Refereed papers

Adoption of information technology in primary care physician offices in New Zealand and Denmark, part 3: medical record environment comparisons

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ABSTRACT
This is the third in a series of five papers about the use of computing technology in general practitioner (GP) practices in Denmark and New Zealand. This paper looks at the environments within which electronic medical records (EMRs) operate, including their functionality and the extent to which electronic communications are used to send and receive clinical information. It also introduces the notion of a longitudinal electronic health record (versus an EMR).

Keywords: electronic health records, electronic medical records system, evaluation and comparison, medical and health informatics

Introduction

This is the third in a series of five papers about the use of computing technology in general practitioner (GP) practices in Denmark and New Zealand. This paper looks at the environments within which electronic medical records (EMRs) operate, including their functionality and the extent to which electronic communications are used to send and receive clinical information.

Virtually all Danish primary care physicians use their EMRs to capture clinical notes – including all medication prescriptions – either by entering the data themselves or dictating them for later entry by office staff. In fact, most primary care physician offices are what are termed ‘paper-light’.

More than 80% of New Zealand’s primary care physicians use their EMRs to capture clinical notes – very few, if any, use dictation systems to do so. A recent Commonwealth Fund survey showed that New Zealand had the highest level of EMR functionality in widespread use (87% of GPs) of the countries surveyed.1

In both countries, the ability to receive and store pathology and radiology results electronically and to make claims electronically stimulated the early development of highly functional EMR systems1 which are now used by nearly 100% of general practices.

The EMR environments

Electronic communications
Virtually all Danish primary care physicians (and as of January 2007 all specialists as well) use their computers to electronically send and receive clinical messages...
such as prescriptions, lab results, lab requests, discharge summaries, referrals, etc. Sixty standardised messages (increased from 32 in 2002) — including a ‘one letter solution’ — have been implemented in about 100 computer systems, including 16 physician office systems, nine hospital systems, 12 laboratory systems and three pharmacy systems. The Danes like to use a gas pump analogy — any automobile can be fuelled, regardless of the oil company which supplies the petroleum or the make of car.

The national network is used by over three-quarters of the healthcare sector, altogether more than 5000 different organisations. Around four million messages a month are exchanged — over 90% of the total communication in the primary sector. All 65 hospitals, all 321 pharmacies, all laboratories and virtually all general practices take part. As of January 2006, all private physiotherapists (1750 in 550 clinics) and all private dentists (2800 in 1600 clinics) were connected to the network. By the end of 2006, all 240 private chiropractor clinics and all 598 private psychologists were also part of the electronic network. This high level of connectivity means that most Danish primary care physicians run paper-light offices.

Electronic communication in Denmark is over a secure network which explains in part why physicians are so comfortable using it. Physicians pull their messages — some every five minutes, others once a day. All transactions go into a mailbox and automatically into the patient’s EMR. All messages in the mailbox must be acknowledged by the physician before they can be removed from the mailbox. Until this happens messages display as ‘not read’.

Denmark originally chose to develop point-to-point messaging which allowed physicians to pass information to each other without having to share data in a central repository. But for the past few years, the focus has been moving from messaging to on-demand web services based on new MedCom web service standards.

All of New Zealand’s primary care providers, the majority of midwives, all hospitals, all laboratories and most specialists use Health Level Seven (HL7) messaging to communicate with each other via standard internet connections or via a virtual private network (VPN).

Virtually all of New Zealand’s primary care physicians and a significant proportion of specialists exchange HL7 messages. These range from pathology and radiology results, referrals, discharge summaries and specialists’ letters to electronic claims for services performed and status messages sent to patient databases. It is relatively commonplace for a New Zealand general practice to be exchanging clinical messages with between 50 and 60 other organisations. With the exception of prescription messages, which are in the process of being automated in most parts of the country, nearly all clinical communication is electronic.

Most of New Zealand’s general practices are now connected via a secure VPN. However, some communications are still carried out over the internet using encrypted HL7 messaging. The way in which the messaging software works in New Zealand is very similar to that of Denmark.

Communications standards

Having chosen EDIFACT 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 (W3C). The use of HL7 was discussed in 2001 but rejected due to the fact that very few information technology (IT) systems in the Danish health sector were based on HL7 at that time.

Before the ‘one letter’ system was introduced there were hundreds of different paper-based forms for discharge letters, hospital referrals, lab results, etc. Now, there is only one electronic form used for all types of letters; it is used in over 5000 health institutions with 50 different IT providers.

New Zealand has reaped considerable benefit from its early choice of the HL7 standard. Use of HL7 enables access to a world-wide range of systems and services and New Zealand has in turn developed international expertise in system design and development. Health care is New Zealand’s largest software export category.

Standard setting

In addition to co-ordinating the communications service in Denmark, MedCom sets all health information-related standards. A contract is signed with the counties (now regions) and the Organisation of General Practitioners in Denmark (PLO) obliging everyone to use them. County compliance is regularly monitored and reported via MedCom’s website. MedCom also monitors which primary care physician has what kind of system, the functionality being used and compliance with MedCom standards.

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 selected software suppliers to agree about the content and function of the standard. MedCom takes the physicians, specialists and appropriate system suppliers to southern France to develop the new standard which is subsequently programmed and implemented in supplier systems.
In New Zealand, standards are set by the New Zealand Health Information Standards Organisation (HISO), a division of the Health Information Strategy Action Committee which is a ministerial advisory committee established in 2006 to provide governance, oversight and leadership for the implementation of the 2005 Health Information Strategy for New Zealand. HISO is a very small government-funded organisation with a secretariat of just three people. HISO’s role includes appointing chairs for standards committees and recruiting members, convening and organising meetings and facilitating the consultation and balloting process. It is a process which works well for New Zealand. Typically HISO works with consortia of vendors and their customers to develop suites of standards required for the execution of specific projects or development of services. HISO works with the Australian National e-Health Transition Agency and other regional and international standards bodies to ensure that whatever New Zealand is doing is consistent with international developments and activities. New Zealand is one of nine countries that are charter members of the International Health Terminology Standards Development Organization that has purchased the SNOMED coding terminology, which is expected to be a cornerstone standard within New Zealand. New Zealand has long been a bastion of HL7 development and in August 2007 hosted HL7’s International Interoperability Conference.

**Structured data**

Though the Danes appear to be the most advanced nation in the world, they trail England and Scotland in terms of structured and coded clinical data. Though most vendor systems can support it fewer than one-third of Danish primary care physicians are using the International Classification of Primary Care to code each visit, which makes it harder for them to use their data for clinical audit. It also makes it difficult for researchers to use primary care physician data to provide outcome data for, say, clinical trials and epidemiological research in the fashion in which English and Scottish EMRs are able to. Private specialists working outside hospitals, if they do so, code their data using ICD-10. Laboratory and medication data is of course highly structured.

Denmark has made a national commitment to the translation, distribution and health-professional validation of SNOMED CT. Approximately 20 million DKK (€2.7M) has been budgeted for the translation process which is expected to be completed by 2008. Once ready, all vendors will be able to imbed the SNOMED nomenclature into their systems. There is at the moment no contract regarding the time when this process should be finalised. It is noteworthy that the new international SNOMED standards body has its headquarters in Copenhagen.

For the past decade, New Zealand has extensively used the British Read Code system for coding primary care episodes and for submitting information to accident insurers. New Zealand’s hospitals use International Classification of Diseases (ICD) coding. This is, however, about to change with New Zealand’s participation in the international consortium formed to purchase and manage SNOMED CT. There is significant enthusiasm for this development. It is likely that as a consequence of the adoption of SNOMED CT the drive to code information will gain a significant boost.

**Directories**

MedCom provides an online ‘Yellow Pages’ which allows Danish primary care physicians to see who they can communicate with electronically. It has been reported that primary care physicians increasingly favour referring patients to specialists who have automated records. It is expected that by mid-2007 most primary care physician offices will be paperless; currently there are still paper documents coming in (e.g. consultation reports from the 20% of specialists or physiotherapists whose practices are not yet computerised). A small number of practices currently scan such documents into their systems.

In New Zealand there are currently two privately run directories, one a directory of community based healthcare providers (GPs and specialists) and the other providing detailed information on hospitals. Both of these are available in electronic form. The New Zealand Ministry of Health is currently developing a ‘Health Provider Index’. This will be a definitive listing of registered healthcare providers. The index will be used to populate regional and national online directories.

**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, 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 (e.g. convert their operating system from DOS to Windows).

In New Zealand, HealthLink provides an interoperability test laboratory and tests and accredits vendors’ systems. However, as there is a much wider requirement for system interoperability, the Auckland University...
Health Informatics Faculty is also setting up a test facility that will work collaboratively with HealthLink and other parties to provide interoperability testing and accreditation.

**Vendor marketplace**

In Denmark, there are currently 11 suppliers who support 14 different physician office systems, with the major products being installed either locally or through internet service (or application service) providers. Three suppliers have 57% of the market. Twelve of the 14 systems are Windows based. It is expected that the number of suppliers will drop to five to 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.

In New Zealand there are approximately 20 vendors whose products range from physician office systems to specialised systems for physiotherapists, laboratories and radiology service providers. There are four vendors providing physician office systems for primary care. Of these, one has a dominant market share with 80% of the market.

**Access to ‘shared’ clinical EHR data**

The authors are of the opinion that it is important to distinguish between a physician’s office/clinic (EMR) and a shared Electronic Health Record (EHR) since the funding models, governance, ownership and data stewardship issues can be very different. Hence, the authors define an EMR as a provider-centric electronic record in a physician’s office while an EHR is a patient-centric longitudinal (womb to tomb) electronic record of an individual that contains data from multiple EMRs and is typically shared across health care settings and organisations.

**Patient access**

The Danish national health portal was created in 2005 in order to provide information about the Danish National Health Service to its citizens and patients. It is also beginning to serve as a unified hub for electronic communication between patients and the health service. The new health portal permits both providers and patients to access biochemistry laboratory results online via the internet – additional types of laboratory results will have come online by late 2006. Additional services already available on the portal include: access to medication profiles, waiting list information, online scheduling of primary care physician appointments, email contact with primary care physicians and online renewal of prescriptions by patients.

The Danes have been capturing hospital discharge abstracts for both inpatient and outpatient clinic visits since 1977. This data is now also available to patients via the internet using an application called the National Discharge Diagnosis Register (LPR). Not only are the Danes able to see each of their discharge letters they are able to drill down to obtain more data if they wish through the e-Journal (national ehealth record). To date, only 25% of the Danish population is able to do so as not all hospital computer systems are able to populate the website with the detailed data. Over 800,000 Danes have applied to the national health portal and have received a digital signature which allows them to access the above information on the sanhed.dk portal. Danish patients are also able to go online to see who has accessed their data.

It is unlikely that New Zealand will centralise its patient data in regional repositories or portals. However, this is by no means a certainty. While there are proponents of centralised data repositories and regional sharing of electronic health records, there is strong ‘grass-roots’ support for the linking of EHRs to GP health records and making GPs stewards of their patients’ personal health information. Under the ‘GPs as stewards of EHRs’ scenario, patients will be able to have access to their medical records and to consult with their GPs from their home computers using email and web-based tools.

The decision as to whether and how EHRs will be created is a vitally important one and there is a growing debate on this topic.

**Physician access**

The above-mentioned discharge abstract data (so-called Events EHRs or e-Journals), to which patients have access, are also accessible to Danish hospital-based physicians and primary care physicians, as are shared laboratory and medication data. It is worth noting that these data are kept in separate databases and that at the moment there is no intention of bringing them all together in some form of EHR.

It is likely that in New Zealand patient data will be available from several sources:

- a summary patient record held by the patient’s GP
- regional secondary care information
- specialised repositories where patients are enrolled (e.g. for management of cardiovascular disease and diabetes).
New Zealand’s general practices are already sent considerable quantities of summary level information about the treatment their patients are receiving elsewhere in the healthcare system. This reduces the need for GPs to access information external to their own EHR. However, development of web services-based synchronous messaging is allowing GPs to request additional, more detailed information from the above information sources and automatically file it within their EHRs.4

Using approaches currently under consideration a healthcare provider looking for a patient’s EHR information will be able to request it from any of the above sources using the National Health Index to identify the source of the information. Information is requested via a synchronous HL7 request message and downloaded into a patient’s record within an EHR. Information requests will be authenticated via use of an individual practitioner’s digital certificate and each information source will be responsible for auditing who has accessed their systems.

Data protection legislation

The Danish Act on Processing of Personal Data came into force on 1 July 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 the 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 of a hospital.

In terms of patient consent, the current legislation is based on an ‘opt-in’ model which means that all physicians are allowed to access the medication profiles (medication databases) of their patients; all other health professionals must ask the patient’s consent before looking at any health information excluding medication.

Danish law forbids the interconnection of IT systems across sectors (e.g. health and taxation).

New Zealand has had in place a Health Information Privacy Code since 1993. This code is a specialised rendering of the New Zealand Privacy Act. The code is very widely understood throughout the sector and as a consequence there is a high level of awareness of the importance of the privacy of the individual. The code places limits on the reuse of personally identifiable data and mandates the obtaining of individuals’ agreement (whether implied or explicit) for obtaining and sharing personally identifiable health information. This code has played a very significant role in shaping the development of New Zealand’s health information landscape.

Early development of privacy legislation and health sector specific interpretation of it meant that there was a common understanding of what was acceptable. New Zealand developed and introduced a Health Information Privacy Code (HIPC) in 1992. A Privacy Commissioner acts as a complaints authority to enforce the HIPC.

Having a clear strategic direction for the sector (provided by the New Zealand Primary Health Care Strategy) has made it much more straightforward to develop supporting systems and services than appears to have been the case in other countries.

Conclusion

In many respects both the approaches taken and the results achieved in both Denmark and New Zealand are remarkably similar – save in the area of transmitting medication prescriptions. Clearly in both cases progress has been driven by the countries’ medical professions’ collective wish to harness the profound capability of computerisation, coupled with a ‘no-nonsense approach’ taken by a small group of true believers. The fact that these two countries have small populations provides some additional clues as to why they have been able to make greater progress in this field than larger (especially federated) countries.

Denmark has chosen to base its communications upon EDIFACT standards which allows it greater flexibility as opposed to the fairly rigid constraints imposed by HL7. New Zealand benefits from HL7 and the wide range of HL7-compliant technology available internationally. One might assume that it will be easier for New Zealand to make the transition to HL7 Version 3: this may or may not prove to be the case.5

In Denmark e-prescribing in all of its facets has taken hold and is widely used, whereas in New Zealand it is in the early stages. New Zealand on the other hand has widespread use of web-services technology integrated with Public Key Infrastructure while Denmark appears not to have gone down this path to the same extent.

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**CONFLICTS OF INTEREST**

None.

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