

# The EHR in Denmark: You Don't Have to be Big to be in Front

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**What can a robust,** hard-working, seafaring nation of only 5.3 million people that is smaller in size than Nova Scotia teach us about health informatics? Perhaps more than we realize. In terms of the use of information technology (IT) in hospitals (i.e., the electronic patient record), Denmark is not remarkable. However, when it comes to primary computing, Denmark rivals the United Kingdom.

## NATIONAL STRATEGY

In 1994, a need was seen to ensure that the regional healthcare data networks being developed made up a nationwide network. A two-year national project (MedCom) was established to:

- Compile national EDIFACT standards for the most frequent text-based messages in the Danish health system.
- Develop communication standards for the most common communication flows between medical healthcare organizations and private companies linked to the healthcare sector.
- Establish a coherent Danish healthcare data network.

The parties behind the *now permanent* MedCom were:

- Ministry of Health
- Association of County Councils in Denmark
- National Board of Health
- Copenhagen Hospital Corporation
- Copenhagen and Frederiksberg Local Authorities
- Danish Pharmaceutical Association

- Association of Danish Doctors
- Dan Net

In 1996, the first national strategy was delivered with a focus to include development of electronic patient records (EPR) for Danish hospitals and primary care. A key element in the strategy was to support a number of regional EPR development projects. The EPR Observatory was launched as a horizontal activity to collect and disseminate experiences from the regional projects.

A year later, MedCom 2 expanded to develop communication standards for the most common communication flows between local authorities and hospitals; to expand communication between medical practices, hospitals and pharmacies; and to carry out pilot projects in the areas of the Internet, telemedicine and dentistry.

By 1999, an update to the national strategy increased the emphasis on communication between the hospitals. Centralization of data was also to be a key requirement. MedCom became a permanent organization with a defined role: "The purpose of MedCom is to contribute to the development, testing, dissemination and quality assurance of electronic communication and information in the healthcare sector with a view to supporting coherent treatment, nursing and care."

The expanded role for MedCom included:

- EDI communication – continued broadening and quality assurance of existing and new EDI communication flows.

- Electronic patient record – development and implementation.
- Changeover to the Internet – development and expansion of the infrastructure in the health-care data network using Internet technology.

**CURRENT STATUS**

MedCom’s standardized messages have now been implemented in 50 IT systems, including 15 doctor’s systems, nine hospital services, 12 laboratory systems and four pharmacy systems. It is used by three-quarters of the healthcare sector, altogether more than 2,500 different organizations. All hospitals, all pharmacies, all laboratories and 1,800 general practices take part. Over 400 specialists, physiotherapists and the local authority health visitor service are also gradually on the way to participating in the electronic communication via the healthcare data network. Around two million messages a month are exchanged, or just over 60% of the total communication in the primary sector.

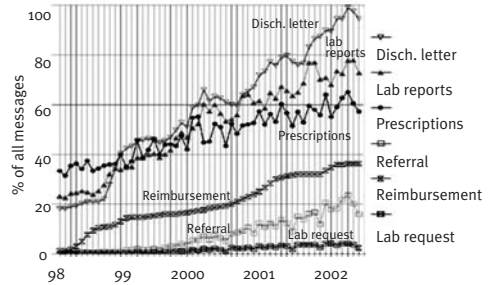
**PRIMARY CARE COMPUTING**

Over 90% of GPs’ offices are computerized, and almost 80% use their computers to send and receive clinical EDI messages such as discharge letters, lab requests and results, referrals and prescriptions. There are 14 suppliers of GP systems. Specialists’ use of computers ranges from 40% to 90% depending on the county, with their use of EDI clinical messages ranging from 15% to 70%.

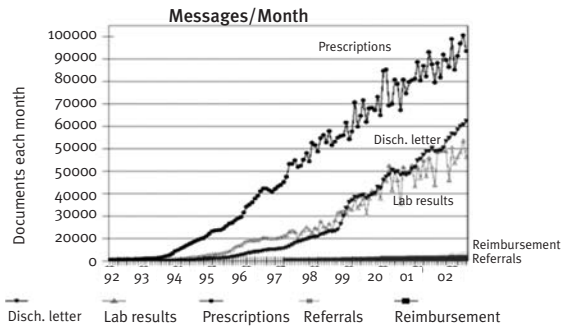
The data consultant scheme is a service scheme with general practice as its primary target group and with the overall aim of strengthening use of computers for quality development and communication. The scheme was introduced on a trial basis in Funen County in the period from 1998 to 2000. It has since been decided that the scheme is to become permanent. During the course of 2001, data consultants were similarly appointed in all 14 counties. The aims of the data consultant scheme are to:

- Strengthen quality development work in the individual medical practice and with the individual GP, partly by using data extraction in medical practices.
- Pass the centrally registered key figures on directly to the individual medical practice.

**Fig. 1: Medcom Status**



**Fig. 2: Medcom – The Danish Health Data Network**



- Strengthen the use of computers in general practice and, in particular, the use of electronic communication to attain greater coherence in patient treatment in the exchange of necessary data in the progression of a patient.

**HOSPITAL-BASED EPRS**

The 85 public hospitals in Denmark are owned and run by the 14 counties and the Copenhagen Hospital Corporation. The use of information technology (IT) in Danish hospitals is largely guided by local needs, resources and expertise. Over time each county or hospital has developed its own solutions and applications of the technology. Danish hospitals could thus be seen as “IT islands.”

The definition of the EPR system covers various generations of systems with different functionality, and meaningful comparisons are difficult. Some of the counties have implemented first-generation text-based systems, while other counties are beginning to develop and implement more advanced systems complying with international standards for classification and communication.

Eleven out of the 14 counties have an IT strategy for the healthcare sector. Over 90% of the hospitals and 80% of the departments state that these strategies will have consequences for their organization. As of 2001, there were a total of 52 EPR projects in the country. The projects were in different phases and were controlled on different levels as indicated in Table 1.

**Table 1: EPR Projects in Denmark**

	Running systems	Under construction	Planned	Total
County project	1	1		2 (3%)
Hospital project	6	4	3	13 (24%)
Department project	24	12	1	37 (72%)
Total	31	17	4	52

Between 5% and 10% of all beds in Danish hospitals are covered by an EPR system. There is a great variation among the hospitals and the counties. In one county (Viborg) the coverage is 50%, and in several counties it is 0%.

Investments in IT infrastructure and systems development are approximately 0.3% – 1.0% of the budget. This data is suspect since accounting systems in public administration do not easily allow for retrieval of this kind of information.

At least four different approaches to the EPR are being taken in Denmark:

**1. Domain Object Model – Århus County**

The goal is to develop a common EPR system for all the hospitals in the county. The first version of the EPR system to be implemented is a “minimum EPR.” One of the main characteristics is the development of a conceptual model – the Domain Object Model (DOM). This model defines objects and the relationship between them and describes the work process structure in the county hospitals. The model functions as a development tool, obtaining integrity between the individual modules and enabling communication with other proprietary systems. The intention is to avoid a vendor monopoly situation, but to assure a multi-vendor project where the county owns the “integration key.”

**2. Standardized transfer of patient data – Vejle and Viborg Counties**

At present the hospitals in Vejle and Viborg counties use a number of different proprietary

systems, and have a need for retrieving and comparing data sets and transfer data for the support, planning and quality assurance of patient treatment. The two counties initiated a joint analysis to achieve a basis for deciding on how to exchange data from proprietary systems – the SUP projects (Standardized Retrieval of Patient data; abbreviates to SUP in Danish). It has been decided to launch a test project where data are retrieved in XML format and stored in a dedicated SUP database. A number of health IT systems, including the EPR systems in use, are appointed as data suppliers. The results of the test will be available in the fall of 2002.

**3. Distributed Health Environment – H:S (Hospital Cooperation in Copenhagen)**

The Hospital Cooperation in Copenhagen (H:S) has chosen a middleware solution as the strategic integration solution. The middleware complies with relevant national, European and international standards. The product they use is Distributed Healthcare Environment (DHE), which was developed in Europe over the last 10 to 15 years. The development has been supported by a number of European research projects in the 1980s and 1990s and has been commercialized by the Italian company GESI. DHE is an integration platform based on HISA (Healthcare Information System Architecture). The aim of DHE is to provide efficient data transfer between existing proprietary EPR systems. This will apply as well to future EPR systems, as it will serve as a standard development platform for new systems or modules.

**4. Basic frame of reference for data transfer in EPR – National Health Board**

This is called basic because it is limited to the most important parts of a frame of reference. It describes a minimum data set for transfer. The minimum data are in this case the data regarded as common in the transfer of patient record information. The frame of reference is represented in the Unified Modelling Language (UML) and is based on a patient flow and problem-oriented way of docu-

menting the activities. Assessments, plans, procedures and evaluations can be documented sequentially. The main purpose of the national frame of reference is to define standards for transfer of data between different EPR systems, clinical databases, other hospital information systems and a national registry of patient flow data. The standards will primarily determine the data elements that can be transferred. Secondly, the standards will also give directions for the EPR system itself. The patient flow documentation will require the data to be stored with reference to patient flow rather than being event driven as it is in many contemporary systems. However, the standards will not determine any relation to the system architecture, the design of data entry or user interfaces.

#### FUTURE DIRECTION

The new healthcare data network, where healthcare professionals and patients exchange information, will be based on Internet technology and will be established by joining existing intranet networks together using Virtual Private Network connections. It is a fundamental principle that the parties in the health service must be free to choose between the VANS-based healthcare data network and the new healthcare data network based on Internet technology. The freedom of choice means that communication has to be ensured across the two.

The healthcare data network of the future has to:

- Meet a number of certification requirements with regard to firewalls, reliability (speed, utilization statistics) and connection with the VANS network, monitoring and traceability.
- Fulfill the security requirement of the Danish Data Protection Agency.
- Have common rules with regard to administration of users and legitimate access to the network. In practice it is largely a matter of coordinating the counties' administration and control of their own users.

There are a number of technological ways of making this administration easier in practice, such as using what are known as Directory

Services. The basis for this administration will be the compilation of a nationwide address list, containing all the services provided and users. The address list is established by regularly expanding the National Board of Health's partnership table, which today contains the EDI addresses of the healthcare sector.

Future MedCom projects are expected to fall within the limits of seven forms of communication:

1. Structured EDI messages
2. Secure clinical e-mail
3. Booking
4. Web access (XML EPR)
5. Patient monitoring
6. Telemedicine
7. Healthcare information systems

The overall purpose of the "XML EPR project" is to organize the MedCom standards for the primary sector so that they can be reused in the hospital area. The project will cover 26 types of messages and involve 36 different IT

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suppliers. As the project title indicates, the intention is to change over from EDIFACT to the modern XML syntax for hospital internal communication. A decision has been taken in Denmark that XML is generally to be used for public exchange formats.

## CONCLUSION

As good as they are in primary care computing, the Danes may not even be the best! According to a recent Harris study, 95% or more of all primary care physicians in Finland, the Netherlands, Sweden, Germany and the United Kingdom use computers in their practices. This is also true of two-thirds or more of the general practitioners in all the other 15 countries of the European Union (EU) except for Greece (52%) and Portugal (37%). The average for all 15 EU countries is 80%.

The survey also highlighted significant variations across Europe in the number of GPs who access the Internet or dedicated GP networks from their practice, which allow them to communicate with other physicians and, potentially, to access electronic medical records. The levels of usage in general practice are: Finland (100%); the Netherlands (100%); Sweden (93%); the United Kingdom (87%); and France (80%).

The countries where the largest proportions of general practitioners are using electronic medical records are:

- Sweden (90%)
- The Netherlands (88%)
- Denmark (62%)
- United Kingdom (58%)
- Finland (56%)
- Austria (55%)

Only 5% of general practitioners in Portugal, 9% in Spain and 17% in Greece are using electronic medical records. The EU average is 29%.

Dare we ask how Canadian figures compare?



## About the Authors

**Denis Protti**, Professor in the School of Health Information Science at the University of Victoria. His colleagues refer to him as the "Dean of Informatics." We agree.

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## References

- Danish Ministry of Health. 1996. *Action Plan for Electronic Patient Records - Strategy Report*.
- Danish Ministry of Health. 1997. *National Strategy for Development and Implementation: Denmark – Electronic Patient Records*. June.
- Danish Ministry of Health. 1999. Denmark nationale IT strategi for sygehusvæsenet (in Danish).
- Epj-Obs; et observatorium for Elektronisk patientjournal i Danmark (<http://www.hep.dk/>).
- Fyns Amt Education and Development Office. 2001. *Electronic Healthcare Record in Sygehus Fyn*. July.
- Harris Poll. 2002. "European Physicians Especially in Sweden, Netherlands and Denmark, Lead U.S. in Use of Electronic Medical Records." *Health Care News*. August 8. [http://www.harrisinteractive.com/news/newsletters/healthnews/HI\\_HealthCareNews2002Vol2\\_Iss16.pdf](http://www.harrisinteractive.com/news/newsletters/healthnews/HI_HealthCareNews2002Vol2_Iss16.pdf).
- Mariboe, S. 1996. Medcom – det danske sundhedsdatanet: EDI i sundhedssektoren; Dansk EDI-Rad; Ekspresstrykkeriet.
- Medcom – the Danish Healthcare Data Network. 1999. Medcom2 in Print. December.
- Medcom – the Danish Healthcare Data Network. 2001. *The Healthcare Communication of the Future*. December.
- Nohr, C. et al. 2002. EPR Projects in Denmark – State of the Art, Personal Communication, April.
- Nohr, C. et al. 2001. "Shared Experience in 13 Local Danish EPR Projects: The Danish EPR Observatory." Medinfo 2001 Proceedings, p. 670.
- Pedersen, C. et al. 2001. "Establishing a National Patient Information System on the Internet in Denmark." Medinfo 2001 Proceedings, p. 1271.
- Pederson, C. 2002. "Electronic Communications and Internet Opportunities in the Danish Health Services." *British Journal of Healthcare Computer Information Management*. 19(1): 22 – 25.
- Vingtoft, S. et al. 1998. *A National Project for Promoting EPR Development: The Danish HOP Project*. EPRIMP, Rotterdam.