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Adoption of Information Technology in Primary Care Physician Offices in Alberta and Denmark, Part 1: **Historical, Technical and Cultural Forces**

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Denmark and Alberta are both advanced in the application of the Western scientific model of healthcare and both currently enjoy similar levels of economic prosperity. Each has a significant investment in medical care, including the use of acute care hospitals, health provision by scientifically trained medical practitioners and dispensing of pharmaceutical agents. Given these similarities, we felt it would be instructive to evaluate the adoption of the latest wave of medical technology, computerized medical records and associated supporting capabilities.

This article evaluates the current state, driving forces and general health system factors that have impacted two culturally and historically different medical jurisdictions – Denmark, a member of the European Union, and Alberta, Canada. Although similar in many respects, there are subtle differences between these two relatively autonomous health systems that have led to varying rates of uptake of medical office computing. The current state of each is different in the magnitude of adoption and also in the manner in which policies have affected this adoption. Nevertheless, within their respective continental domains of Europe and North America, these two jurisdictions have pioneered the introduction of medical computing into a "post-Internet" electronic environment that capitalizes on innovations in electronic medical records (EMRs), provision of basic components of information such as laboratory data and prescribing information, and communication between different health professional groups such as physicians and pharmacists.

Danish physicians became excited with the potential for EMRs during a period when the Danish citizen was willing to have personal medical records captured electronically and when the county (i.e., provincial) Danish governments were supportive of "point to point" exchange of information between health practitioners. Alberta physicians also saw the advantages of medical computing, but socio-cultural restraints related to privacy laws, government management of laboratory data and a strong desire to have centralized repositories of information delayed diffusion. Government funding policies and improvement in data transfer techniques caused a very rapid adoption in Alberta over a five-year period (2001–2006); however, more recent concerns related to data integrity and security have slowed adoption in the past year.

Virtually all Danish physicians use their computers to record their clinical notes and to send and receive clinical electronic

messages. Their national health network (MedCom) is used by almost all the healthcare sector, involving over 10,000 users in more than 4,000 different organizations. Over 90% of the country's primary sector clinical communications with the secondary care sector are exchanged over the network.

The highest use of computers by Canadian physicians is in Alberta. In 2001, less than 3% of physicians were fully automated in Alberta. Now more than 60% use computers for their medical records. Both primary care physicians and specialists have taken up EMRs, in approximately the same numbers. The provincial government, through regional health authorities (RHAs), has participated in a major fashion, by forwarding laboratory data electronically to connected physicians in several, but not all, regions. A parallel effort by the government has been to develop an electronic health record that currently contains laboratory and prescribing information and is accessed by more than 20,000 users, including nurses, physicians and pharmacists.

Healthcare Systems

Though the methods of hands-on delivery of care are virtually the same in Alberta and Denmark, the way in which the healthcare is financed, administered and managed do vary somewhat – as do the cultures of Danes and Albertans. Table 1 summarizes some of the characteristics of the respective healthcare systems.

Table 1. Health system characteristics

	Denmark	Alberta
Population (million)	5.3	3.5
Area of jurisdiction (by 1,000 sq km)	43	662
Total expenditure as % of gross domestic product (2004 OECD)	9%	6%
Public expenditure as % of total expenditure (2004 OECD)	83%	70%
Per capita healthcare expenditures (2005 OECD $US)	2,763	3,001
Number of health regions (as of January 2007)	5	9
Number of acute care hospitals (2006)	65	104
Number of acute care beds/1,000 population (2003 OECD)	3.4	3.2*
Number of pharmacies (2004–2005)	331	865
Number of primary care physicians (2006) – includes family practitioners in Alberta	3,453	3,258
Number of practices	2,000†	600
Per capita primary care physician consultations (2004 OECD)	6.2	6.5
% of primary care physicians who work alone	30	15
Practising physicians per 1,000 population (2003 OECD)	2.9	1.6‡

*This is an Alberta figure and not Organization for Economic Co-operation and Development (OECD) data.

†This figure has been decreasing; there are now 40 communities with no primary care physician. Regions are now building health centres and providing all the basics including computers to encourage primary care physicians to come to underserviced areas.

‡Alberta currently has 5,500 physicians and a population of 3.5 million for a ratio of 1.6; the Canadian average in 2003 was 2.1. According to the Esmail and Walker (2006) report, when doctors per 1,000 population are age adjusted, based on OECD 2003 data, Denmark has 3.0 and Canada has 2.3, though provincial differences occur.

Oversight of Healthcare Delivery

Since 1970, most decisions regarding the form and content of healthcare activity in Denmark have been made at the county and municipal levels. Up until 2007, counties and the local authorities financed 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). Municipalities were responsible for home care, long-term care and social care.

Working in close co-operation with the government and 275 municipalities, the 14 counties were responsible for 65 hospitals and physicians. Acute care is mainly provided by hospitals (the smallest having 25 beds) owned and run by the counties (or the Copenhagen Hospital Corporation in the Copenhagen area, which was disbanded in 2007). Private hospital providers are limited, accounting for less than 1% of hospital beds.

In January 2007, the counties were replaced by five health regions that do not have taxation powers as the counties did. The number of municipalities was reduced from 275 to 98 at the same time.

Alberta has nine RHAs that are responsible for hospitals, continuing care facilities, community health services and public health programs in Alberta. They deliver health services in the regions and work with communities to deliver health services to local residents. The only healthcare expenditures not within the RHA remittance are physician reimbursement, retail drugs and ambulance services. Federal and provincial taxes fund the healthcare expenditures and are provided to the regions on a population- and needs-based formula, the foundation of which is the burden of illness borne by the citizens in that region.

There are 7,452 acute care hospital beds within the nine regions, with the majority (5,000) provided in two major urban regions that contain two million people. Rural regions have some acute care facilities as small as four beds.

Virtually all Danish physicians use their computers to record their clinical notes and to send and receive clinical electronic messages.

Primary Care

Most primary care in Denmark is provided by privately practising primary care physicians, who are paid on a combined capitation and fee-for-service basis. The number and location of primary care physicians are controlled by the counties; primary care physicians' fees and working conditions are negotiated nationally.

Denmark has about 3,500 primary care physicians in 2,000 practices. Danes do not need primary care physicians to refer them to all specialists; Danes are able to go directly to see ear, nose and throat specialists and ophthalmologists. Danish citizens are all also free to select which hospital they would like to go to. In addition, they are guaranteed not to wait more than two months for any treatment.

Approximately 30% of Danish primary care physicians work alone. A typical primary care physician has 1,400–1,500 patients, up to a maximum of about 2,400. A typical office visit takes eight to 10 minutes. Approximately 20% of primary care physicians' income is based on the number of patients on their list, while the rest is fee for service. The annual income for Danish primary care physicians is in the order of 800,000 DKK ($164,000).

Primary care physicians are paid to be at the phone from 8:00 to 9:00 a.m. every morning to take calls from their patients. Both primary care physicians and specialists are now also being paid a fee for e-mail communications with their patients. The fee for each e-mail consultation and/or e-mail (currently primarily about laboratory results) is twice that for telephone calls. Currently, there are some 20,000 e-mails per month exchanged between physicians and their patients. Use of e-mail technology will be mandatory as of the end of 2008.

In Alberta, most primary care is provided by privately practising primary care physicians, the majority of whom are paid on a fee-for-service basis, though that model is beginning to change. Alberta reimburses 15% of its physicians on an alternate funding plan that allows special innovations in care provision. There are no limitations as to the number and location of primary care physicians. Physician fees are negotiated provincially every three to four years.

Alberta has approximately 2,900 primary care physicians in about 600 practices who act as the primary referral source to specialists. Approximately 15% of Alberta primary care physicians work alone. A typical primary care physician has 1,500 patients to a maximum of about 3,000. A typical office visit takes 10–12 minutes. The annual gross income for Alberta primary care physicians, including an overhead expense of approximately 50%, is in the order of $197,000.

In what is referred to as a "trilateral approach," interested groups of physicians organize a network and, in collaboration with their RHAs, submit a proposal to a local Primary Care Network (PCN) committee made up of equal members of the Alberta Medical Association, the RHA and the Department of Health and Wellness. In order to receive funding, the networks have to provide 16 basic services including palliative care, screening programs and minor emergency care. They also expand clinic hours and integrate a triage telephone service to provide assistance 24 hours a day, 365 days a year.

In May 2005, the first PCN involving 59 physicians (mainly primary care physicians) was opened in Edmonton. As of May 2006, there were 500 primary care physicians who were working within operating PCNs, and another 400 physicians

were engaged in developing new networks. Currently, there are 18 PCNs with 30–200 physicians involved.

Alberta physicians rarely communicate with their patients by e-mail and are not reimbursed to do so. Alberta primary care physicians are not expected to take phone calls at set times of the day; they typically call patients in the late afternoon, though this is not a regular occurrence.

Out-of-Office-Hours Services

In 1997, the Danish PLO (the equivalent to the Alberta Medical Association) and the County Association negotiated the creation of out-of-office-hours (OOH) services for the country. At that time, 30 OOH services were established, which provide patients with access to a primary care physician from 4:00 p.m. to 8:00 a.m. and on weekends and holidays. There are no walk-in clinics in Denmark. A primary care physician will typically serve three times per month for 25 hours on a fee-for-service basis; depending on the need, there could be up to three primary care physicians present at once. Some primary care physicians may be on call for house visits as part of the service. Some of the OOH services are based at hospitals, while others are in offices adjacent to a primary care physician practice. Patients are encouraged to call their OOH service before going to the hospital emergency department.

All OOH services use the same computer system (funded by the counties), and all primary care physicians had to learn how to use it if they wanted to be paid for their time at the OOH. The primary clinical purposes of the OOH computer system are to (1) send medication prescriptions directly to a pharmacy (there is currently no decision support built in) and (2) generate a report, which is sent electronically to the appropriate primary care physician's office system. Both types of messages are sent via the MedCom network. The OOH computer system is less sophisticated than many would like it to be as most of the data are textual – only five to six fields are structured (e.g., allergies). While in an OOH clinic, a primary care physician currently only has access to all of the patients seen in any OOH clinic in that county – now the whole region. 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.

In Alberta, notwithstanding the emerging PCNs, the bulk of out-of-office-hours services in urban areas is provided by walk-in clinics, which tend to be open from 9:00 a.m. to 9:00 p.m., seven days a week, including holidays. Out-of-office-hours care in rural areas and at night is done in the approximately 100 hospital emergency departments across the province.

In Alberta, there is no analogous out-of-office-hours payment scheme. Physicians are generally paid on a "fee-for-service" basis, with the schedule of payments dependent on certain factors, such as time of day, length of consultation and location. These fees do not include any requirement to use a particular computer system, although all bills for work must be sent directly, via computer, to Alberta Health and Wellness for reimbursement.

Laboratories

Most laboratory work in Denmark is done in the hospitals – the only private laboratories are in Copenhagen. Laboratory work ordered by Alberta physicians in the community is done primarily by laboratories operated by the RHAs, although a small number of private laboratories provide contractual work to the RHAs.

Currently, there are some 20,000 e-mails per month exchanged between Danish physicians and their patients.

Pharmacies

There are 321 pharmacies in Denmark. Rural physicians are able to dispense medications. Patients may be discharged from hospital with a supply of medications.

In Alberta, there are 865 pharmacies, with five large chains accounting for 90% of them. Physicians do not dispense medications; however, they will give patients samples. Patients are rarely discharged from hospital with a supply of medications.

Unique Identifiers

Every Danish citizen has had a unique national person identification number since 1966; it is used for health and in many other jurisdictions such as taxation. When first introduced, there was a reluctance to give out the number. Today, however, it is part of the fabric of the Danish culture and its widespread use is apparently not an issue.

Every Albertan has a unique provincial health identification number, which is used only by the healthcare system. The number has been in existence since 1995.

History and Evolution of Computing in Physician Offices

Denmark

In the mid-1980s, Danish primary care physicians received a small financial subsidy to electronically send a floppy disk of their medical claims to the public health insurance, which stimulated the purchase of a single administrative computer to use in the physician's office. This created the early infrastructure for future use of computers for clinical purposes.

In the late 1980s, a Danish primary care physician, who also worked part time in a hospital biochemistry laboratory, and a pathologist, who was a professor at the university, convinced the head of information technology (IT) in Funen County that

sending clinical messages electronically would be of particular benefit to primary care physicians.

In 1990, the FynCom project was created to connect two primary care physicians on one system with a hospital system and a laboratory system. The project (later titled MedCom) went ahead without formal approval and long before it became a part of the Funen County IT strategy. By 1992, laboratory results and discharge letters were being transmitted electronically to a number of primary care physician practices, and the emergence of EMRs became a reality. At about the same time, primary care physicians began to transmit prescriptions to pharmacies.

By 2000, an update to the national health information strategy further increased the emphasis on communication between hospitals, pharmacies and physician offices. At that time, MedCom became a permanent non-profit organization whose 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 MedCom Board is chaired by the Ministry of Health and co-chaired by the Association of Danish Regions; MedCom is funded by a variety of sources:

- One-third the Ministry of Health
- One-third the Association of Danish Regions (formerly the County Councils Association)
- One-third other sources: (1) Association of Municipalities (recently), (2) Copenhagen and Frederiksberg Municipalities, (3) Dan NET/Danish Telecom (the mailbox supplier), (4) Danish Doctors Association (early on only), (5) Danish Pharmacy Association and (6) Ministry of Social Services (recently)

In 2002, MedCom moved into new independent offices. 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.

MedCom now has 14 people on staff and an annual budget of 15 million DKK per year ($3.1 million), of which 50% covers the basic costs for running the organization. The remaining 50% is used toward 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 from MedCom.

Alberta

The real growth in physician office computing for medical records in Alberta did not occur until 2001 with the introduction of the Physician Office System Program (POSP). Prior to that time, physicians interested in EMRs were few in number and principally made their own investment on a stand-alone basis. However, by 1992, 90% of physicians were using computers to record their patient visits for administrative purposes, the primary reason being to bill the provincial government for services rendered. Regular submissions of data occurred using modems, which were largely replaced by Internet connection by 1998.

The POSP is an initiative under the master agreement between the Alberta Medical Association, Alberta Health and Wellness and Alberta's RHAs. Phase one of POSP ran from October 2001 to March 2003; 1,500 physicians enrolled in the program. In phase two, which ran from March 2003 to March 2006, a further 1,800 physicians began their EMR journey. In the last intake for phase two of the POSP in March 2006, a record 346 physicians joined the program. Now, 61% of Alberta physicians are using IT in their practices, making Alberta the leading jurisdiction in physician automation in Canada.

Sixty-one percent of Alberta physicians are using IT in their practices, making Alberta the leading jurisdiction in physician automation in Canada.

Each physician enrolled by March 31, 2006, received 48 months of funding, plus any extensions that may occur through future negotiations between the program sponsors. POSP is jointly sponsored by the Alberta Medical Association, Alberta Health and Wellness and Alberta's RHAs. The program is governed by a joint committee consisting of three representatives of each partner or sponsor. POSP's daily administration is run by a program director and program management office.

The 3,369 physicians in the program are practising in 1,074 clinics across the province. These physicians come from all health regions, represent a mix of specialties and roughly mirror the demographic breakdown of the physician population in Alberta.

The POSP is staffed by 23 people; 25% of their effort is involved in developing and monitoring standards for software vendors (vendor conformance and usability requirements [VCUR]), 25% on maintaining the payment inventory and process for enrolling new physicians and 50% on change management processes and programs.

The annual budget of the entire program is approximately $32 million, of which more than 85% is direct payment to physicians to pay for 70% of the costs for their EMRs and associated equipment. Funding was negotiated by the Alberta

Medical Association, on behalf of physicians, as part of their office reimbursement and was provided in lieu of other increases in the fee-for-service payment managed through the provincial payer. The balance of program funding is spent on change management programs, VCUR and special projects related to enhancing connectivity with provincial systems.

Standard Setting

In addition to coordinating the communications service in Denmark, 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 (http://www.medcom.dk). MedCom also monitors which primary care physician has which kind of system, the functionality being used and the compliance with MedCom standards. A steering committee of the major paying agencies meets every three months to review the compliance data.

For the past five years, MedCom has been including suppliers in setting new standards. When a new message is needed, MedCom pays for a few primary care physicians and specialists and all of the physician office and appropriate system suppliers to go to southern France to develop a new standard. After a three-day journey, they come back with a standard to which everyone has agreed; suppliers then have a fixed amount of time to implement the new message in their systems.

In Alberta, the standard-setting process is primarily set through the VCUR process described below. Currently, laboratory results are the only electronic messages being sent to physician office systems; however, a limited production rollout is being used for the Pharmacy Information Network electronic messaging. This allows physicians to post prescriptions online to a central "clearing house," and additionally provides pharmacists with an electronic capability to record medication dispensing online. Standards for these are set by a working group of physicians, vendors and IT personnel from the provincial department of health (Alberta Health and Wellness), with support from technical resource personnel at POSP. An annual review of the standards is undertaken, and changes are posted one year in advance. Vendor solutions are tested against the standards, and only those vendors successfully completing the evaluation are eligible for funding through the POSP.

The POSP has a register of which system is used by each physician it has sponsored. There is no central registry of the 40% of physicians who are not on the POSP.

Certification of Vendor Systems

MedCom tests and has been certifying all supplier systems in Denmark since 2000. 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 and so on. Certification takes approximately 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 system from DOS to Windows).

As part of the POSP in Alberta, the VCUR standard was put into place in 2003. Developed for POSP but serving the needs of all stakeholders, these requirements are based upon collaboration between physicians, clinic managers, physician office system vendors, RHAs and the provincial government. They were built by consensus – on a shared vision for physician office systems that enhance the care physicians deliver, connecting them to a larger world of integrated health information.

VCUR enable the vital information that is generated by physicians in their office to be part of a common provincial platform, and at the same time provide physicians with real-time, point-of-care access to patient information regardless of where this information is generated. VCUR ensure that this occurs in an efficient and standardized way that is based on the need to provide good patient care.

VCUR include common functionalities; billing; scheduling; EMRs; electronic prescribing; workflow; usability and ergonomics (e.g., screen placement; log-in processes; internal messaging; different methods of input; and storage, retrieval and review of data); clinical decision support; access, privacy and security; and mobile communication devices. Some of the requirements went into effect on April 1, 2004; others went into effect in April 2006.

Vendor Marketplace

In Denmark, there are currently 11 suppliers who support 16 different physician office systems, with the major products being installed either locally or through an Internet service provision (application service providers). Three suppliers have 57% of the market. Only 11 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 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 and laboratory systems, using the MedCom network.

In Alberta, there are currently 12 vendors who have satisfied the VCUR standard. All 12 use the MS Windows XP operating system, and five vendors also offer a MAC-compatible version. The majority of the approved vendors are local installers, while a few are application service providers. Five vendors have captured approximately 75% of the market.

Discussion

There appear to be more similarities than differences between

Denmark and Alberta with respect to the practice of primary care and the environment in which it is practised. However, there are significantly more single physicians in Denmark, and there are definitely differences in the population distribution, hospital beds and nature of prescribing patterns. These differences, plus the different stages of health information legislation and infrastructure funding processes, have led to variations in the uptake of EMRs. What is overwhelmingly clear is that physicians in both jurisdictions value laboratory, medication and hospital discharge information, and when these are available are prepared to use EMRs. In Alberta's case, there are issues related to being part of a larger political entity, Canada, which has effects on both market and legal forces, not to mention standard setting. There have also been differences, quite possibly related to the much larger geographic territory in Alberta, that have altered the approach of RHAs to the dissemination of laboratory, hospital discharge and imaging data to physicians.

According to Edwards (2006) of Gartner Industry Research, there are a number of critical success factors in Denmark, many of which generally apply to Alberta as well. These include the following:

- Support to adopt standards that is paid for by others, not the physician. Project coordinators at hospitals involved staff in determining the data to be communicated electronically and developed new procedures for handling electronic messages. Data consultants trained physicians and their staff on how to use electronic communications. In Denmark (and Alberta), physicians were paid to help hospitals and regions communicate better with physician practices.
- Precise standards. Clinicians need to be involved in the precise content of the standards. This process, though time consuming, has resulted in more accurate communications and was critical in educating clinicians about the value of IT.
- Peer pressure through public monitoring of participation – a helpful factor in Denmark (and may be applicable in Alberta). The MedCom website displays a running total of electronic messages sent, participating counties and compliant vendors.
- Gradual approach with realistic time frames. There was an acceptance by all parties that the adoption of electronic communication would take many years and should not be rushed.
- Financial incentives to physicians to adopt EMR systems. Physicians in Denmark are independent contractors who make independent decisions about IT. Physicians who adopted EMR systems and used the MedCom standards received faster reimbursement. Also, MedCom gave physicians 1,500 euros per year to spend on EMR systems. (Alberta physicians dedicated part of their fee increases to computerization in an organized fashion. This helped with professional buy-in.)
- Incentives to vendors. No one required healthcare organizations to use a particular vendor. Counties encouraged vendors to upgrade their hospital applications to the MedCom standards by committing to purchase the upgraded applications. (Alberta used VCUR to ensure vendors used appropriate standards and were able to communicate with the provincial networks.)
- Culture of consensus. MedCom is funded by many different stakeholders and is viewed as an impartial organization. (The Alberta POSP employs third-party individuals and also maintains an impartial perspective on vendors, RHAs and physicians.)
- Project-based approach. Approximately half of MedCom's budget is spent on permanent employees and overhead. The rest is devoted to projects. MedCom believes that this approach has given it more flexibility. (This approximate budgetary expenditure is similar to Alberta's POSP efforts.)

It is worth noting that both Denmark and Alberta are considered "vendor friendly," particularly with physician office system vendors. Compared with other jurisdictions, both more actively involve vendors in the setting of standards and view them as partners.

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