# Widespread Adoption of Information Technology in Primary Care Physician Offices in Denmark: A Case Study

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**ABSTRACT:** Denmark is one of the world's leading countries in the use of health care technology. Virtually all primary care physicians have electronic medical records with full clinical functionality. Their systems are also connected to a national network, which allows them to electronically send and receive clinical data to and from consultant specialists, hospitals, pharmacies, and other health care providers. Under the auspices of a nonprofit organization called MedCom, over 5 million clinical messages are transferred monthly. One of the most important innovations has been the "one-letter solution," which allows one electronic form to be used for all types of letters to and from primary care physicians; it is used in over 5,000 health institutions with 50 different technology vendor systems.

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## Introduction

Denmark is one of the world's leading nations in the use of health information technology. All Danish primary care physicians use electronic medical records (EMRs); 98 percent of primary care practices have advanced clinical functionality.[1] The robust EMR (i.e., one with full clinical functionality) allows primary care physicians to electronically manage medication lists, generate problem lists, enter clinical progress notes, access image archives, use external decision-support programs, and send patients automatic reminders for preventive care. Through services provided by a nonprofit organization called MedCom, primary care doctors are also able to use clinical messaging to communicate with other areas of the health care

### Danish Primary Care Practices Have Advanced Information Technology Capacity

- Ninety-eight percent of primary care practices (PCPs) use full clinical functionality of EMRs.

- Danish PCPs have the capacity electronically to:
    † manage medication lists
    † generate problem lists
    † enter clinical progress notes
    † perform clinical messaging
    † issue automatic preventive reminders
    † access external decision support programs; and
    † generate electronic prescriptions and send them to pharmacies.

- All out-of-hours services use the same computer system as PCPs, a requisite for getting reimbursed.

- PCPs and specialists are paid a small fee for e-mail communications with their patients.

- Danish PCPs use over 60 standardized messages to electronically transmit and receive clinical data in the Danish health care sector.

- A unique patient identification number is ascribed to each Danish citizen and used across several jurisdictions, including health and taxation.

sector—including specialist care, hospitals, laboratories, and pharmacies. All laboratory tests and results, medication prescriptions and refills, and referrals to hospitals and specialists are sent and received electronically. Primary care physicians are automatically notified when their patients register in the emergency department of a hospital and receive reports electronically when their patients visit an out-of-hours care center. Over 90 percent of all clinical communication between primary and secondary care is exchanged electronically.

Introduced in 2005, the Danish National Health Portal (Sunhed.dk) has been particularly successful in providing patients electronic access to their EMRs and facilitating communication between patients and the regional health service. E-mail communication between patients and primary care doctors is widespread. Patients can also electronically schedule appointments; renew prescriptions; access laboratory results, hospital discharge letters, medication profiles, and waiting list information; and view who has accessed their data.

Primary care doctors have only been mandated to use health IT since 2004, but other factors have facilitated the introduction and implementation of EMRs into Danish primary care practices, including national policies dating to the early 1990s, peer pressure, technical assistance, and the use of a national health system integrator, MedCom. Such policies included national standards to ensure the interoperability of electronic data and payment innovations—namely, quicker reimbursement for physicians who use EMRs and financial incentives to primary care practices for phone call and e-mail consultations. Peer pressure has been competitive and supportive. Public monitoring of participation coupled with patients' views that physicians not using EMRs are "second-rate," compelled primary care physicians (PCPs) to install IT in their practices. But the pressure has also been collegial and collaborative, with early adopters sharing with colleagues how computer systems affected their practice. Danish primary care physicians report increased efficiency because of the use of computers and automated systems. They report saving approximately one hour per day of staff time, which offsets the costs of investing in and maintaining an EMR; better coordination with hospitals and emergency departments; and quicker access to patient data. Finally, the use of a health system integrator to develop a national health IT infrastructure, set standards for electronic communications and information, certify suppliers, and provide technical assistance, has allowed for system integration and interoperability that would otherwise be difficult to achieve.

Data about Denmark were gathered through visits and interviews with Danish officials and general practitioner (GPs) over the past five years, as well as through a review of the scientific literature.

## Background: Health Care in Denmark

Denmark is a small country with a population of 5.5 million, about the same as Wisconsin or Maryland. Since 1970, most decisions regarding the form and content of health care activity have been made at the county and municipal level. Up until 2007, the 14 counties and 275 municipalities financed health care services partly through taxes, which they levied themselves, and partly through block grants from the national government, allocated according to objective criteria including population demographics. There is little cost-sharing in the Danish health care system—GP and specialist visits are free at the point of service. There are low deductibles and copays for prescription medications, with annual caps (US$678) for chronically ill patients. Until 2007, the 14 counties owned and operated 65 acute care hospitals and were responsible for the specialist physicians who practice in them. Danish citizens are free to select among the hospitals. They are also guaranteed not to wait more than one month for any treatment. Private hospital providers are limited, accounting for less than 1 percent of hospital beds. Municipalities were responsible for home care, long-term care, and social care (e.g., help with washing, dressing, or feeding). In January 2007, the 14 counties were replaced by five health regions that derive their funding solely from the national government. At the same time, the number of municipalities was reduced from 275 to 98. They continue to have the same mixed funding and health care responsibilities.

Denmark has 3,450 primary care physicians in 2,090 practices. About 25 percent of Danish primary care physicians are solo practitioners. Patients must choose and register with a GP within 10 kilometers of where they live; 99 percent of the population does so, with 1 percent of Danes having an exception to register with a GP further away. Follow-up and management of patients with specific chronic illnesses, such as diabetes, chronic obstructive pulmonary disease, and heart disease,

is performed in specific disease management programs. Twenty-five percent of all GPs participate in the disease management programs, which includes a team-based approach that uses nurses to manage and monitor patients (e.g., taking measurements for lung functions, weight, ordering laboratory tests, etc.). Results from subsequent consultation with the GP are stored in a national database called the sentinel data collection module.

GPs are self-employed and act as gatekeepers, and are paid a combination of capitation (30%), based on the number of patients on their list, and fee-for service (70%). The annual income for Danish primary care physicians is approximately 1,000,000 DKK (US$200,000), which is similar to salaries for primary care physicians in the United States. A typical primary care physician has 1,400 to 1,500 patients, up to a maximum of about 2,400, and typical office visits are eight to 10 minutes long.

Among countries in the European Union, Denmark has the highest public satisfaction with the health care system.[1] Primary care physicians are paid to be accessible by phone from 8:00 a.m. to 9:00 a.m. every morning to take calls from patients. Primary care physicians and specialists are now also paid for e-mail communications with patients. The fee for e-mail consultations, which are primarily about lab results, is twice that for telephone calls. Currently, there are some 50,000 e-mails per month exchanged between physicians and patients. Use of e-mail by physicians became mandatory in January 2009.

In 1997, the Danish Medical Association and County Association (the umbrella organization that brings together all of the counties) negotiated the creation of out-of-office hours (OOH) services. Thirty OOH services were established, which are physician-organized cooperatives that provide patients with free in-person or telephone access to primary care physicians from 4:00 p.m. to 8:00 a.m. daily, as well as on weekends and holidays, and home visits if needed. There are no walk-in clinics in Denmark. Some primary care, physician-run OOH services are based at hospitals, while others are in offices adjacent to primary care practices. Patients are encouraged to call their OOH service before going to the hospital emergency department.

## History of Health Information Technology in Denmark

In the mid-1980s, Danish primary care physicians began to receive a small financial subsidy for electronic transmission of medical claims. This function, which was handled by sending a floppy disk to the public health insurance agency, stimulated physicians to purchase computers for administrative use. It also created the early infrastructure for future use of computers for clinical purposes.[2]

In the late 1980s, a Danish primary care physician, who also worked part time in a Funen County hospital biochemistry lab, and a pathologist, convinced the head of IT in Funen County that sending clinical messages electronically would be of particular benefit to primary care physicians. As a result, in 1990, the FynCom project was created to connect two primary care physicians on one system with a hospital system and a lab system. The project (later to be called MedCom) went ahead without formal approval and became a part of the Funen County IT strategy. By 1992, lab results and discharge letters were being transmitted electronically to a number of primary care physician practices and EMRs became a reality. At about the same time, prescriptions started being transmitted from primary care physicians to pharmacies.[3]

In 1994, the local FynCom project was nationalized and MedCom was created with support from the Ministry of Health. A three-year national project was established to:

- Compile national standards for the most frequent text-based clinical messages in the Danish health system.

- Develop communication standards for the most common communication flows between health care organizations and private companies linked to the health care sector.

- Establish a coherent Danish health care data network.

In 1997, MedCom, an independent nonprofit organization, became a part of the Danish national IT strategy. MedCom was given the mandate to expand and to further develop communication standards for the most common communication flows between local authorities and hospitals; expand communication between medical practices, hospitals, and pharmacies; and to carry out pilot projects in the areas of the Internet, telemedicine, and dentistry. By 2000, MedCom was recognized as a permanent fixture with a clearly stated mission: "To contribute to the development, testing, dissemination and quality assurance of electronic communication and information in the health care sector with a view to supporting coherent treatment, nursing, and care." Centralization of data was a key requirement. MedCom's expanded role included: facilitating communication between hospitals and physician offices, developing and implementing electronic patient records, and developing and expanding the infrastructure in the health care data network using Internet technology.

The percentage of primary care physicians using computer technology for clinical purposes rose from about 15 percent in the early 1990s to over 90 percent by 2000. The introduction of electronic communication, using MedCom standards, for discharge letters, x-ray reports, lab results, electronic prescriptions and reimbursements, as well as the introduction of the new out-of-office hours (referred to as regional call centers) in 1997 contributed to the jump in the use of technology by primary care physicians. By 2002, MedCom was seen to be a critical part of the national IT health care strategy and its mandate became focused on seamless care and a higher degree of patient involvement.

Since 2000, MedCom has tested and certified all supplier systems in Denmark. Two full-time staff members are devoted to certification and to providing advice to suppliers. To become certified, suppliers must meet all messaging standards, presentation formats, and functionality. Completing 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 (e.g., convert their operating systems). Currently, suppliers do not have to pay to have their systems certified.

There are currently 10 suppliers who support 13 different physician office systems, with the major

products being either locally installed or provided by an Internet service provider. Three suppliers have 57 percent of the market; 12 of the 14 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 new Internet-based requirements are introduced. Overall, there are some 60 vendors with over 100 software systems, ranging from physician office systems to hospital clinical laboratory systems, using the MedCom network.

MedCom employs 14 people and has an annual budget of 15 million DKK per year (US$2.9 million); 50 percent of the budget covers the basic costs of running the organization. The remaining 50 percent is used toward specific projects, contracts, external advisers, training courses, and meetings (including paying physicians for participating). When fulfilling a contract, if the solution is implemented on time, the health regions and the software companies receive a financial bonus from MedCom. The MedCom board is chaired by the national Ministry of Health and cochaired by the Association of Danish Regions. MedCom is funded from a variety of sources: the Ministry of Health covers one-third of the costs, as does the Association of Danish Regions (formerly the County Councils Association). The remaining third comes from other sources, such as the Association of Municipalities and the Danish Pharmacy Association.[3] In its role as a health system integrator, MedCom has supported health IT development by having the specialized expertise to solve complex issues, a contractual commitment and external governance that minimizes risk and provides reassurance to patients and health professionals, and a goal of reducing investment risk to regional and national governments.

## Electronic Medical Records

Virtually all Danish primary care physicians use their electronic medical records (EMRs) to capture clinical notes—including all medication prescriptions—either by entering the data themselves or dictating it for later entry by office staff. Most primary care physician offices are "paper-light." Danish primary care physicians and specialists use their computers to electronically send and receive clinical messages such as prescriptions, lab requests, lab results, discharge summaries, and referrals. Sixty standardized messages (up from 32 in 2002) have been implemented in about 100 computer systems, including 16 physician office systems, nine hospital systems, 12 laboratory systems, and three pharmacy systems. Most primary care offices also scan important residual paper documents into their EMRs. One of the most important innovations has been the "one-letter solution," which allows one electronic form to be used for all types of letters to and from primary care physicians; it is used in over 5,000 health institutions with 50 different IT vendor systems. Before it was introduced, there were hundreds of different paper-based forms that GPs had to use to request tests and consults, while each hospital had its own forms for specialists to use to send back discharge letters, consultation findings, laboratory results, etc.

All out-of-office hours (OOH) services in the country use the same computer system, which is funded by the regions, and all primary care physicians must learn how to use it in order to be paid for their OOH time. The primary clinical purposes of the OOH computer system are to send medication prescriptions directly to pharmacies and to generate reports, which are sent electronically to primary care physicians. Primary care physicians working in the OOH only have access to patient data prerecorded in the OOH system. That is, they do not at present have access to patients' data in their primary care physicians' EMR, although there are ongoing discussions about whether to allow this. The feature is technically possible, as all GP systems are able to export a full EMR using a MedCom standard that is regularly used when patients change GPs.

Another major benefit to Danish physicians is simplified repeat medication prescribing, including access to lists of generic drugs. A process that used to involve pulling charts and handwriting a prescription now takes 10 seconds. Danish physicians say that they have much quicker access to all their patient data, particularly recent reports and results. They can finish all they need to do while the patient is still in the room. In addition to being a time saver, particularly for repeat prescriptions, the automation of medication prescriptions addresses

legibility concerns, which enhances patient safety. This functionality dovetails with pharmacy systems that ensure accurate dispensing and offers decision-support capabilities, in some cases as part of a national pharmaceutical association database.

In Denmark, primary care physicians enter all prescriptions for medications themselves. They access a drug database that is maintained centrally by the national Danish Medicines Agency. The agency automatically updates the physician office systems every 14 days. Physicians are required to use lowest-cost drugs unless a "no substitution" order is given. Most systems provide some decision support in terms of things like drug–drug interaction and warnings concerning pregnant patients. Recently, there has been a push to develop national standards for decision support (similar to the Common User Interface in England), which all vendors will be required to introduce into their systems. The decision support around medications makes use of a central national medication database and the MedCom virtual private network. The development and dissemination of medication-related capabilities involves MedCom, the Danish Doctors Association, primary care physician vendors, and the Danish Medicines Agency.

After the patient identifies which pharmacy he or she wishes to use, the physician selects the pharmacy from a pull-down menu and the prescription is sent electronically to that pharmacy. All 321 pharmacies with three different IT systems can receive electronic prescriptions. An acknowledgment from the pharmacy is automatically sent back to the physician's office system, with all transmissions encrypted. A complete medication record is being developed by the Danish Medicines Agency, which will bring together all medications prescribed by GPs, hospitals, home care, and the OOH offices. Clinical guidelines are also available to primary care physicians. When coding in ICPC/ICPC2, which 60 percent of primary care practices do, GPs are able to link directly to specific guidelines and relevant clinical information. This capability is most frequently used for patients with diabetes, chronic obstructive pulmonary disease, and those needing anticoagulant therapy.

Primary care physicians access their messages, some every five minutes, others once a day. All transactions go into a mailbox and into the patient's EMR. All messages must be acknowledged by the physician before they can be removed.

Danish physicians also benefit from improved communications and efficiency by using their computers. They report much-improved dialogues with hospitals; for example, receiving test results as soon as they are available, as opposed to the former wait time of about five days. In addition, they are automatically notified when patients are registered in emergency departments of most hospitals. And, hospital discharge summaries arrive electronically within two days, compared with more

## Danish Primary Care EMR Interoperability

- PCPs are connected to specialists, pharmacies, laboratories, and hospitals via clinical messaging systems.
- Over 90 percent of clinical communications in the primary care sector are exchanged electronically over the Danish national network.
- *Electronic prescribing*
    - All pharmacies are able to receive electronic prescription messages.
    - PCPs can access the Danish Medicines Agency's database.
    - Most systems provide some level of decision support (e.g., alerts on drug interaction).

- *Danish National Health Portal*
    - Patients and providers can access laboratory results and medication profiles.
    - Patients can access waiting list information, schedule PCP appointments, send e-mails to PCPs, renew prescriptions, and also view who specifically has accessed their health records.

- *e-Journal*
    - Patients' hospital care records (including discharge summaries and laboratory and medication data) are available to patients, hospital-based physicians, and primary care physicians.

than four weeks previously, because of policies set and enforced by the former counties.

Though there is little hard data available, some Danish physicians have said EMRs save one hour per day of staff time. As a result they are able to see more patients—an estimated 10 percent more—which they argue more than covers the cost of the computer systems.[3] Two surveys in 1998 found that primary care physicians save more than 30 minutes each day as a result of receiving electronic laboratory results and discharge letters and sending electronic prescriptions.[5] Recent studies in Denmark have found that 50 minutes are saved per day in each primary care physician practice, telephone calls to hospitals are reduced by 66 percent, and €2[3] (US$3.30) is saved per message, of which there are 60 million per year.[5] The cost of a typical EMR is about €4 (US$6) per patient per year, which includes network connectivity charges.

## The National Health Portal

The Danish National Health Portal (Sunhed.dk), which was created in 2005 to provide information about the Danish National Health Service to citizens, serves as a unified hub for electronic communication between patients and the Health Service. The portal permits providers and patients to access laboratory results online. Additional services include: access to medication profiles, waiting list information, online scheduling of primary care physician appointments, e-mail contact to primary care physicians, and online renewal of prescriptions by patients.

The Danes have been capturing hospital discharge abstracts electronically for both inpatient and outpatient clinic visits since 1977. These data are now also available online to patients. Danish patients can view their discharge letters and also are able to drill down to obtain more data through the e-Journal (the Danish equivalent to a national e-health record), provided the hospitals they attended have computer systems that can provide the data. Danish patients also can see who specifically has accessed their data. Over 1,300,000 Danes have received a digital signature, which allows them to access the above information on the National Health Portal.

The discharge abstract data are also accessible by hospital-based Danish physicians and primary care physicians, as are the shared laboratory and medication data. It is worth noting that these data are kept in separate databases. There is no current plan to bring it all together in a centralized comprehensive electronic health record. A national patient index keeps track of where patient data exists in EMRs and in hospital electronic files.

Electronic communication in Denmark occurs over a secure network, which makes physicians and patients comfortable using it. The National Health Information Network is used by over three-fourths of the health care sector, consisting of more than 5,000 different organizations. Around 5 million messages a month are exchanged, or over 90 percent of the total communication in the primary care sector. All 65 hospitals take part, as well as pharmacies, laboratories, general practices, and 98 municipalities. By the end of 2006, all private physiotherapists, dentists, chiropractor clinics, and psychologists were also part of the national network.

## Driving Forces to Adopt Technology

The Danish Doctors Association has always supported MedCom and the use of EMRs by primary care physicians. Over the years, the negotiated funding provided by the Ministry for Quality Assurance to primary care physician practices has been changed to quality assurance and IT support, acknowledging the critical role that IT plays in quality improvement initiatives. Peer influence and collegial pressure also played a significant part in the movement to adopt technology in Danish primary care. Early adopters often shared with colleagues how the computer system affected their work life. At the yearly, one-week primary care physician education seminars—referred to as primary care physician days—there were IT workshops covering topics ranging from basic computer use to advanced use of diagnostic coding.[3]

Another contributing factor to the Danish success story is their "comparative culture." Since inception, MedCom has regularly reported on which counties have led the way in various aspects of primary care IT. The competition helped to spur the introduction of information technology in Denmark.

Nonfinancial support was also a significant factor in Denmark, with support from the counties being a key influencer. Since 1992, the counties (and now the health regions) have provided primary care physicians with a disk of all their patients when they first started their practice. Then, in 1998, Funen County introduced a data consultant scheme on a trial basis—in short, technical assistance for practices. By 2001, data consultants had become a permanent fixture in all 14 counties and have helped to strengthen the use of computers in general practice and, in particular, have promoted the use of electronic communication to attain greater consistency in patient treatment through the timely exchange of clinical data. A typical data consultant working for a region regularly visits primary care physicians in their practice sites at least two times each year. They can demonstrate to physicians capabilities like extracting data or help them improve data quality. They are on call, if needed, and help to reassure primary care physicians that they are not on their own and help is readily available. Denmark has a "cancer treatment guarantee," which requires that treatment begins within 48 hours of receiving a referral form. The data consultants have become responsible for ensuring that the referral cancer forms have been completed (https://www.sundhed.dk/Profil.aspx?id=20264.827).

The health regions also fund "practice coordinators" for each specialty. These physicians work two to three hours per month and coordinate requests for changes to the way the computer systems interact between providers and hospitals. Any concerns that physicians have as a group are brought forward to MedCom by these individuals.

The use of technology by Danish physicians has historically been on a voluntary basis. It was not until the primary care physician contract of 2004 and the specialist contract of 2006 that using computers and MedCom was mandated, although patients would consider primary care physicians second-rate if they did not use computers.[1]

## Technical Aspects of the Danish Information Technology System

Denmark originally chose to develop point-to-point messaging, which allowed physicians to pass information to each other without sharing data in a central repository. The tremendous rise in messaging from 3 million per month in 2005 to 5 million per month in 2009 was much higher than expected. For the past few years, the focus has moved from messaging to Web services such the National Health Portal.[4] Internet use has also increased more than expected, and as a result, the national databases are now used daily by physicians to look up lab results, patient identifiers, and medications. A new Web-based vaccination database will be launched in 2010, with mandatory use beginning in 2011.

Since the 1990s there has been national policy to set standards for electronic data in the health care sector to ensure interoperability. Having chosen EDIFACT (the United Nations/Electronic Data Interchange for Administration, Commerce and Transport international standard) as their communications standard in the early 1990s, the Danes have recently decided to gradually convert to XML as promoted by the World Wide Web Consortium. Currently, 90 percent of communications still use the EDIFACT standard. The use of HL7 (a framework and related communication standard for the exchange, integration, sharing, and retrieval of electronic health information) was discussed in 2001 but rejected because very few IT systems in the Danish health sector were based on HL7 at that time.

In addition to coordinating the communications service in Denmark, MedCom sets all health information-related standards. A contract is signed with the counties (now regions), with the Danish Doctors Association obliging everyone to use the standards. County compliance is regularly monitored and reported via MedCom's Web site. A steering committee of the paying agencies meets every three months to review the status of ongoing projects and the compliance data. As new functions emerge in GP systems (e.g., ICPC-2 coding), they will undergo certification testing for validation and approval (see http://www.medcom.dk/wm109991). MedCom also monitors the kinds of systems used by primary care physicians, the functionality being used, and compliance with MedCom standards.

For more than 10 years, MedCom has included suppliers in setting new standards. When a new message

is needed, MedCom describes the new standard and sends the appropriate system suppliers, along with a few physicians and relevant specialists, to southern France (usually in the winter) to program and implement the new standard. They come back with a standard to which everyone has agreed and a commitment to implement it into their systems. Involving key stakeholders in the process of developing the standards has led to their buy-in.

The Danes may be advanced with respect to health information technology, but they significantly trail England, Scotland, and Wales in terms of structured and coded clinical data. Though most vendor systems can support it, less than 50 percent of Danish primary care physicians code each visit, which makes it harder for them to use their data for clinical audits. It also makes it difficult for researchers to use it to provide outcome data for clinical trials and epidemiological research the way that that British researchers do.

Currently, only 45 percent of hospital beds in Denmark are covered by full electronic patient records, but all hospitals use systems on the inpatient wards for administration and documentation of medications given to patients during hospitalization. Currently, there are eight vendors that provide electronic medication systems in Danish hospitals. There is little order entry capability, mainly for ordering laboratory tests and x-rays. All hospitals also use a common hospital information system—considered a "semi-electronic health record"—which retrospectively collects data on the registration of all episodes, referrals, discharge letters, diagnoses (ICD-10), and all administrative matters related to patients. The data is sent monthly to the National Diagnoses Register.

Denmark has made a national commitment to the translation, distribution, and validation of SNOMED CT (otherwise known as Systematized Nomenclature of Medicine-Clinical Terms, SNOMED CT is a comprehensive system of multilingual clinical health care terminology) as the clinical nomenclature for use in EHRs and EMRs. Approximately 20 million DKK (US$3.8 million) was budgeted for the translation process, which was completed in 2009. Once ready, all vendors will able to imbed the SNOMED nomenclature into their systems; however it is not yet known when this process will be finalized. The new international SNOMED standards body is headquartered in Copenhagen.

## Data Protection Legislation

The Danish Act on Processing of Personal Data went into effect in 2000. The act implements the European Union Directive 95/46/EC on the protection of individuals with regard to the processing of personal data and on the free movement of such data. The act replaced The Public Authorities' Registers Act and The Private Registers Act. The Danish Data Protection Agency exercises surveillance over processing of data to which the act applies. The agency mainly deals with specific cases on the basis of inquiries from public authorities or private individuals or cases taken up by the agency on its own initiative. In 2005, the Act was amended to permit physicians to have access to medication data. Prior to the change, it was against the law to maintain a medication profile outside a hospital.

In terms of patient consent, the current legislation is based on an opt-in model. All physicians are allowed to access the medication profiles of their patients, but all other health professionals must ask the patient's consent before looking at any health information, excluding medication.

Since 1966, every Danish citizen has been assigned a unique national person identification number. In addition to health services and information, it is used in other areas, such as taxation. In health care, it is the unique identifier the patient must provide when going to any health care provider or hospital. When first introduced, individuals were reluctant to give out their numbers to health care providers because of security or privacy concerns; however, today it is part of the fabric of the Danish culture and its widespread use is not an issue as it is in other countries.[5] Furthermore, Danish law forbids the interconnection of IT systems across sectors (e.g., health and taxation).

Privacy laws do not restrict the use of data for quality improvement and public reporting. One emerging trend in Denmark is patients accessing their own data. Though there has been some demand, it has not been nearly as significant as politicians expected.

## Implications of Health Information Technology for Primary Care Practice

It is likely that the use of information technology and its continual enhancement is associated with higher productivity. The number of visits to Danish primary care physicians has increased over the past 15 years while the number of practicing primary care physicians has decreased. At the same time, there is little evidence to suggest that Danish primary care physicians feel they are working too many hours or are burning out. Innovations such as payment to physicians for phone call and e-mail visits with designated call-in times have helped, as has automating processes to save time. Whatever the reasons, there is little doubt that the Danes are the forerunners to effectively using clinical information technology to improve the overall care process in primary care which importantly includes being able to efficiently exchange information with other health care sectors.

## Critical Success Factors in Denmark's Implementation of Electronic Medical Records

As the United States undertakes an ambitious agenda to implement EMRs nationwide, there are useful lessons that may be drawn from the Danish health care system. Critical success factors include the following:

- Denmark had a coherent national policy that supported the development of a national health information technology infrastructure and objectives that linked health information technology enhancements to quality, efficiency and patient-centeredness.

- While the use of health information technology in primary care was historically voluntary in Denmark, beginning in 2004, adoption of EMRs became mandatory under the primary care physician contract and, in 2009, a requirement to use e-mail technology to communicate with patients was instituted.

- Early on, a national health system integrator, MedCom, a nongovernmental organization, was established to provide an overarching national coordinating structure for health information technology development, with a mandate to develop national standards for electronic information, ensure interoperability and seamlessness across the health care system, certify all HIT vendor systems, provide technical assistance to providers, and produce pragmatic market-driven solutions to complex systemwide problems.

- Every Danish citizen has a unique national person identification number that enables the patient's entire medical history to be accessible and coordinated. Privacy is protected by a requirement that all health professionals get patients' consent to look at their health information, with the exception of medication profiles, which are accessible to all physicians.

- A high priority was placed on the engagement of clinicians in determining the precise content of the EMRs and in setting standards for data.

- Provision of technical support, provided and paid for by the government, has been integral to the widespread adoption of EMRs in primary care practice. Data consultants regularly visit practices to train physicians and staff, help practices improve data quality and implement standards, and encourage use of the full functionality of EMRs.

- Fnancial incentives for physicians further spurred adoption of EMR systems and MedCom standards, including faster reimbursement and additional fees for patient–doctor e-mail consultations.

- Peer pressure through public monitoring of participation has been a helpful factor in encouraging EMR uptake in Denmark, with the MedCom Web site displaying a running total of electronic messages sent, participating counties, and compliant vendors.

Denmark is undoubtedly at the forefront of automation in primary care and provides an advanced model

with lessons about the challenges, achievements, and critical success factors from which other countries and delivery systems can learn. The Danish system merits future examination, as the use of IT in primary care continues to evolve, particularly in the areas of developing seamlessness and higher levels of patient involvement as well as in expanding standards.

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## Appendix. Example of a "One Letter Solution"

Letter Head 1. Hospital Referral

| | | | | |
|---|---|---|---|---|
| | Sent: | | | |
| **Priority** | Very high? | | High? | Normal? |
| **To** | ID: | Organisation: | | Department: |
| | Street: | | ZIP: | City: |
| | Contact person or unit | ID: | Name: | |
| **CC** | ID: | Organisation: | | Department: |
| | Contact person or unit | ID: | Name: | |
| **From** | ID: | Organisation: | | Department: |
| | Street: | | ZIP: | City: |
| | Contact person or unit | ID: | Name: | |
| | Phone: | Fax: | | E-mail : |
| **Patient** | ID: | | | |
| | First names: | | Last name: | |
| | Street: | | ZIP: | City: |
| | Home phone: | Work phone: | | E-mail: |
| | Sex: | | Date of Bird: | |
| **Relative** | First names: | | Last name: | |
| | Relation to the patient: | | | |
| **Physician** | ID: | Name: | | |
| **Payment** | No: | Name: | Police No: | Coverage: | Remark: |
| **Signed** | Date: | | Name: | |

Letter Body 1. Hospital Referral

| | | | |
|---|---|---|---|
| **Clinical situation** | | | |
| **Consent** | Patient consents to data being sent (Y/N) | | |
| **Absenteeism** | Patient is absent form work (Y/N) | | |
| **IN/OUT** | In patient? | | Out patient? |
| **Reason** | Code: | Diagnose: | |
| **Allergy** | ID: | Allergy description: | |
| **Medications** | Medications the patient has been prescribed | | |
| **Clinical Information** | Anamnesis<br>Social<br>Diseases<br>Subjective findings<br>Earlier results<br>Told the patient<br>Clinical conclusion | | |

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