Further Lessons from Denmark About Computer Systems in Physician Offices

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In the last issue, we asked: What can a small country of only 5.3 million people teach us about health informatics? When it comes to physician office computing and the electronic medical record (EMR), it may be worth taking a closer look at what the Danes have accomplished and how they got there.

The Danes spend about 100B Dkr (approximately $20B) per year in health system expenditures (100 Dkr = $22). This amounts to 8.4% of their GDP and is broken down as 82% public expenditure and 18% private expenditure. Private expenditure covers user payments for pharmaceuticals, dentistry and physiotherapy.

Their 14 counties (i.e., provinces) plus the city of Copenhagen are responsible for 65 hospitals (there are no major private hospitals). Counties and local authorities finance healthcare services partly through taxes, which they levy themselves, and partly through block grants from the government allocated according to objective criteria (including population demographics).

Denmark has about 3,500 GPs in 2,000 practices, 800 full-time specialists and 250 part-time specialists. As in Canada, patients must be referred to specialists by their GP. Most lab work is done in the hospitals; the only private labs are in Copenhagen. There are 332 pharmacies in Denmark. Every Danish citizen has a unique national person identification number, which is used for health and many other jurisdictions.

Approximately 30% of Danish GPs work alone. A typical GP has 1,400 to 1,500 patients, up to a maximum of about 2,400. A typical office visit is 10 minutes. Approximately 30% of a GP's income is based on the number of patients on his or her list, while the rest is fee-for-service. GPs are paid to be at the phone for one to two hours every morning to take calls from patients. Specialists' income is entirely fee-for-service. Both GPs and specialists are now also being paid a fee for e-mail communications with their patients. There is a fee of 40 Dkr for each e-mail consultation and/or e-mail about lab results – compared to a telephone contact, which costs 20 Dkr.

More than 90% of GP offices are computerized and use EMRs. Almost 90% use their computers to send and receive clinical EDI messages such as discharge letters, lab requests and results, referrals, prescriptions, and reimbursements.

Specialists' use of computers range from 40-90% depending on the county they are in. Their use of EDI clinical messages ranges from 15-70%.

Standardized messages have now been implemented in 50 computer systems, including 16 physician systems, 9 hospital systems, 12 laboratory systems and four pharmacy systems. It is used by 75% of the healthcare sector, altogether more than 2,500 different organizations. All hospitals, pharmacies, laboratories and about 1,800 general practices take part. More than 400 specialists, physiotherapists and the local authority health visitor service now participate in electronic communication via the healthcare data network. Around two million messages a month are exchanged, or more than 70% of total communication in the primary sector.

Figure 1: MedCom — The Danish Health Data Network

Figure 2: Medcom Status
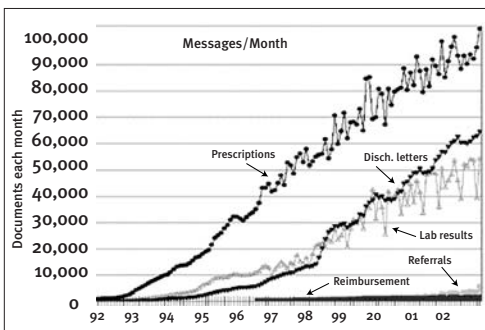
HOW DID DENMARK GET TO WHERE IT IS TODAY?

The first physician office system, called APEX (a UNIX main frame-based system), was installed in 1986. It never achieved acceptance and disappeared in 1988 when the first PC-based system was introduced.

In the late 1980s, a GP and a pathologist convinced the head of IT in Funen County that sending clinical messages electronically would be of particular benefit to GPs. A project was proposed to Funen County for the next round of its IT strategic planning.

In 1990, the FynCom "project" was created to connect two GPs on one system with a hospital system and a lab system. The project went ahead without formal approval and before it became a part of the Funen County IT strategy. By 1992, lab results and discharge letters were being transmitted electronically. Medication prescriptions and reimbursements were added later.

In 1994, the local Fyncom project was nationalized and MedCom was created as a "project." A need was seen to ensure that the regional healthcare data networks being developed made up a nationwide network. A three-year national project was established to:

- compile national EDIFACT standards for the most frequent text-based clinical 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; and
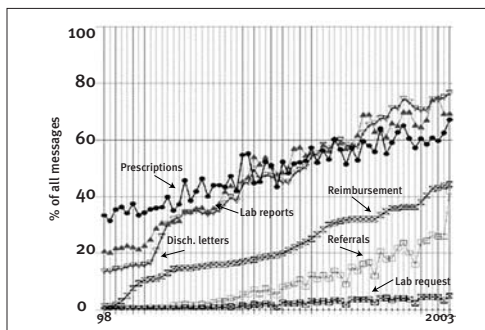
- establish a coherent Danish healthcare data network.

A commitment of 10M Dkr over three years was secured.

In 1997, following the success of MedCom 1, MedCom 2 became a part of the Danish national IT strategy. MedCom was given the mandate to expand and 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. A target of 66% of all documents in the health sector was set, and $15M Dkr for three years was approved.

By 2000, an update to the national health information strategy further increased the emphasis on communication between hospitals and physician offices. Centralization of data was a key requirement. At that time, MedCom 3 became a permanent non-profit organization with an annual budget of 8M Dkr/year. MedCom's mission became: "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 healthcare data network using Internet technology.

In 2002, MedCom's annual budget was increased to 11M Dkr/year. At that time, MedCom 4 moved into new independent offices along with the Funen County International Office and the EU project. This move freed MedCom from county rules and regulations, even though all accounting services are still provided by Funen County. MedCom was seen to be a critical part of the national Strategy for IT in Healthcare (2003-2007), which focuses on seamless care and a higher degree of patient involvement.

FynCom continues to be a greenhouse for IT in healthcare in Denmark. Much of the exploratory work done in FynCom inspires MedCom and is transferred from Funen County to the rest of the country.

WHAT WERE THE DRIVING FORCES TO THE PHYSICIAN UPTAKE OF COMPUTERS IN THEIR OFFICES?

The use of technology by Danish physicians is voluntary. There is no central policy or dictum forcing them to comply. Most physicians use their computer system directly themselves – there is no mandate from their College or Association to do so. Apparently, as long as five years ago, patients would consider a GP to be "second-rate" if he or she did not have a computer.

The major reason physicians use their computers is because of the communication benefits they afford. Physicians report a much-improved dialogue with hospitals (for example, where they used to wait five days for test results, they now receive them almost as soon as they come off the equipment). They are automatically notified when a patient is registered in an emergency department of most hospitals. Discharge summaries now arrive within one to three days (this used to be four or more weeks) due to standards set by the counties and due to communications via MedCom. The ability to use data for clinical research is another benefit.

Simplified repeat medication prescribing is a major benefit. A process that used to entail having to pull charts and handwrite a script now takes 10 seconds – interestingly, a comment frequently made by British GPs as well. Danish physicians say that they have much quicker access to patient data – particularly recent reports and results. They are able to finish all that needs to be done while the patient is still present. Streamlined billing, though not a clinical benefit, is nonetheless a benefit as well. Though there is apparently little hard data available, some physicians have said they save one hour per day of staff time. As a result, they are able to see more patients – the estimate is 10% — which they argue covers the cost of the computer system. Two surveys in 1998 found that a GP saves more than 30 minutes each day as a result of receiving electronic lab results and discharge letters and sending electronic prescriptions.

Other driving forces include:

- Apparently many physicians access the Internet two to three times daily from their offices. One reason is to see the waiting times for X-rays for all the clinics in their county, This web-based service includes a list of the procedures done at each clinic, and is often viewed online with the patient to make joint decisions as to where the patient should go. Another reason is to obtain vaccination and disease information for specific countries for patients going abroad.
- Peer influence – collegial pressure – has played a part. Early adopters apparently often hosted their colleagues to show them how the computer system affected their work life. At the yearly, one-week GP education seminars – referred to as GP days – there are IT workshops each day covering topics ranging from basic computer use to advanced use of diagnostic coding.
- The PLO (the organization of general practitioners) wrote conversion software to facilitate the transfer of patient data from one physician system to another.

Support from the counties was another influencer. Since 1992, the counties have been providing GPs with a diskette of all their patients

when they first start their practice. In 2000, the counties started to provide a help desk and training by a "data consultant" who visits the practices on a regular basis. The service is now offered by eight of the 14 counties; by 2004 it will be obligatory that every county provide the service. The counties fund "practice coordinators" for each specialty (general practice, psychiatry, general surgery, etc.). These physicians work two to three hours per month to coordinate and communicate the wishes of their colleagues to hospitals and viceversa. The physician IT agenda moves forward through them.

A significant driving force – perhaps the largest one – was when the PLO and the County Association negotiated the creation of an Out of Office Hours (OOH) service for the country in 1997. There are about 30 OOH services across the country which provide patients with access to a GP from 4 p.m. to 8 a.m. and on weekends. There are no walk-in clinics in Denmark. A typical GP serves three times per month on a fee-for-service basis. Depending on the need, there could be up to three GPs present. Some GPs may be on call for house visits as part of the service. Some OOH services are based at hospitals, while others are in offices adjacent to a GP practice. Patients are encouraged to call their OOH before going to the hospital emergency department.

All OOH services use the same computer system (funded by the counties) and all GPs had to learn how to use it if they wanted to be paid for their time at the OOH. As a further incentive, the PLO developed the formats for data exchange between the OOH computer system and the physician office systems.

The primary clinical purposes of the OOH computer system are to: (a) send medication prescriptions directly to a pharmacy (there is currently no decision support built in); and (b) generate a report, which is sent electronically to the appropriate GP's office system. Both types of messages are sent via MedCom. The OOH computer system is less sophisticated than many would like it to be as most of the data is textual – only five to six fields are structured (for example, allergies). While in an OOH clinic, a GP currently only has access to patients seen in any

OOH clinic in that county. They currently do not have access to their own systems via the OOH system. However, many of the physician office systems do support remote access.

FACTS ABOUT MEDCOM

The purpose of MedCom was to establish a nationwide healthcare data network. The MedCom Board is chaired by the Ministry of Health and co-chaired by the County Association. MedCom is funded from a variety of sources, namely:

- 1/3 from the Ministry of Health
- 1/3 from the County Association
- 1/3 from other sources
  - Association of Municipalities (recently)
  - Copenhagen and Frederiksberg municipalities
  - Dan NET/Danish Telecom (the mailbox supplier)
  - Danish Doctors Association (early on only)
  - Danish Pharmacy Association
  - Ministry of Social Services (recently)

MedCom has nine people on staff and an annual budget of 11Dkr/year, of which 45% covers the basic costs for running the organization – salaries, office space, office system software, administration, travel costs and informational materials. The remaining 55% goes towards specific projects, contracts, external advisors, training courses, and meetings (including paying physicians for participating). When fulfilling a contract, if the solution is implemented on time, the counties and the software companies receive a financial bonus.

More than 90% of the 2,000 GP clinics/practices are computerized. The 10% of non-users are primarily those who will retire in the next three years and those just starting without the necessary capital. Typically, new GPs require one to two years before they introduce a computer system. The upcoming agreement between the County Association and the PLO is expected to mandate that by December 2004, electronic communications must be used and all GPs must have a computer system.

In their January 2003 agreement, specialists were encouraged to invest in computers. They

receive 15,000 Dkr to install computers and use electronic communications. Specialists already having computers but no communications capabilities receive 5,000 Dkr to invest in communications software.

There are currently 11 suppliers who support 16 different physician office systems. Three suppliers have 57% of the market. Only seven of the 16 systems are Windows-based. It is expected that the number of suppliers will drop to five or six over the next three to four years, as the owners of the smaller companies retire and the Internet-based requirements are introduced.

In addition to coordinating the communications service, MedCom sets all the standards. A contract is signed with the counties and the PLO obliging everyone to use them. County compliance is regularly monitored and reported via MedCom's website. MedCom now also monitors which GP has what kind of system, the functionality being used, and compliance to MedCom standards. Over the past three years, MedCom has been closely monitoring compliance due to the earlier different implementation of the standards. A steering committee of the paying agencies meets every three months to review compliance data.

MedCom provides an on-line "Yellow Pages" which allows GPs to see who they can communicate with electronically. It has been reported that GPs increasingly favour referring patients to specialists who are automated. Few offices are totally paperless as there are still paper documents coming in (such as consultation reports from non-computerized specialists or physiotherapists). A small number of practices scan such documents into their system.

A growing number of discharge letters from specialists are now being received by e-mail as GPs prefer electronic documents; paper-based ones need to be retyped or scanned. Currently, more than 50% of the résumés (800,000 per year) are sent electronically.

MedCom tests and certifies all supplier systems. Two full-time staff are devoted to certification and to providing advice to suppliers. Currently suppliers do not have to pay for certification, which entails not only messaging standards but also presentation formats, functionality, ability to change, etc. Certification takes about one week and includes a visit to supplier offices to run test protocols. At present, suppliers are certified for life unless they introduce major changes such as converting their operating system from DOS to Windows.

For the past four years, MedCom has been including suppliers in setting new standards. Recently a new microbiology message was needed, so MedCom sent two microbiologists, two GPs and all physician office and lab system suppliers to France to agree on a new standard. After a three-day journey, they came back with a standard to which everyone agreed; several suppliers immediately implemented it. The suppliers in Denmark are apparently a reasonably happy lot; they appreciate having only a "oneletter" solution that applies to a variety of types of messages and to everyone. What the Danish refer to as "letters" includes:

- Booking messages
- Consultation reports
- Discharge summaries
- Emergency reports
- OOH reports
- Outpatient clinic reports
- X-ray reports, etc.

WHAT DOES A TYPICAL PHYSICIAN OFFICE SYSTEM LOOK LIKE AND COST?

Most GPs enter their own clinical notes and data (some dictate) and use their computer in the office to review patient files. Some review files from their homes. All use their systems for internal bookings as well. Several physician office systems have an impressive colour-coding scheme whereby a physician's list of patients to be seen that day would change depending on where the patient was. The patient's name would become green when the patient entered the physician office and swiped an ID card in the reader on the receptionist's desk (this triggers the reimbursement and reduces fraud). The colour goes to blue when the patient is in an examining room, and to red when an order that needed some type of followup is placed. Once the physician has completed his or her notes, the patient's name goes to black.

Many GPs have more advanced systems (for example, saving dermatological images, or EKG tracings which can be compared to pre-

vious ones). GPs are increasingly doing ICPC coding in order to be able to pull out all episodes of care for a given condition. All the specialists in hospitals apparently do their own ICD-10 coding – there is no central medical records coding function.

The initial investment (not currently tax-deductible) for a system to support one GP and one assistant is on the order of:

80,000 Dkr	hardware (two workstations, server and communications server, two printers, slot/card reader, back-up, UPS, installation)
20,000 Dkr	software including training from the supplier
25,000 Dkr	VAT tax (currently not deductible)
125,000 Dkr	Total (approximately $25,000)

The annual running costs, which are tax-deductible, are in the order of:

10,000 Dkr	upgrades & support
3,000 Dkr	communications mailbox (location #)
4,000 Dkr	messaging costs (1-2 Dkr each)
17,000 Dkr	Total (approximately $3,500)

Early in 2003, ASP solutions (server and software at the supplier site and just terminals at the physician office running on ADSL lines using a VPN network) became available at costs on the order of 15,000 Dkr plus 25% VAT for a single user/one workstation and including communications). In these cases, the annual running costs are about 14,000 Dkr plus VAT, including updating, back-up, ADSL lines and all messaging costs. Specialists who are in single-user clinics are the primary users of this approach.

It is worth noting that, unlike in England, the sender of a message in Denmark pays for it. In the case of prescriptions, part of this charge is passed on to the patient at the pharmacy.

HOW ARE PRESCRIPTIONS HANDLED?
GPs enter all medications themselves. They access a drug database that is maintained cen-

trally by the Danish Drug Agency. The agency automatically updates the physician office systems every 14 days. Physicians are required to use the lowest-cost drug unless a "no-substitution" order is given. Most systems provide some decision support in terms of drug-drug interaction, warnings concerning pregnant patients, etc. After the physician selects the patient's pharmacy from a pull-down menu (often a default), the prescription is sent electronically to the specific pharmacy.

Pharmacies pull messages from their mailboxes – following receipt of a "you have mail" message. An acknowledgement from the pharmacy is automatically sent back to the physician office system. MedCom is considered more secure than normal mail (the VAN checks the validity of the phone number calling in). The VAN (the mailbox handler) also uses a VPN technical solution whereby the Internet is used, but the VPN has a hardware box at the sender and at the receiver sites, which encrypts all the data transmissions. All users have a single logon and password, which is never changed. Apparently there has never been a privacy issue with MedCom (not so with hospitals).

The future medications agenda is to develop a central database of all dispensed medications (i.e., a BC PharmaNet type system); a monitoring of dosage changes, and an updating of the database by home care nurses as to what medications were actually taken.

About 85% of the GPs are able to send electronic prescriptions. All 332 pharmacies with four different IT systems are able to receive electronic prescriptions.

GPs pull their messages (some every five minutes, others once a day). All transactions go into a mailbox and into the patient's EMR automatically. All messages in the mailbox must be seen/approved/acknowledged by the GP before they can be removed from the mailbox. Until this happens the message displays as "not read."

CHANGE MANAGEMENT – THE DATA CONSULTANT
The data consultant is a service scheme with general practice as its primary target group and with the overall aim of strengthening the use of

computers for quality development. The scheme was introduced on a trial basis in Funen County in 1998. By 2001, the data consultant became a permanent fixture in all 14 counties. The aims of the data consultant scheme are to:

- 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;
- strengthen quality development work in individual medical practices and at the individual GP level, partly by using data extraction in medical practices;
- pass the centrally registered key figures on directly to the individual medical practice. When a GP sends reimbursement claims to the county administration, all the data about the type of visit, the number of prescriptions, and several other items are collected and compared to figures from other GPs. Statistical information, such as the mid-range of visits to GPs, number of prescriptions, etc., is automatically sent to each individual GP for quality assurance and quality control purposes.

A typical data consultant working for a county:

- Regularly visits GPs in their own practice at least two times per year and talks to them about the use of their EMR.
- Explains the system's possibilities – especially the opportunities to extract data and use it for quality monitoring.
- Provides hot-line assistance, mainly for communication issues (the consultant has a copy of most of the IT systems and it is often able to help by phone).
- Communicates with suppliers of the different electronic medical record systems.
- Arranges supplementary (i.e., beyond what the suppliers provide) courses for all the staff in the practice in using their IT system for specific topics, such as ICPC coding. The courses are part of the data consultant service and are provided at no cost to the physicians and their staff.

- Reassures GPs that they're not on their own – help is readily available.

WHERE ARE THEY GOING?
MedCom 4 (2002-2003) is a natural extension of the previous MedCom projects. The focal areas are:

- Internet-based infrastructure for EDI, e-mail, web lookup, telemedicine, etc.
- Development and implementation of communication to and from EPRs in hospitals
- Continued dissemination and quality assurance of the existing EDI communication

The new healthcare data network – likely to be in place by December 2003 where healthcare professionals and patients will exchange information – will be based on Internet technology. The new network will be established by joining existing intranet networks in each county 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. 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, this 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 will be established by regularly expanding and routinely updating the National Board of Health's partnership table, which today contains the EDI addresses of the healthcare sector. This new table will eventually supersede the existing MedCom yellow pages, which are currently only updated every few months. This address list appears to be similar to the provider registry which a number of Canadian provinces are in the process of implementing.

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

1. Structured EDI messages – to become XML-based
2. Secure clinical e-mail (currently there is no encryption)
3. Electronic booking of secondary referrals and procedures at GP clinics
4. Web access (XML EPR) for both physicians and patients
5. Patient monitoring
6. Telemedicine – likely to start with tele-dermatology
7. Healthcare information systems – VISINFO – a web-based information service for both professionals and the public.

A decision has been taken in Denmark that XML is to be used for public exchange formats. The overall purpose of the "XML EPR project" is to organize the MedCom standards for the primary sector so that they can be re-used in the hospital area. The project will cover 26 types of messages and involve 36 different IT suppliers. As the project title indicates, the intention is to change over from EDIFACT to the modern XML syntax for hospital internal communication.

CONCLUSION

Denmark is a small country with a big story to tell. It's a story of success based on many factors: on cross-sector agreements in a country without regional health authorities; on cross-professional agreements involving physicians, IT suppliers, counties and the federal government; on

everyone – providers and suppliers – committing to one standard and agreeing to use it; on viewing healthcare information technology as a political priority; and finally, on establishing a trusted and reputable non-profit company to organize the process, set the scene and deliver the goods.

Can we do the same in Canada?

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