Continuing training for the doctor.
- Simpler check-ups/follow-up treatment in general practice.
- Support for the patient's free choice of specialist.



Skin image from image series in the project

Telemedicine and the GP:

- Dermatology (image series and video)
- Cardiology (electrocardiography and cardiac stethoscopy sounds)
- Clinical chemistry/pathology/microbiology (image material)
- Otology (image series and video)
- Ophthalmology (image series)
- Radiology (image series)
- Health visitor service (image series)

Overall, the solution is socio-economically attractive, as the patient is treated at the lowest possible cost level, resulting in high quality and patient satisfaction.

Procedures applied

Depending on the nature of the skin condition (acute/non-acute) and the time available, three different procedures are followed:

- Image series, notification to the patient later
- Image series, simultaneous telephone connection
- Video sequences, later notification to the patient

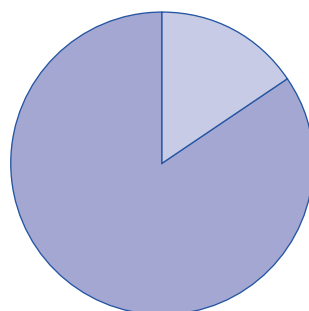
Both image series and video sequences are recorded with a digital video camera, compressed (JPG and MPG formats respectively) and sent with an attached general e-mail message by ISDN. The reply from the dermatologist is received and integrated as electronic specialist's discharge notes in accordance with Med-Com standard.

Telemedical first-time consultations

- A subsequent referral to a specialist was necessary in 4 out of 22 cases.
- In 18 cases the diagnosis/treatment was clarified on the basis of image communication.

Typical skin conditions requiring direct referral to a dermatologist:

- Obvious malignant skin conditions (surgery)
- Alopecia areata (Bucky rays)
- Nail detachment (injections)
- Age-related cornification of the skin (cryotherapy)



Telemedical solution involving two hospital departments in the area of pathology

Current pathology conferences

15 connections in 3 months

- 12 conferences with Medical Department.
- 2 training sessions for younger doctors.
- 1 acute diagnosis enquiry (diagnosis could not be made owing to image quality).

Telemedical solutions allow specimens and conference participants to be viewed on screen.

All hospitals need pathology assistance in examining specimens. However, the institutes of pathology are centralised in the individual counties. Telemedical solutions are therefore appropriate in this field.

The Department of Pathology in Skive provides a service to all hospitals, general practitioners, specialists and dentists in the county.

A large proportion of the pathologists' work consists in taking part in conferences with the clinical departments. The project has been primarily focused on conferences with the Medical Department at Viborg Hospital. The conferences have related particularly to patients with diseases of the blood and lymph nodes. The aim is to avoid time wasted on the road and to be able to hold conferences as and when required. The alternative would typically be fixed monthly conferences.

This solution enables the participants each to see specimens and conference participants on their own screens. The images are transmitted via a closed ISDN connection, but during the con-



Telemedical vision for pathology

- Electronic requests for pathological investigation from general practitioners are supplemented by digital photographs of skin changes.
- Electronic pathology results returned to the general practitioner are supplemented by digital microphotographs.
- Teleconferencing between institute of pathology and clinical departments is extended to all hospitals.
- Establishment of a network for videoconferencing between the country's departments of pathology for second opinion, continuing training and access to reference programmes.

tinuation of the project will change over to a high-speed network, which will make remote diagnosis possible.

Experience

A number of findings have been made as a result of experience gained during the project:

- The system is very well suited to conferences in which microscopic tissue and cell changes are demonstrated. Despite geographical distances, it is possible to discuss diagnostic options in urgent cases at very short notice.
- The system is well suited to the training of younger doctors, as review of the case history and clinical conditions can be supplemented by pathological anatomical changes found in samples from the patient.
- The system is not expected, for the time being, to acquire greater significance as an actual diagnostic tool for the county's pathologists. The quality of the image seen under the microscope continues to be far better than that transmitted and displayed on the screen.

Areas of application for telemedicine

- 1 Clinical application: *Dermatology, cardiology etc.*
- 2 Interdisciplinary clinical application: *Pathology, radiology etc.*
- 3 Outside the health service:
The patient's home, at sea, Armed Forces
- 4 Development of skills: *Conferences, training etc.*
- 5 Administrative application:
Videoconferencing between geographically disperse managements etc.

TM3

Image communication

Transfer of CT and MR scans between hospitals

Send the image instead of the patient

In some cases it may be necessary to transfer a patient from a local hospital to a hospital that has national and regional speciality units. If CT and MR scans are transmitted electronically to the highly specialised hospitals, the department at a smaller hospital will have access to a rapid assessment from a specialist department. At the same time, unnecessary transfers of patients could be avoided.

CT and MR scan images are transmitted from hospitals in Sønderborg, Haderslev, Åbenrå, Esbjerg, Varde and Grindsted to the Department of X-ray Diagnosis at Odense University Hospital. Printout is redirected from Southern Jutland County to the same type of printer in Odense. The images are transmitted directly from Ribe County to a screen-based workstation in Odense,



In five minutes, the senior physician Jørgen Nepper-Rasmussen can receive 15 urgent scanner images from connected hospitals without any loss of image quality.

allowing the images to undergo further processing. Transmission from all the hospitals takes place via a closed ISDN connection.

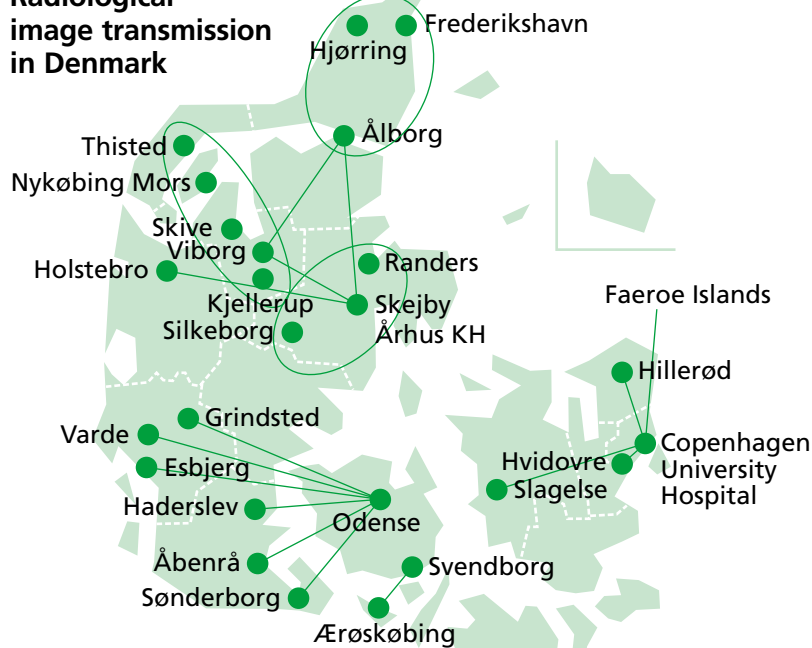
Procedures

The smaller hospital contacts the Department of Neurosurgery at Odense University Hospital by telephone. When the on-call doctor has agreed to assess the patient, the images are sent to the Department of X-ray Diagnosis, where they are collected by the on-call doctor. If the neurosurgeon wishes, a radiological assessment can be made. This is equivalent to the situation where both the patient and the CT/MR scans are taken by ambulance to Odense.

Expansion requires...

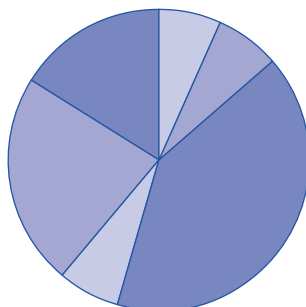
- Significantly faster data connection.
- Transfer to screen-based workstation in all cases.
- Agreements on rates to be charged for image transmissions.
- Clarification of medical liability, particularly in the case of transfer from hospitals without radiological expertise.
- Political decisions on organisational consequences: are X-ray on-call services to be closed down? Is radiological expertise to be brought closer together?

Radiological image transmission in Denmark



Consequences of 44 transmissions in three months

- Emergency transfer: 3
- Transfer deferred until daytime: 3
- Transfer cancelled: 18
- Treatment prior to transfer: 3
- Assessment by conferencing: 10
- Other, including faulty transmission: 7



On-call service from home

Radiological on-call services often consist of a relatively inexperienced first on-call doctor, who if in doubt can consult a more experienced second on-call physician. Partly to make access to the second on-call doctor easier, a teleradiological home workplace has been established in Viborg County. This move is a natural extension of the County's commitment to IT solutions in the area of radiology.

The radiology functions at the County's five hospital units have been digitised. In addition, the radiology departments in Viborg, Skive, Thisted, Kjellerup and Nykøbing Mors have been connected together by a radio link.

The main purpose of the home workplace is to ensure the quality of the assessment made of the patient's condition and treatment. This is done by ensuring easier access to assessment by a radiological specialist. At the same time, the home workplace is used as a diagnostic instrument and to prepare conferences.

Radio link

The connection between the hospital and the home workplace is established by a radio link. Because of the low power involved, no special permits are needed to use radio signals. On the other hand, there must be an unobstructed view from the hospital roof to the antenna about 4.5 km away. Functionality is not restricted by either fog or rain.



Possible organisational consequences of telemedicine

- Changed distribution of work between the primary and secondary healthcare sectors
- Changed distribution of work between hospitals.
- Changed distribution of work between staff groups.
- Co-operation over large geographical distances.

Experience

- Potentially disabling injuries are not overlooked.
- The radiologist will be able to supply essential information in the case of 25% of chest X-rays.
- Patients with clinical signs of blood clots in the brain, but negative CT scans, should also be seen by the second on-call doctor.
- Instruction and training of the first on-call doctor from the home workplace works perfectly. Diagnoses are confirmed or rejected and the treatment is arranged accordingly, without the second on-call doctor having to drive to the hospital.
- The home workplace can be used to describe image-based diagnostic investigations.
- The transmission rate between hospital and home is adequate.
- The software tested is not suitable for conference preparation or permanent writing-up of the investigations.

3 months of pilot operation have involved:

- 507 casualty patients (1360 images)
- 276 urgent chest X-rays (524 images)
- 81 urgent CT scans of the brain (2850 images)

TM5

Information systems

Booking GP appointments via e-mail and the Internet

Making appointments 24 hours a day

The Internet is used increasingly to search for information and order various services and goods. In the same way, it is possible for a general practice to provide information on the Internet and give its patients the option of making appointments and renewing prescriptions by e-mail regardless of opening hours and how busy the doctor's surgery is.

The doctors in Viuf have tried out a solution of this type. To make electronic

appointment booking and prescription renewal attractive for GPs, the solution means that the data the

Three months of Internet appointments, classified by type of consultation

National screening programme (cervical smear test)	9
Child examination/vaccination	13
Blood test	1
Blood-pressure check	2
Certificate for driving licence	2
Contraceptive pill consultation	2
Antenatal examination	1
Travel vaccination	1
Others	14

Total 45

firming the time, together with any comments from the doctor.

Experience

- Many appointments are sent in the evening and are ready in the surgery next morning. This is taken as indicating a need for appointments to be made outside opening hours.
- The solution should be brought closer to on-line booking, so that patients are notified straightaway.
- The solution is primarily an improved service for patients. There is little easing of the administrative burden with the present relatively low numbers of electronic appointments.
- The consequences of electronic communication between patient and doctor in other areas should be considered carefully, including in equivalent contexts.

Renewing prescriptions

Electronic renewal of prescriptions is targeted particularly at the health-visitor service. A total of eight electronic prescription renewals were received in 14 days in June and July from both patients and nursing homes.

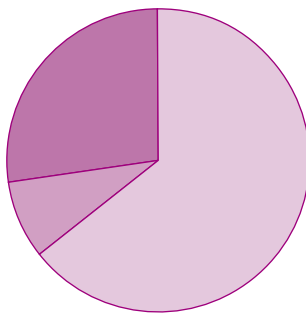


patient types in on the homepage www.viuf.dk can be re-used in the practice's IT system.

Procedures for making appointments

The patient opens the homepage, chooses an appointment and keys in his or her civic registration number. The type of consultation and specification is selected (for example, "child examination, 6 months"), as well as the name of the doctor the patient wishes to see. The date and time are chosen and a comment is written to the doctor if necessary. The message is then sent to the surgery. The first time the patient uses the system, he or she must give an e-mail address.

The surgery's server receives the appointments as structured e-mail, which is imported into the IT system. The doctor/secretary sorts through the appointments individually. The first spare slot that matches what the patient wants is suggested automatically. If the appointment is accepted, it is transferred to the appointment diary in the medical system. At the same time, an e-mail is automatically sent to the patient con-



Improved service for patients

A questionnaire survey produced 675 replies:

- Making appointments via the Internet is an improvement to the service - 430 (64%)
- Making appointments via the Internet is **not** an improvement to the service - 52 (8%)
- Don't know - 93 (27%)

Web-based national medical insurance scheme data warehouse for GPs

From checking to quality development

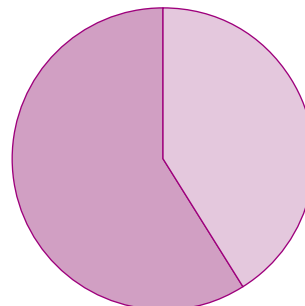
The large volumes of data on the practice sector in the national health insurance system have traditionally been used primarily to check on the efforts of GPs. The data document activity, drawings on interdisciplinary clinical hospital departments, patterns of referral and prescribing and so on.

Regardless of how much time the national health insurance scheme spends on analysing data, the result will generally only be of historical value. At the same time, some doctors are somewhat reluctant to ask for selected analyses. Other doctors perhaps do not know what data the national health insurance scheme has at its disposal.

The national health insurance scheme in Århus County has therefore chosen to give doctors direct access to data via the Internet. The purpose is to support the work of the general practice sector on quality development in the individual practice, in the continuing-training group and among the county's doctors as a whole. The quality development work proceeds completely independently of the traditional checking work, which is carried out as a separate entity.

Experience

The solution does not just provide access to selected standard reports but is based to a large extent on the possibility of designing individual reports. This dynamic solution has been found in practice to



Use of the data warehouse

In September 1998, 25 GPs divided between seven continuing-training groups had access to the system. Over a period of three months, 426 reports were extracted using the web solution:

- 174 service reports (41%)
- 252 prescribing reports (59%)

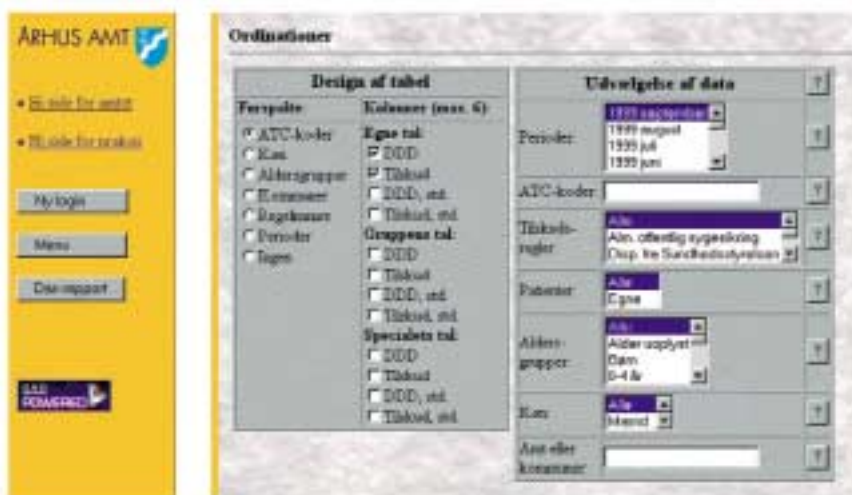
have both benefits and drawbacks. There is primarily a need for significant input on the part of doctors, for example, to acquaint themselves with the system for ATC codes, which is essential if the full yield is to be obtained from prescription data.

Quality report

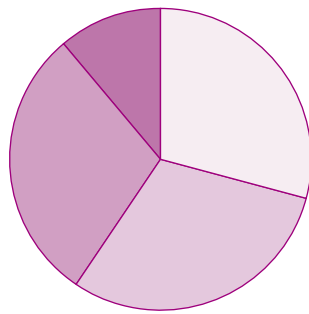
The solution is a supply of quality reports which are to support the county's clinical guidelines in numerical terms in selected areas, for example:

- Correlation between consumption of preventive asthma medication and relief medication among younger patients.
- Consumption of narrow-spectrum and broad-spectrum penicillin.
- The number of lung function tests.

The aim is for doctors to be able to download up-to-date quality reports for their practices by clicking with the mouse. The doctors can then use the data warehouse to delve into parts of the quality report that are of particular interest for their own particular practices.



Referral information in a new guise



Expansion of VISINFO in Funen County. Position at mid-August 1999

- VISINFO-Internet (updating via floppy disk): 54 practices = 29%
- VISINFO-Internet (updating via Internet): 56 practices = 30%
- VISINFO-DOS (updating via floppy disk): 53 practices = 29%
- No access to VISINFO: 21 practices = 11%

When general practitioners refer patients to other parts of the healthcare sector, they need easy access to different types of information on relevant care and treatment provisions. In 1992, Funen County established an electronic information system for GPs, known as VISINFO. The system was DOS-based and was updated monthly with floppy disks.

Internet technology was brought into use in 1998, firstly to obtain more and better ways of joining information together via links and secondly to allow more types of information to be entered into the system, for example images and video sequences.

The switch to an Internet platform means that account has been taken of the varying technology in general practice. This solution makes it possible to:

- Read VISINFO directly on a password-protected Internet site
- Download VISINFO from an Internet site to one's own computer
- Update VISINFO in "Internet format" via floppy disks from the National Health Insurance Scheme.

Not just waiting time

The basic principle of VISINFO is always that the system must be a tool for the general practitioner in the referral situation. Basic material is required for this purpose:

- Future-oriented waiting-time information from clinical and image-based diagnosis departments.
- Factual information about hospital departments, specialists, private clinics and the local-authority healthcare sector with information on addresses, telephone numbers, medical manning, treatment provided and so on.

Referral information across county boundaries

Using Internet technology enhances the prospects for ready access to referral information across county boundaries, but there is a need for:

- Agreement on data contents, including comparable waiting-time analyses.
- Agreement on presentation of information that is relevant across county boundaries.
- Recommendations on Internet connections in general practice, including speed and security.

- Treatment guidelines for a number of diseases.
- Klinik Nyt (Clinic News) prepared by the individual department in collaboration with the practice consultant.
- Patient guidelines drawn up by the individual hospital department and specialist.
- Guidelines to support the electronic referrals and requests of GPs.

Experience with Internet technology

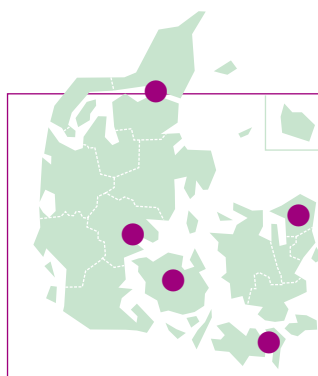
A number of direct benefits have been achieved by the switch to the Internet platform. The system has become more user-friendly as a result of better layout and hyperlinks across the extensive material and to other relevant sites on the Net, for example the "Centre for Small Handicap Groups". In the longer term there is the possibility of direct updating of VISINFO, for example in the form of waiting-time information from the hospital departments.

Editorial group

VISINFO is edited in Funen County by an editorial group which ensures at all times that the information in the system is relevant, correct, updated, concise and precise.

Electronic referral information in Denmark

North Jutland County	VISINFO
Vejle County	VISINFO
Funen County	VISINFO
Frederiksborg County	SUNDINFO
Storstrøm County	PRAXINFO



Pretty secure e-mail



There has been an explosive increase in the ordinary use of e-mail via the Internet in recent years, but not as a form of communication between parties in the healthcare sector. One of the greatest problems is security, as an ordinary e-mail message can best be compared with an open post-card and is therefore not suitable for communicating personal information.

A trial with secure e-mail has therefore been run in connection with the project entitled "The developing co-operation in healthcare", involving the local authority, hospital and general practitioners in Elsinore. The purpose has been to:

- Optimise patient-related information.
- Improve communication on and co-ordination of patient histories.
- Eliminate barriers in order to achieve contact with healthcare personnel across a local-authority emergency team, medical hospital department and general practitioner.

The communication is encrypted using the Pretty Good Privacy (PGP) program, to secure it against the possibility of third parties seeing the contents of the messages.

Experience

- Communication of routine documents such as referrals and nursing reports must be integrated with the specialised systems.

Benefits/drawbacks of PGP

- Easy to implement
- Standard product - can be used independently of mail system
- Laborious administration of encryption keys
- Too many manual procedures for encryption
- In the version used, it only encrypts attached files - not the e-mail messages themselves

E-mail as an alternative to telephone messages

- Amplifying questions on routine messages such as discharge notes, referral and nursing report.
- Agree on meeting times, for example for a discharging conference attended by hospital department and emergency team.
- Agree telephone contact.
- Message from emergency team on change/cancellation of out-patient appointments on behalf of the client.
- Enquiry from hospital department to medical aids department.
- Enquiry from hospital department to GP information regarding medication.
- Enquiry from 24-hour care/emergency team to GP on change of medication.
- Enquiry on descriptions of procedures regarding patient treatment from emergency team to hospital department.
- Communication on prescribing and observation from emergency team to GP.

- Secure e-mail as an alternative to telephone enquiries and messages makes everyday work easier.
- Secure e-mail requires concise and precise formulation in a busy everyday situation.
- Secure e-mail makes demands on the receipt of mail, including routines for emptying the mailbox and answering mail.
- Secure e-mail entails not just encryption but digital signature as well.
- The communication solutions should be universal, so that everyone in the healthcare sector can send secure e-mail to each other.

Pulling the X-ray results

In the past, the exchange of the frequent, routine messages between the parties in the healthcare sector was based on the principle of “data push”. The sender “pushes” EDI messages to the recipient’s electronic mailbox. This is also true of communication between radiology departments and general practitioners, where X-ray results in particular have become very common.

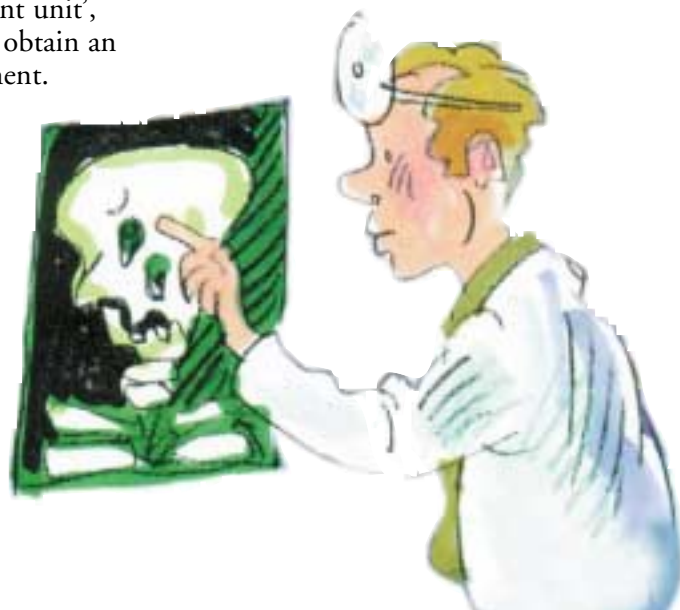
In the wake of the expansion of the Internet, a web module for Kodak’s X-ray system has been developed. This module makes it possible for a practice to enter X-ray referrals directly into the X-ray system and “pull” the X-ray results back to the GP’s practice - “data pull”.

This solution was tested over a three-month period at Fredericia Hospital in 1999. The hospital’s radiology department has an ‘open outpatient unit’, where referred patients can obtain an X-ray without an appointment.

This service necessitates rapid transfer of the electronic referral.

Recommendations

- Response times for connecting GPs to the solution should be improved.
- Referral and response using the web solution must be integrated into the medical records if the solution is to replace EDI.
- The web solution can supplement EDI by giving access to referrals for and enquiries on previous examinations, including any image material, but with current X-ray results still sent via EDI.
- Web access can be used internally in hospitals, if doctors from clinical departments are to be given access to old X-ray descriptions, booking of examination times and image material where appropriate.



Experience	Benefits	Drawbacks
EDI solution (data push)	<ul style="list-style-type: none"> ● Integrated communication in both X-ray system and medical records. ● Rapid issuing of referral in doctor’s practice. 	<ul style="list-style-type: none"> ● Too slow to use in open outpatient units. ● Difficult to troubleshoot.
Web solution (data pull)	<ul style="list-style-type: none"> ● Immediate on-the-spot referral in X-ray system. ● Easy maintenance. ● Possibility of seeing old X-ray descriptions and seeing when a referred patient has been given an appointment. 	<ul style="list-style-type: none"> ● Lack of integration with medical system. ● Too slow in start-up and application from GP’s practice.

TM10

Text communication

Encrypted and digitally signed EDI via the Internet

60,000 accounts in July 1999

The national health insurance service in Århus County received 60,000 individual accounts in July, sent via 19 e-mail messages over the Internet. Reconciliation of the production result and the decrypted accounts from the Internet shows that the figures are completely in agreement.

Secure EDI on the Net

Electronic communication in the health-care sector since the beginning of the nineties has been based on a closed network. The communication has taken place through what are known as VANS suppliers (Value Added Network Services) which have ensured that the EDI messages are routed to the correct electronic mailboxes. This also applies to electronic settlement with the national health insurance scheme from GP practices, on-call services, dental practices and pharmacies. Approximately 5000 VANS-based account messages a month are sent nationally. Added to this there is a significantly greater number of floppy disk-based accounts.

An experiment has been conducted in Århus County with the dispatch of account files over the Internet. The aim has been to achieve improvements in comparison with billing based on floppy disks and VANS billing on three items:

- Greater security through the use of strong **encryption**.
- Elimination of the paper-based collective statement, which at present has to supplement the electronic account. This is done with **digital signature** to achieve correct identification of the recipient of the fee.
- Lower communication costs in the **e-mail system** on the Internet than in floppy disk and VANS billing.

Procedures

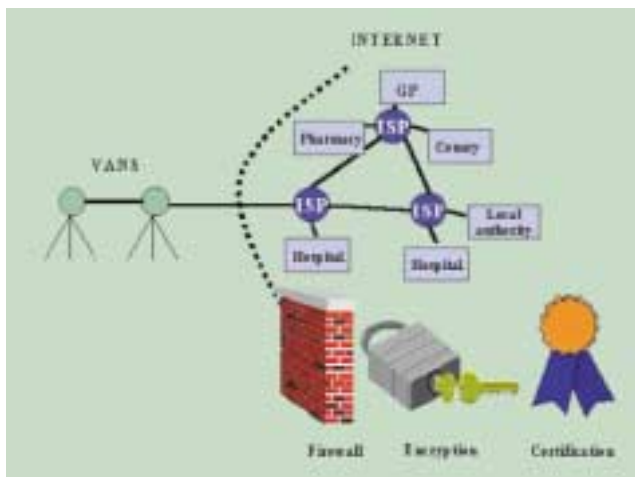
A "secure e-mail client" has been installed in four medical practices, two dental practices and two pharmacies with different IT systems. The billing file formed by the IT system is transferred manually to the "secure e-mail client". Strong encryption and digital signature take place automatically using a chip card.

The file is then dispatched via the Internet's e-mail system using standard mail programs. When the e-mail is received at the National Health Insurance Scheme, the digital signature is validated and approved. The document is then decrypted and transferred to the Århus County mainframe for traditional account processing.

Finally an acknowledgement to the sender is generated. The acknowledgement enumerates the contents of the billing file. The monthly fee specification is sent in encrypted form via the Internet.

Experience and prospects

- The solution has proved to be usable for inexpensive and very secure weekly or monthly electronic account settlement.
- The solution will be used experimentally in Århus County to exchange medical records and in the slightly longer term also in daily routine communication such as discharge notes, laboratory results etc.



EDI via the Internet necessitates a free choice between VANS and Internet providers as well as suitably high security.

Requirements for the expansion of EDI via the Internet in the Danish healthcare data network

- Full integration of EDI based on e-mail.
- Broad agreement on encryption and signature standard.
- Co-ordinated Danish administration of encryption keys and passwords.
- Requirements for the monitoring of activity on an Internet-based healthcare data network.
- Requirements for maximum throughput times between certified network providers.
- Requirements for smooth transition to the new technology.

The overall need for electronic communication

The overall need for electronic communication between the parties involved in the healthcare sector consists of three main fields: clinical communication, information systems and administrative communication.

Clinical communication

The types of clinical communication concern information related to the treatment and care of the individual patient.

Type 1. Structured clinical messages

Examples: Discharge notes, nursing reports, prescriptions

Fully automatic and structured communication between the parties' IT systems (EDI) entails major interchange, co-ordination and maintenance tasks. This type of communication is therefore most appropriate for the most commonly used messages. In the longer term there will be a need for the messages to accommodate multimedia files - images, video, sound, graphics. There will also be a need to transfer clinical measurement data, to supplement the frequent exchange of text messages.

Type 2. Clinical electronic mail

Example: Amplifying questions on a nursing report

Encrypted and digitally signed electronic mail can be used in situations which do not require direct two-way communication such as notifications or in the case of non-emergency enquiries. It is also suitable for types of messages which are used less often and which cannot support structuring and fully integrated communication.

Type 3. Cross-sector booking

Example: Making X-ray appointments from medical practice

Electronic booking of appointments can be considered in every referral situation, and in cases in which patients themselves can ask for an appointment.



Type 4. Cross-sector records

Example: Joint record for diabetes patients

Cross-sector electronic records, where several of the parties in the healthcare sector update in the same record system, will be capable of improving the efficiency and assuring the quality of GPs' co-ordination of patient histories. This can be done for example with joint electronic medication cards, electronic contact books for the health-visitor service, occupational medicine electronic records, electronic diabetes records and electronic pregnancy records. The records can be updated using EDI.

Type 5. Cross-sector records of treatment

Example: Division of work between healthcare professionals

Diagnosis-specific division of work can support and improve the existing division of work between the practice sector, hospitals and local-authority nursing and retraining provisions. This can be done using electronic records of treatment, which are available across sectors. The more parties are involved in the patient history concerned, the greater the need for clear, written agreements.

Type 6. Telemedicine

Example: Communication of CT scans for specialist assessment

Telemedical solutions can improve the efficiency and assure the quality of the provision of treatment in the electronic transfer of text, images, sound etc.:

- between patient and doctor (for example digital blood-sugar devices in the patient's home)
- between the practice sector and the secondary sector (for example digital electrocardiograms with heart sounds)
- between hospitals (for example digital X-ray images for assessment)
- between the health service and other parts of society (for example video-conferencing with ships)



General information systems

General information systems are characterised by being electronic works of reference which contain information that does not relate directly to an individual patient but has great significance as a practical aid or quality-assurance device in relation to care and treatment.

Type 7. Cross-sector clinical databases

Example: Reporting to central database of selected treatment data for diabetes patients

Clinical databases are an important tool particularly for the medical profession, when the quality of a particular treatment has to be documented. The databases make it possible for the individual doctor to compare his or her own treatment results with those of others. By making the databases cross-sector, the effects of treatment can be followed across the various levels of treatment in the healthcare sector.

Type 8. Referral information

Examples: Waiting times and treatment instructions to medical practices

In order to make use of the capacity of the healthcare service and support the patients' options as well as possible, there is a need for readily available support systems in all referral situations. The systems provide updated information on waiting times, treatment and care provisions etc.

Type 9. Practical information

Example: Names, telephone numbers, e-mail addresses in the health-visitor service

Readily available and updated "yellow pages" for all parts of the healthcare sector are an essential requirement for co-operation across sector boundaries.

Type 10. Public information

Example: Quality measurements in the hospital area

The public, patients and clients are increasingly looking for electronically available information on options and rights in relation to the healthcare sector. There is a need for quality assurance of this public information, as well as for easy access to practical information on the healthcare system.

Administrative communication

The purpose of the types of administrative communication is to ensure financial transactions or administrative follow-up of the activity in the healthcare sector.

Type 11. Billing for services

Example: the national health insurance scheme

Electronic billing can ensure rapid and correct financial transactions in the healthcare sector, for example in relation to the national health insurance scheme, private medical insurance and settlement between counties in connection with free choice of hospital.

Type 12. Electronic commerce

Example: Purchasing for hospitals

The national drive towards electronic commerce is also relevant in relation to both the public and private parts of the healthcare sector.

Type 13. Reporting to health authorities

Example: Pension cases to the Social Appeals Board

Electronic reporting of data in connection with administration and general statistical follow-up can improve the efficiency of administrative functions and bring statistical information up to date. This will boost usability in future-oriented planning tasks.

TeleMed contacts

General

TM1: Teledermatology

Finn Klamer, GP
Præstbrovej 238, Øster Jølby, DK-7950 Erslev
Tel (+45) 9774 1333
E-mail: med@klamer.dk

TM4: Radiological homeworking

Finn Lindhardt, Head Physician
Billeddiagnostisk Afd., Viborg Sygehus
Heibergs Allé 4, DK-8800 Viborg
Tel (+45) 8927 2727
E-mail: vsbdafl@vibamt.dk

TM2: Pathology teleconferencing

Jens Grønlund, Principal Administrative Officer
Viborg Amt, Skottenborg 26, DK-8800 Viborg
Tel (+45) 8727 1700
E-mail: sufjg@vibamt.dk

TM6: National Health Insurance Scheme data on the web

TM10: Secure EDI via the Internet

Kjeld Erbs, Head of Section
Social- og Sundhedsforvaltningen, Århus Amt
Lyseng Allé 1, DK-8270 Højbjerg
Tel (+45) 8944 6666
E-mail: ag.op.ke@aaa.dk

TM9: Web access to X-ray system

Tove Charlotte Nielsen, Head of Section
Kvalitets- og Informatikafdelingen, Vejle Amt
Damhaven 12, DK-7100 Vejle
Tel (+45) 7583 5333
E-mail: tcn@vejleamt.dk

TM5: Booking in medical practice

Poul Sigh, GP
Storgaden 67, DK-6050 Viuf
Tel (+45) 7556 1411
E-mail: poul sigh@dadlnet.dk

TM3: CT and MR scan transfer

Jørgen Nepper-Rasmussen, Senior Physician
Odense Universitetshospital
Røntgendiagnostisk Afdeling
Sdr. Boulevard 29, DK-5000 Odense C
Tel (+45) 6611 3333
E-mail: jorgen.nepper.rasmussen@ouh.dk

TM7: VISINFO Internet

Tove Lehrmann, Deputy Chief of Section
FynCom, udviklingsafdelingen
Danish Centre for Health-Telematics
Heden 18, DK-5000 Odense C
Tel (+45) 6613 3066
E-mail: tle@health-telematics.dk

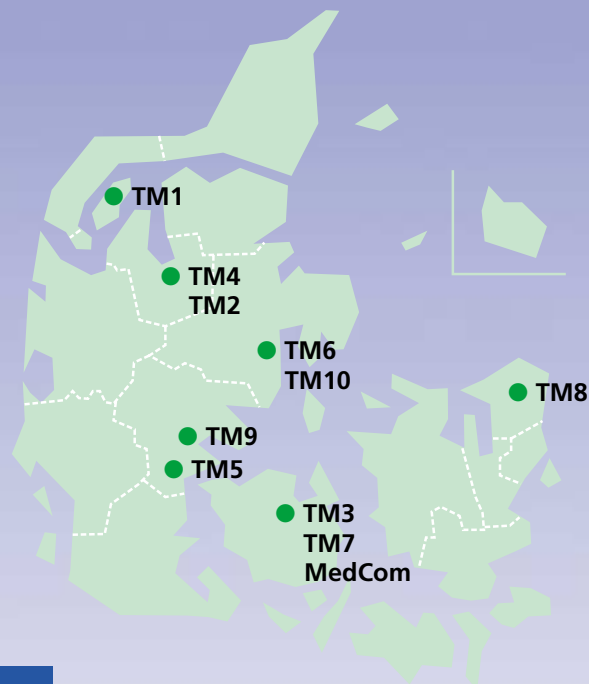
TM8: Secure electronic mail

Anny Føns, Nurse, MI
IT-afdelingen, Hillerød Sygehus
Helsevej 2, DK-3400 Hillerød
Tel (+45) 4829 3111
E-mail: af@fa.dk

Project co-ordinator Lonnie Wroblewski
DUS sekretariatet, Helsingør Sygehus
DK-3000 Helsingør
Tel (+45) 4829 2472
E-mail: lwr@fa.dk

TeleMed project manager

Lars Hulbæk Fog, IT-Consultant, MedCom
Danish Centre for Health-Telematics
Heden 18, DK-5000 Odense C
Tel (+45) 6613 3066
E-mail: lhf@health-telematics.dk



Danish Centre for Health-Telematics

COUNTY OF FUNEN

Heden 18 DK-5000 Odense C
Tel (+45) 6613 3066 Fax (+45) 6613 5066
Homepage: www.medcom2.dk

The Danish Ministry of Health

Holbergsgade 6 DK-1057 København K
Tel (+45) 3392 3360 Fax (+45) 3393 1563