

# FROM THEORY TO PRACTICE - ELECTRONIC COMMUNICATION AND INTERNET OPPORTUNITIES IN THE DANISH HEALTH SERVICE

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## INTRODUCTION

This article does not describe a research project, nor is it an article on technology, health science or social science. Rather, the article describes how earlier research and development results have now been implemented and are being used on a large scale in the Danish health service. As such, this article is a presentation of an object which can be made the subject of either health or social science research.

The object is thus the development of electronic communication in the Danish health service. Development has focused on communication between the primary and secondary sectors. In practice, this is the communication between GPs, specialists, hospitals, the care services for the elderly, and various clinical services such as laboratories and X-ray departments. The article describes how a very high level of electronic communication has been achieved in Denmark, and how this experience will be used during the coming years to implement Internet technology as an active tool in daily clinical activities.

## HISTORY AND BACKGROUND

The work of establishing electronic communication in the Danish health service began more than 10 years ago. In a number of counties, small pilot projects were carried out to introduce electronic communication of some routine information between GPs and hospitals, chemists or laboratories. At that time, the most modern technology for this type of communication was EDIFACT which, by means of a closed network – the VANS net<sup>1</sup>, was sent between the subscribers.

The major gain with EDIFACT communication was machine-to-machine communication, whereby all information was sent directly from one system and automatically stored in the correct place, for example, in a patient journal in the recipient system.

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<sup>1</sup> VANS = Value Added Network Services – a closed network in which all subscribers have a mailbox – a unique location number or address with a VANS provider. All messages are communicated via a mailbox.

When it became apparent that work was being done to solve the same problems in different ways at various places in the country, Funen County took the initiative in 1994 to establishing a two-year project at the national level – MedCom – the objective of which was to compile national EDIFACT standards for the most frequent text-based messages in the Danish health system.<sup>2</sup> Work in developing the Danish EDIFACT standards was based on the international standardization work in CEN. The Danish EDIFACTER are thus a subset of the UN EDIFACTER.

All the major organizations in the Danish health system were behind the MedCom project: the Ministry of Health, the National Board of Health, the Association of County Councils in Denmark, the Danish Medical Association, the National Association of Local Authorities, H:S, and a number of private companies.

Project work was distributed among the participating counties and systems suppliers so that the development of discharge documents took place in one county in cooperation with their supplier, while work on developing electronic laboratory responses was done by another county in cooperation with their supplier. In this way, a national EDIFACT standard was developed for the approximately 40 most frequent messages in the Danish health service.

However, on completion of the project, it was clear that there was a need for a new project (MedCom II) to ensure the spread and use of the standards that had been developed. MedCom II began in 1997 with the objective of 75% of all communication in the Danish health sector becoming electronic by the end of 1999. When MedCom II was concluded, nearly 200 local projects had been carried out, with the result that approximately 50% of communication had become electronic.

At the close of 1999, MedCom became a permanent organization, and a new two-year project began which was to ensure further growth of electronic communication, and to carry out technical and health-professional quality assurance of the EDIFACT standards being used.

## **ELECTRONIC COMMUNICATION TODAY**

Today, Denmark has a fully developed VANS-based health data net by which more than 80,000 messages are communicated daily. All hospitals chemists, emergency doctors on call, 90% of GPs, 98% of laboratories, 55% of specialists, 30% of physiotherapists, and 20% of municipalities are connected to the health data net. A total of more than 2500 organizations use the health data net daily.

Today, communication covers all significant communication streams. Figure 1 indicates the types of messages that are now in full daily operation. The extent of this communication is the result of nearly 10 years of constant focus on electronic communication and massive support of MedCom projects by all parties in the Danish health service.

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<sup>2</sup> Marriboe, 1996

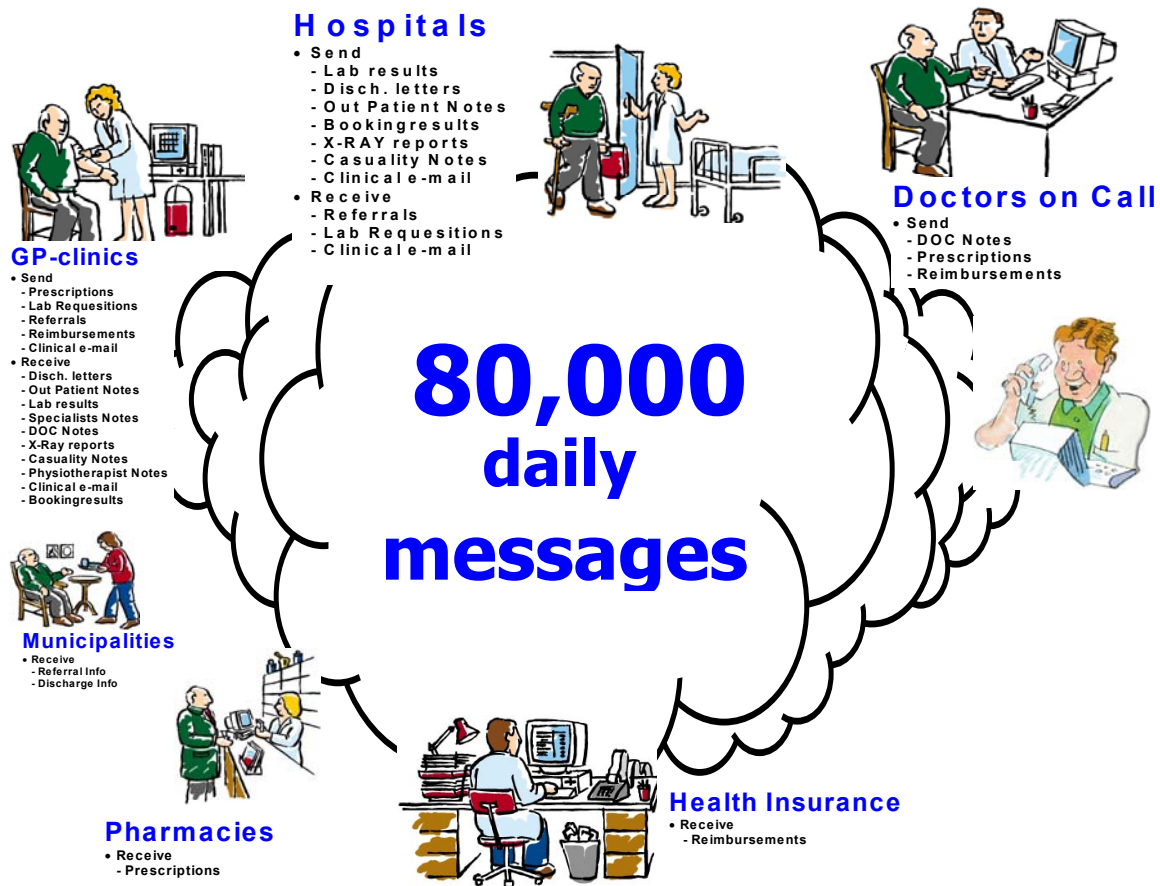


Figure 1.

The use of EDIFACT communication has resulted in major financial and quality gains for the Danish health service.<sup>3</sup>

That it has been possible to achieve health-professional unanimity at the national level regarding, for example, the composition of a referral and discharge document, has meant major gains in the correlation of treatment of patients. A simple thing such as the reduction in the number of illegible handwritten prescriptions has resulted in far fewer patients receiving the wrong medicine.

## EVALUATION

There has never been an actual scientific evaluation of the work, which MedCom does, nor of the significance of mass electronic communication for the Danish health service. The MedCom philosophy has always been that evaluation took place in the marketplace; provided the parties (primarily hospital owners and GPs) in the health service purchased communication solutions, the value was greater than the costs (that the marginal economic

<sup>3</sup> Kaae, 2001

cost < marginal benefit). Since the beginning of the project, it has involved considerable costs for a GP to begin communication. Costs for a GP to commence communication are estimated as being between 14,00 and 40,000 euro. Since GPs in Denmark are self-employed and all costs must therefore be paid from their own pockets, they cannot make investments that do not result in positive returns. Since more than 90% of the GPs have made this investment, it is reasonable to assume that the project has passed the market test.

There is also no doubt that communication has led to significant improvement of efficiency at the hospitals. An example of this is the use of electronic referrals, which saves many resources, since re-entering data is no longer required and the professional quality of referrals has risen. Another example is discharge letters, in which one of the advantages is that, like referrals, they are stored directly in GPs' journal systems without re-entry, while the fact that they are sent electronically enables monitoring of whether or not discharge letters are sent on time. This possibility has led to a marked fall in the number of discharge letters which are not sent from hospitals within a professionally satisfactory period – since it is now possible to perform systematic electronic reviews of time lapses from the time a patient is discharged until the discharge letter is sent, and therefore enable continual monitoring of quality targets.

#### **MedCom IV: Transition to Internet technology**

With the considerable success that has been achieved with VANS and EDIFACT communication, it is reasonable to ask why resources should be used to change Internet technology.

A significant reason for beginning to use Internet technology is that, in Denmark, as in all other countries, there has been an increasing degree of specialization and distribution of activities among various groups such as specialized hospital departments, laboratories, GPs, chemists, and the municipal health care sector. Without this specialization, it would not be possible to achieve sufficient quality and efficiency in treatment of patients.

Nevertheless, this specialization and distribution of activities means that ensuring coordinated and coherent treatment of patients is an increasing problem. Patients also see this problem as a decisive weakness in the modern health sector.

If society and patients are to reap the benefits of increasing specialization, it is necessary to ensure coordinated and coherent treatment of patients. It is also necessary to ensure that the parties involved use the same language (terminology, treatment protocols, distribution of activities, regulations, etc.), and to ensure that the parties can communicate the necessary treatment-related information quickly and efficiently.

Internet technology offers a large number of opportunities for supporting coherent procedures that can improve the interaction among the health-professional organizations, and between the health-professionals and the patients.

Internet technology contains facilities which, in addition to existing EDI communication, will be capable of meeting a large number of additional communication needs in the health sector. Initially, the following areas:

- clinical e-mail with queries in connection with treatment and care. In many cases, this will replace time-consuming telephone contacts when sufficient e-mail security has been established.
- appointment making for examinations and treatment. This will take place by notices on hospital homepages, and these homepages can be integrated with existing appointment systems.
- WEB notices (pull) of X-ray results laboratory replies and patient information. These will take place by notices in X-ray and patient systems.
- Patient monitoring in the home. This will take place by direct transmission of monitor results to home-care services, patient records, etc.
- Telemedicine. This can be established by forwarding pictures, X-rays, sounds, graphics and video materials on the Internet, or by establishing videoconferences.
- Health information systems with information on illnesses or visitation portals can be made accessible for health professionals, as well as the public.

Moreover, it will be possible to use Internet e-mail the same way as the current VANS net is used for communicating prescriptions, laboratory results, discharge documents, etc., by EDI, provided Internet e-mail is integrated with sending and receiving systems in the same way that VANS e-mail has been integrated with the use of MedCom standards.

### **The transition to Internet Technology**

The transition to Internet technology and development of services is based partly on European experience as described in the report *Building Regional Health Care Network in Europe*,<sup>4</sup> and partly on experience from specific pilot projects carried out under MedCom II<sup>5</sup> and III<sup>6,7</sup> in the areas of telemedicine, appointments, clinical e-mail, and posting of patient information (data-pull).

### **The Infrastructure Project**

The Infrastructure Project is to establish the technical and physical prerequisites for the health data net. The Internet-based Health Data Net is to be structured by means of a central VPN solution that includes establishing a central gateway: SundhedsDIX (Health DIX).

The sender sends a message on a VPN connection to the Health DIX which relays messages to the addressee specified by the sender via another VPN connection.

Everyone in the health sector can connect to this by establishing a VPN tunnel to the Health DIX. The Health DIX ensures that traffic between various subscribers can be relayed at one place only: this gateway.

The Health DIX consists of one large router, or a router complex at a specific geographic location. The gateway is established and operated by a public authority, or is contracted to an operating centre.

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<sup>4</sup> Oates & Jensen, 2000

<sup>5</sup> Fog, 1999

<sup>6</sup> Pedersen (1), 2001

<sup>7</sup> Pedersen (2), 2001

sISPs<sup>8</sup> are to establish the connection to the Health DIX and assume responsibility for establishing VPN connections from the individual user/the individual Intranet to the Health DIX. It will also be possible for individual Intranets to connect directly to the Health DIX, provided the connection is set up as a crypted VPN connection.

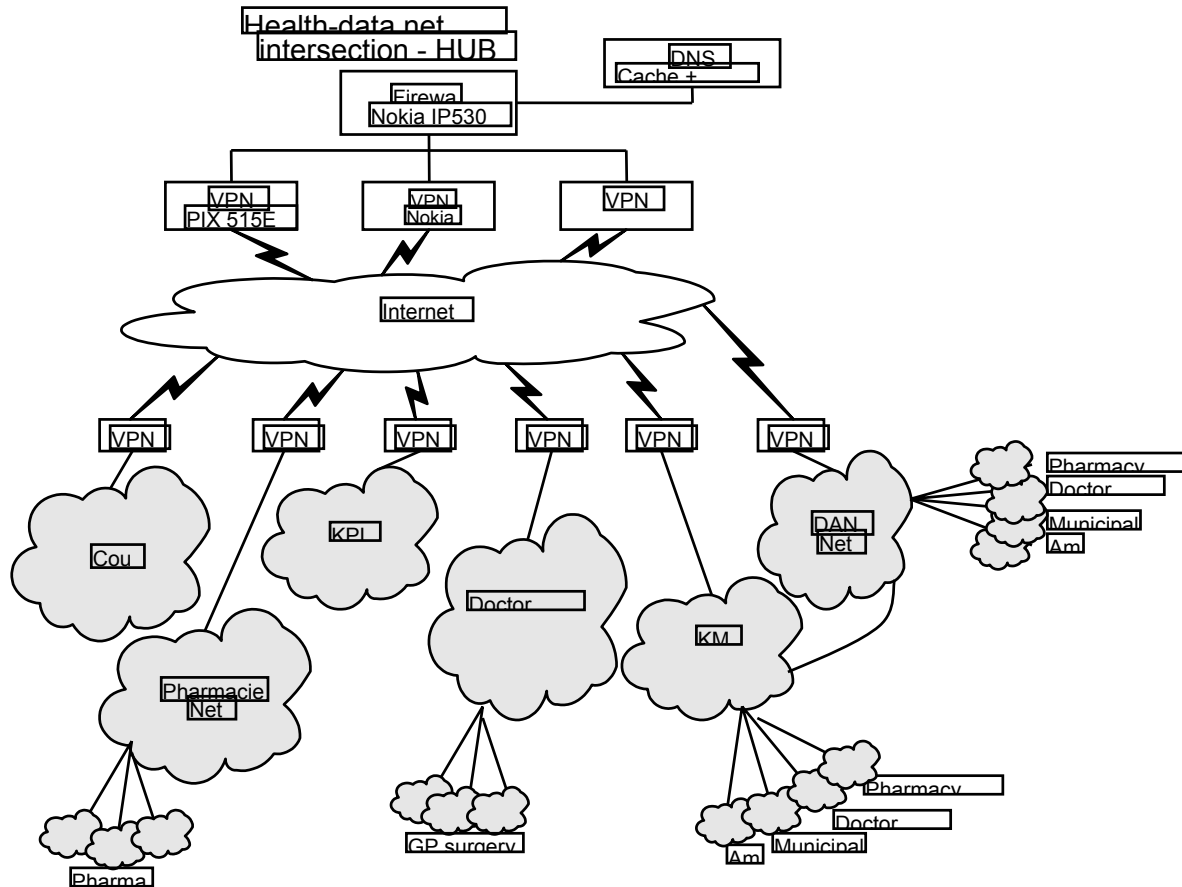


Figure 2. The physical structure of the closed Danish health Internet.

Each connection between two health subscribers in the connection will consist of two crypted VPN connections: one from subscriber A to the Health DIX, and one from the Health DIX to subscriber B.

Establishment of the national Danish health Internet began officially on 18 June 2002, with a decision by the MedCom steering committee. A large-scale pilot project has been started which is to test the idea and ensure the experience necessary for a permanent network which operates reliably. Thirteen (13) public and private organizations are participating in this pilot project, of which there are six (6) counties, the Danish Pharmaceutical Association, IT suppliers of both doctor and pharmacy systems, private laboratories, municipalities and VANS providers (who are to ensure the connection to existing EDIFACT communication).

<sup>8</sup> An sISP (Secure Internet Service Provider) is a public or private organization that offers services on, or connections to the Health Net in the same way Internet Service Providers offer services on the open Internet.

The physical intersection (DIX) will be established during the autumn of 2002, and the possibilities will be tested of sending edifacts, making searches in clinical systems such as laboratories and X-ray files, and holding video conferences. The pilot project will close in the spring of 2003 with a transition to permanent operation.

In connection with the pilot project, two subordinate projects have been initiated to solve two specific problems.

### **Secure connection of GP surgeries**

In theory, at least, it is not very difficult to make secure connections between the DIX from, for example, a county which typically has a large and professional IT department with experience in firewalls, VPN connections, proxy servers, WAN, LAN, etc. It is much more difficult to connect an ordinary GP who rarely is very interested in network protocols, etc., or has any insight in them. Therefore, the project must find a simple and secure means by which a typical GP surgery can be connected without causing security breaks, and without giving the individual GP new and overwhelming duties.

### **User control**

When health professionals search for health information that can be traced to individuals, Danish law requires logging of the search. System owners must always be able to document who has seen which information.

In the coming health Internet, it will be possible to make interorganizational searches. This means that the organizations, which make information available for searches, must register and administer all external users who wish to have access. In theory, this is all employees in the Danish health service, approximately 200,000 persons who, on an average, change jobs every six (6) months. Of course, this is an impossible assignment in either the short- or the long-term. Therefore, it has been decided to establish a central directory service that can automatically verify user IDs and passwords interorganizationally, probably using LDAP (Lightweight Directory Access Protocol). If this is to function in practice, it requires automatic maintenance of a central directory from local user administrative systems.

### **Developing services**

Phase 2 of the health data net, the Communication Project, is to ensure large-scale use of the infrastructure – in more ordinary terms, it could be said that it will ensure the transition from *road* to *traffic*. To ensure the success of this transition, the point of departure will be a number of areas where solutions and/or projects already exist at the local level, and can be expanded to the national level.

The following communication projects will be implemented.

- Present EDIFACT communication is also to function on the health data net, i.e., it must be possible to send all current and future EDI messages by e-mail.
- Secure e-mail communication between all subscribers in the Danish health system, as well as development of special types of e-mail, such as *acute* e-mail for use when acutely ill

patients are transferred between hospitals. Subscribers that receive acute e-mail are obligated to check their e-mails at least once every five minutes.

- Establishing of a national telemedicine dermatology network which enables GPs to obtain specialist evaluation by means of photographs. The objectives of the project are as follows:
  - to ensure that patients who live in secluded areas or areas with but few specialists have equal access to the best dermatology treatment available
  - to avoid unnecessary patient transportation
  - to maintain health professional competence in secluded areas
  - to support continual education and training of GPs through clinical dialogue with specialists
  - to increase efficacy in treatment.
  - through new communication options to strengthen health-professional cooperation among specialists, GPs, and nurses who, for example, visit elderly patients at home to treat bed sores.

Interorganizational posting of patient information: X-rays and descriptions.  
The objectives of the project are as follows:

- to ensure online access to X-rays and/or X-ray descriptions across the boundaries of counties and organizations
- to ensure patients that all relevant information can be retrieved in connection with treatment and examinations
- to minimize the number of re-examinations so patients are not subjected to unnecessary inconvenience
- to improve diagnoses and planning of treatment
- to improve the dialogue between GPs and patients through access to X-rays.

Interorganizational posting of patient information: laboratory results and ECGs.

- Ensure online access to all laboratory data for a patient across county and organizational boundaries.
- Ensure that all relevant information can always be accessed in connection with treatment and examinations.
- Minimize the number of re-examinations to avoid unnecessary inconvenience to patients.
- Improve diagnoses and planning of treatment.

Establishing of structured information between general practitioners, hospitals and carers in the municipal sector, in Denmark known as the *triangle of age* or the *Bermuda triangle*.

The Communication Project is to ensure massive expansion of these services in the Danish health service by the end of 2005.

## CONCLUSION AND PERSPECTIVES

The opportunities available through Internet technology will mean new and improved electronic communication in the health service, though experience also indicates that there is a considerable distance between technical communication possibilities and actual communication in daily operations. In relation to the upcoming MedCom project to establish the Health Net, there are three (3) conditions that are important to remember:

- The current electronic communication system with EDIFACTs will remain the central and supporting communication system in the Danish health service for a considerable length of time.
- It only pays to work with communication systems that function in daily operations. Pilot projects can be necessary for obtaining experience, but all pilot projects should terminate by continuing in daily operations on a large scale.

Only communication streams of considerable volume are interesting. Ambitious and transparent targets must be established for all projects. For example: by the close of 2005, all counties must have established teledermatology agreements between GPs and specialists. Finally, it must be concluded that even though we use market evaluation of MedCom projects, there are many issues which have not been clarified in connection with electronic communication in the health service, which would receive major benefit from thorough scientific evaluation.

## REFERENCES

- Fog, Lars Hulbæk; TeleMed; MedCom; Odense, 1999.
- Kaae, Tove; FynCom 1991 – 1999 Expectations, Results, Outlook, FynCom; Printing Unit of County of Funen, 2001.
- Mariboe, Steen; MedCom – det danske sundhedsdatanet. EDI i sundhedssektoren; Dansk EDI-Råd; Ekspres-trykkeriet, 1996.
- Oates, John & Jensen, Henrik Bjerregaard; Building Regional Health Care Network in Europe; IOS Press; The Netherlands, 2000.
- Pedersen, Claus Duedal; Opslag via Web; MedCom; Odense, 2001.
- Pedersen, Claus Duedal & Fog, Lars Hulbæk; Establishing a national patient information system on the Internet in Denmark; paper at MEDINFO 2001; London, 2001.

