Adoption of information technology in primary care physician offices in New Zealand and Denmark, part 5: final comparisons

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ABSTRACT
This is the last in a series of five papers about the use of computing technology in general practitioner (GP) practices in Denmark and New Zealand. This paper introduces a unique comparison instrument developed for this study using the best evidence available namely data was pulled from centralised databases and was indisputable (e.g. percentage of primary care physicians who send medication prescriptions electronically to pharmacies). Where the data was simply not available, estimates were made. Since the reliability of the data on the use of computers by primary care physicians is so variable and in some case simply not available, the authors also introduce the use of a Cochrane-like confidence factor (CF) to each comparison measure. The paper draws particular attention to the fact that both countries have a highly visible central unifying body or what might be called a Health System Integrator; though Denmark’s Medcom is a pseudo government agency New Zealand’s HealthLink is a private company, both play critical roles in the success story of these two countries.

Keywords: critical success factors, electronic medical records systems, evaluation and comparison, medical and health informatics

Introduction

This final paper builds on the previous four papers which after reviewing the respective healthcare systems went on to document the history and current status of primary care computing in New Zealand and Denmark. The use of computer technology by primary care physicians has been a common practice in European countries for over 15 years and has been well documented.1–7 What has been lacking, however, has been a systematic and reliable way of measuring and comparing the degree of automation. Most accounts of the use of computers by general practitioners are descriptive and are only occasionally supported by large sample surveys.

As many have found, evaluation of the application of information technology in health care is complex; it is easy to measure many things but not necessarily the right ones.8–11 Reference functional models for electronic health record systems representing the static relationships between them have been developed and the computerised problem-oriented medical record has been evaluated.12 Studies have been conducted to determine whether physician experience with and attitude towards computers is associated with adoption of specific functionalities.13 One of the difficulties is that many of these evaluation methodologies are based on acute care hospital settings. The world of primary care is
different in a number of ways and requires evaluation methods which take into account these variations.

The unique instrument developed for this study draws on the work done by Jaana et al for the comparison measures of three clinical dimensions of information technology (IT) sophistication: functional sophistication, technological sophistication and integration level. In their study, the acute care clinical areas considered included patient management, patient care activities and clinical support activities. Since there is very little robust data in the scientific or grey literature on the degree to which primary care physicians utilise information technology and since the cost of conducting large-scale surveys was not feasible, the authors chose to find the best evidence available – namely the centralised databases in the Danish MedCom and New Zealand HealthLink offices. The information to fill out the instrument came from on-site discussions and meetings with local experts in each jurisdiction. In most cases, the data was pulled from centralised databases and was indisputable (e.g. percentage of primary care physicians who send medication prescriptions electronically to pharmacies). Where the data was simply not available, estimates were made.

It should be noted that this paper is built on the premise that there are individual electronic medical records (EMRs) within each primary care physician’s office. It does not take into account the situations in jurisdictions such as Andalucía, Sweden or the US Veterans Health Administration where primary care physicians have access to a complete shared electronic health record (EHR) and there are no separate EMRs. The paper also assumes that the EMR functionality is ‘active’ in terms of being real-time and online versus ‘passive’ which supports offline activities such as printing forms which are then manually faxed or mailed.

Comparing Denmark and New Zealand

Various models were used to identify the criteria to be scored, including the factors identified in the Commonwealth Fund study. According to the Davies Awards criteria, ‘the EMR in use must capture and manage medications, the problem list and at least one other type of patient information (e.g. laboratory test results, notes) and provide some real-time clinical decision support such as drug checking (drug duplication, drug–drug interaction, drug allergy checking). This is the bare minimum functionality’,.

Any attempt to develop a scoring method by which jurisdictions can be compared is clearly a work in progress. Varying definitions, means of implementation and actual usage of technologies by primary care physician staff compared to those of the researchers are but some of the many factors which make this exercise challenging. This work is exploratory and qualitative in nature and therefore cannot completely tease out all of the various effects. The reliability and validity of the instrument will have to be determined by having other jurisdictions apply it and provide feedback. That being said, the Table 1 attempts to establish the ‘state of the nation’ across 12 criteria based on actual usage by primary care physicians rather than on EMR system functionality being available.

Roger’s diffusion theory acknowledges the expectation of change over time, i.e. the Gaussian distribution describes the distribution in the population by ‘type of innovation up-taker’. To show progress it was deemed to be useful to break the adopted function score into smaller increments. This would allow jurisdictions to know if the adoption was stalled, increasing or dropping and what impact incentives and/or government policies were having. On this basis, the score for each criterion is broken into five 20% slices:

- 1 = <20% of primary care physicians
- 2 = 20–40% of primary care physicians
- 3 = 40–60% of primary care physicians
- 4 = 60–80% of primary care physicians
- 5 = >80% of primary care physicians.

Using this degree of granularity will be important to provide detail of whether jurisdictions are gaining adopters and at what rate.

Since the reliability of the data on the use of computers by primary care physicians is so variable and in some cases simply not available, the authors are of the opinion that a weighting factor needs to be applied to any scoring system. The authors are sensitive to the possibility that some jurisdictions may be motivated to ‘adjust’ numbers to match political rhetoric and bureaucratic incentives. This is particularly true when counting is involved and where the definition of what is to be counted introduces the possibility of significant error. Hence each criterion is given a Cochrane-like confidence factor (CF) in which the scale used is:

- A = the jurisdiction has provided a descriptive statistic prepared and verified by an independent organisation – the data is indisputable.
- B = the jurisdiction has provided an inferential statistic, repeated over a series of years, which provides great confidence as it is based on repeated, properly documented, large-scale, technically representative surveys of physicians resulting in valid and reliable inferential statistics about the population of interest.
- C = the jurisdiction has provided an inferential statistic that is reasonably reliable based on recent, statistically significant, large-scale surveys.
D = the jurisdiction has provided a report supported by statistics and expert opinion but falls short of meeting the test of representativeness of the national population of physicians. This report is likely to be an estimate derived from multiple small-scale surveys and the opinions of a number of local medical/health (government or industry) experts.

E = the jurisdiction has made simple claims/statements based on the views of a few local experts and made without sufficient evidence to scientifically support the claim.

It could be argued that the criteria selected in this study are incomplete, too difficult to measure reliably and not mutually exclusive – all valid arguments which will have to be subjected to the test of time. It is also evident that the proposed instrument does not measure the impact of the use of EMRs and this is indeed opportunity for future research to enhance the instrument. Eventually, it will be important to know how much the EMR capabilities above have an apparent effect on and/or value for clinically relevant outcomes.

Measures of this type are usually expected to facilitate self-evaluation through the power of comparison and to trigger individual action. Implicit in the concept of how a jurisdiction is doing is the notion that there will be a continuum from doing well to doing poorly in terms of a jurisdiction’s collective use of technology by primary care physicians. Given that this is a work in progress, the authors expect to use this tool or a variant to demonstrate adoption over time. For the time being, the two scales being used indicate that they collectively allow for data users to have a sense of confidence regarding the quality of the estimate based upon the methodology used to achieve the estimate. More formal weighting strategies are under investigation.

The recent report by DesRoches defined the key functions that should be present in an outpatient EHR to qualify the system as ‘fully functional’.20 These functions generally fall into four domains: recording patients’ clinical and demographic data, viewing and managing results of laboratory tests and imaging, managing order entry (including electronic prescriptions) and supporting clinical decisions (including warnings about drug interactions or contraindications). They also defined a minimum set of functions that would merit the use of the term EHR, calling this a ‘basic’ system – most of these functions are to be found in this study as well. The principal differences between a fully functional system and a basic system were the absence of certain order-entry capabilities and clinical decision support in a basic system.

**Discussion**

The extensive use of information technology in primary care physician offices in both Denmark and New Zealand is consistent with the growth seen in other European countries and is in sharp contrast to the stunted growth in Canada and the USA. It has been suggested that one reason for the failure of North American primary care physicians to take up EMRs is the fragmentation of the market, though the Danish experience would suggest otherwise.

Physicians will not convert to EMRs until they are satisfied that they can make the transition effectively and relatively painlessly. It is not possible to persuade any physician, be they a GP or a specialist, to move from a paper-based record system to an electronic system unless s/he is fully convinced that the change will improve the efficiency of their practice and simultaneously improve the quality of patient care that they are able to provide. In order to be satisfied that a practice EMR satisfies these two key conditions, practices need to be able to obtain at modest cost a system which (at the very minimum) enables them to: i) establish a useful record of a patient’s condition and history that can be updated during a patient consultation; ii) perform routine tasks (letter writing, prescribing, referring) easily and iii) receive most incoming communication electronically – via a highly dependable means (so as to no longer require a parallel set of paper records). Both Denmark and New Zealand are evidence that it also helps when the government sets the correct policy agenda and then stands aside and lets the private sector do the job while working in close collaboration with primary care.

The impact of information technology must be significant, particularly in primary care, though it is difficult to show empirically. How could the number of visits to Danish primary care physicians have been increasing over the past ten years while the number of practising primary care physicians has been decreasing, when there is little evidence to suggest that Danish primary care physicians feel they are working too many hours and/or are burning out? Perhaps innovations such as payment to physicians for phone call visits, with designated call-in times has helped. Gaining an hour through automation processes no doubt has also helped. Demographics and the demands of different age/gender groups on the healthcare system may also play a role. Danish patients may have come to expect less time from physicians and be more prepared to gather health information from other healthcare providers such as pharmacists and nurses.
General practice automation has played a key role in ensuring the success of the New Zealand Government’s overall healthcare reform and in particular their Primary Care Strategy. Without extensive computerisation, general practices could not have taken on the responsibility they have. Today, almost every aspect of general practice is computerised and as a consequence general practice has become far more

| Table 1 Use of EMR functionality as of February 2008 |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Note | Denmark | CF | New Zealand | CF |
| Patient administration | | | | |
| % who have patient appointments recorded in their computer | 1 | 5 | A | 5 | A |
| % who are able to book appointments with specialists and clinics from their computer | 2 | 3 | B | 0 |
| Medications | | | | |
| % who generate printed medication prescriptions from their computer | 5 | A | 5 | E |
| % who receive alerts or prompts warning of potentially adverse prescribing | 3 | 4 | B | 1 | E |
| % who electronically send prescriptions to pharmacies from their computer | 2 | 5 | A | 0 |
| % who have access to medications dispensed to their patients by other clinicians | 5 | 5 | A | 0 |
| Clinical notes | | | | |
| % who record the majority of their progress or clinical notes in their computer | 4 | 5 | A | 5 | B |
| Sending orders or referrals | | | | |
| % who send procedure requests to laboratories from their computer | 2 | 5 | A | 1 | B |
| % who send referrals or consultation requests to specialists from their computer | 2 | 3 | A | 3 | A |
| % who send referrals to hospitals from their computer | 3 | A | 2 | B |
| Receiving results | | | | |
| % who receive most of their patients’ laboratory results into their computer | 2 | 5 | A | 5 | A |
| % who receive specialists (e.g. radiologist, cardiologist etc.) reports into their computer | 2 | 5 | A | 5 | A |
| % who receive hospital discharge summaries into their computer | 2 | 5 | A | 4 | B |
| Other functionality | | | | |
| % who use web services enquiries to online databases | 1 | A | 4 | E |
| % with PKI (Public Key Infrastructure) authentication | 5 | A | 5 | E |

Notes
1. The entry of the appointment need not be done by the clinician.
2. This is a computer–computer electronic data interchange and does not include printing forms and sending/receiving faxes or mailing.
3. These could be regarding drug dosage, drug–drug interaction, drug duplication, drug-allergy checking or drug-disease warnings.
4. This includes notes which are dictated by a clinician and entered by staff.
5. Medication dispensed in hospitals is not included.
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sophisticated and capable of delivering much greater value to the healthcare system and to patients.

**Conclusion**

This series of five papers has:

1. contrasted the healthcare systems in Denmark and New Zealand
2. documented their history of computing in primary care – with similar timelines but quite different motivating forces
3. contrasted the EMR functionality of their physician office systems and networks – very similar except for medication prescriptions
4. identified the benefits being achieved – more timely communication with specialists and time saved with repeat prescriptions is common in both countries
5. introduced a new comparative methodology which attempts to rank primary care computing in the two countries.

The papers have examined the reasons why the Danish and New Zealand primary care health systems have succeeded in making the transition to the information age and have looked at the challenges, costs and benefits.

In closing, it seems worth drawing particular attention to the fact that both countries have a highly visible central unifying body or what might be called a Health System Integrator (HSI). The histories of Denmark’s MedCom and New Zealand’s HealthLink are remarkably similar. Both have annual revenues of approximately €2.7 million and both run a national Health Information Exchange (HIE). The HSI is a model that seems to be emerging around the world and particularly in the USA where Regional Health Information Organizations and HIEs are beginning to materialise.21 Denmark’s government works closely with MedCom, whereas in New Zealand, HealthLink is a totally independent privately owned entity free from direct government control. Both models appear to work well. While HealthLink enjoys freedom from direct government control, it is aware of the fact that it must broadly comply with government policy to survive and must closely support government strategy if it is to prosper. Making IT easy to use and dependable is a key factor in driving uptake. Just as a patient needs a GP who can manage his or her health care and determine which services the patient needs, so too a general practice needs a highly skilled organisation such as an HSI to deliver, maintain and support connectivity with the rest of the health sector.

Finally, an essential ingredient for success in both countries has been the ‘grass-roots’ or ‘bottom-up’ approach to health sector automation. The amount of money being expended in both countries seems exceptionally small and the approach taken in both cases is very low-key and incremental. This stands in stark contrast to countries that have spent vast sums of money on ambitious, visionary projects that have yielded few tangible results and often need fundamental re-examination.

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**REFERENCES**


**CONFLICTS OF INTEREST**

None.

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