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Comparison of Information Technology in General Practice in 10 Countries

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Abstract

A study commissioned by Canada Health Infoway provides a comparative analysis of automation in general practice in 10 countries. The most common clinical application is the automation of medication prescriptions – even if it is not a mandatory requirement as it is in Norway. It is the clinical application that provides one of the biggest benefits to general practitioners as it addresses legibility concerns, can be a significant time saver (particularly for repeat prescriptions) and offers the potential to make use of decision-support capabilities. The transmission of laboratory results is the most common electronic clinical communication application.

This comparison is the culmination of a year's work on behalf of Canada Health Infoway. During much of 2005, information was collected in 10 countries with the help of locally based academics, physicians and industry representatives. The countries chosen all have a high degree of use of computer technology by their general practitioners (GPs), namely, Australia, Austria, Denmark, England, Germany, the Netherlands, New Zealand, Norway, Scotland and Sweden.

Data were collected from the scientific literature, from the Organization for Economic Co-operation and Development (OECD), government and professional association reports and websites, as well as from personal interviews with GPs and ministerial representatives in each country. The quality of the data ranges from very robust and reliable (particularly in Denmark) to estimates by local experts based on small sample sizes. As Jha and colleagues (2006) also discovered, trustworthy data on the number of installations and applications – let alone on the actual use of technology – simply are not available in some countries, often due to the lack of a single unifying or oversight organization.

The stimulus for this work was primarily to identify the governmental, collegial, technological and other factors contributing to the success of each country in achieving high levels (>90%) of GP office automation. The success stories were intended to inform healthcare policy and reform efforts in Canada, specifically in the area of primary care. Evidence emerging internationally points to a variety of contributing factors to the successful implementation of information technology (IT) in

Table 1. Population and spending

Country	Population (Millions in 2004)	Per Capita Healthcare Expenditures – 2003 (US$)	Healthcare as % of GDP (2003)	Practising Physicians per 1,000 Population	No. of GPs	No. of Patients per GP	% GPs Who Work Alone	Method of Payment (% FFS)
Australia	20.1	2,699	9.3	2.5	19,000	1,000†	65	100
Austria	8.1	2,280	7.6	4.7	11,000	1,300	90	70
Denmark	5.3	2,763	9.0	2.9	3,500	1,500	30	70
England	49.5	2,231*	7.7*	2.2*	29,000	1,700	15	30
Germany	82.5	2,996	11.1	3.4	40,000	1,200	75	100
Netherlands	16.3	2,976	9.8	3.1	7,000	2,400	80	100
New Zealand	4.3	1,886	8.1	2.2	3,000	1,500	10	100
Norway	4.6	3,807	10.3	3.1	4,300	1,200	15	100
Scotland	5.1	2,231*	7.7*	2.2*	4,000	1,300	20	60
Sweden	9.0	2,594	9.2	3.3	4,400	2,000	5	20

FFS = fee for service; GDP = gross domestic product; GP = general practitioner.

*United Kingdom.

†Standardized Whole Patient Equivalent.

general practice. While many of these enablers diverge across the countries reported here, other common elements of success speak to an emerging pattern of health system characteristics, government health policy, infrastructure initiatives, historical driving forces, benefits and incentives, computer features and practices and ongoing support. In their study of the differences between UK and US family practice, Schade et al. (2006) found that similarities in primary care practice, clinical information needs and physicians' personal and professional requirements might outweigh the larger-scale differences in organization and

payment for care between the two countries, when physicians make choices about which tools they need to improve practice efficiency and effectiveness.

Since the 1980s, when IT was first introduced into primary care (the realm of general practice computing), functionality has evolved from introducing computers to the consulting room, to collating patient data to electronically linking primary and secondary care and to obtaining and reviewing useful Internet information during consultations.

Existing evidence in favour of physician automation includes enhanced coordination of care between multiple providers, reductions in medical (especially prescription) errors, quicker results reporting, fewer unnecessary tests, reduced duplication, increased economies of scale from widespread and coordinated technology adoption and, most importantly, improved health outcomes and saved lives. A significant majority of doctors in the recent Commonwealth Fund study reported that it is "easy" with their computer systems to generate lists of patients by diagnosis (registries) and patients who are due or overdue for tests or care, and to list medications by patient, including prescriptions by other doctors (Schoen et al. 2006).

Healthcare Systems

Though the methods of hands-on delivery of care are virtually the same in all the countries studied, the ways in which the healthcare systems are financed, administered and managed vary widely. Unfortunately, space does not permit a full discussion of the similarities and differences. Though England and Germany differ significantly from the other eight countries in terms of scale of population and the number of GPs (Table 1), they are at opposite ends of the spectrum in terms of per capita expenditures on healthcare.

As evidenced in Table 1, there is a wide variability across the 10 nations in terms of the percentage of GPs who work alone, ranging from lows of 5% and 10% in Sweden and New Zealand to highs of 80% and 90% in the Netherlands and Austria.

Fee-for-service is by far the most common model by which GPs are reimbursed. The major exception is Sweden, where more than 90% of GPs physicians are employed by primary health centres. It should be noted that the fee-for-service data are consistent for three of the five countries that this study and the Schoen Commonwealth Fund study had in common; there are, however, discrepancies in the data for Australia and New Zealand.

Utilization Characteristics of Computer Systems in GP Offices

Over 95% of the GPs in nine of the countries studied have computer systems (i.e., electronic medical records [EMRs]) in their offices that they use for clinical purposes – and in almost all cases, the computers are being used by the GPs themselves (Table 2). Consistent with the findings of the Schoen study, the exception is Germany, where though 90% of practices have computers, only 40% of the GPs use them directly at this time.

The term *EMR* requires clarification as it is not used consistently in the United States, let alone around the world. Though international agreement is becoming less elusive, the following definitions attempt to distinguish between the different types of electronic records – realizing that they are not mutually exclusive and overlap does exist in some healthcare environments (e.g., an acute care facility's data about a patient being electronically accessible to a primary care physician):

- *EMR* generally refers to computer-based clinical data of an individual that are location specific and kept by a single physician office or practice, community health centre or possibly an ambulatory clinic.
- *Electronic patient record* generally refers to computer-based clinical data of an individual that are location specific and kept by a single healthcare organization such as a hospital, acute care facility or regional health authority.
- *Electronic health record* generally refers to computer-based clinical data of an individual that are available across multiple locations. It is sometimes referred to as a *longitudinal health record*, which includes data about the individual from a number of different interoperable EMRs and electronic patient records. An electronic health record is shared across jurisdictions such as primary care and secondary care.
- *Electronic care record* is an emerging term that generally refers to computer-based data of an individual that are available across multiple locations. More specifically, it is seen as a record that is shared by healthcare practitioners and social services professionals.

This article is exclusively about the use of EMRs and, more specifically, those in GPs' offices (versus in ambulatory clinic settings).

Existing evidence in favour of
physician automation includes, most importantly, improved health outcomes and saved lives.

Medication Prescriptions: The Most Common Clinical Application

Consistent with other findings (McInnes et al. 2006; Schade et al. 2006; Schoen et al. 2006), this study found that the most common clinical application is the automation of medication prescriptions – even though it is not necessarily a mandatory requirement as it is in some countries, such as Norway. There are

Table 2. Use characteristics of computer systems in GP offices

Country	% with Computers	Year Technology Use Became Common	GPs Who Use Computer	GPs with Automated Medication Prescriptions	GPs Recording Progress Notes	Coded Data in Records	"Paper-Light" Offices
Australia	98	2001	Most	Most	Many	Little	Some
Austria	99	2003	Many	Most	Few	Little	Few
Denmark	99	1994	Most	Most	Most	Little	Most
England	95	1992	Most	Most	Most	Most	Some
Germany	90	1997	Some	Most	Few	Some	Few
Netherlands	97	1993	Most	Most	Most	Much	Few
New Zealand	100	1993	Most	Most	Most	Some	Few
Norway	100	1995	Most	Most	Most	Little	Most
Scotland	95	1997	Most	Most	Many	Most	Few
Sweden	97	1995	Most	Most	Few	Little	Few

GP = general practitioner.

Note: As accurate data are virtually impossible to obtain in most of the 10 countries, the safest way to represent the findings is to classify them into four simple categories: *most* = >75% of GPs are using the functionality identified; *many* = >50% are doing so; *some* = >25%; *few* = <25%.

virtually no handwritten prescriptions in most of the countries studied. In all 10 of the countries, the majority of GPs enter the original medication prescription into their computer themselves and, at a minimum, print a script for the patient to take to the pharmacy. In some countries, such as Norway, they are only paid if they do so themselves.

The data in Table 3 are based on small samples and can only be used to obtain a general sense of why GPs use computers in their offices. As indicated earlier, there are data in the literature that support the view that medication prescription is the application that provides one of the biggest benefits to GPs as it addresses legibility concerns, can be a significant time saver (particularly for repeat prescriptions) and offers the potential to make use of decision-support capabilities – in some cases as part of a national pharmaceutical association database. Simplified prescribing, including access to lists of generic drugs, is often seen to be of value as well.

The time saved in recording and processing prescriptions – particularly repeat prescriptions – can be significant. A process that used to entail having to pull charts and handwrite a script now takes 10 seconds in Denmark – a comment frequently made by English GPs as well (Protti et al. 2006).

One Swedish GP reported saving 100 work-hours each year. A Swedish study found that doctors save about a half-hour each day, and pharmacies have seen up to a 30-second savings on each prescription (Tillinger 2005). The number of occasions when the pharmacists have to call the doctor to check a prescription is significantly reduced. As put by one GP, "Repeat prescriptions are so much easier – I had forgotten how hard it was writing 15 repeats per day by hand."

This study found that the most common clinical application is the automation of medication prescriptions … There are virtually no handwritten prescriptions in most of the countries studied.

Other Clinical Applications

The major reason Danish physicians use their computer is the communication benefits it brings them. They report a much-improved dialogue with hospitals (e.g., where they used to wait five days for test results, they now receive them almost as soon as they come off the laboratory equipment). They are automatically notified when a patient is registered in a hospital emergency department. Discharge summaries now arrive within one to three days (versus four or more weeks). The ability to use

Table 3. Benefits of automation in GP practices*

Country	Simplified Repeat Prescription	Saving Time	Quicker Receipt of Results	Improved Patient Management†	Legibility of Records and Forms‡	More Timely Communication with Other Clinicians	Availability of Clinical Data on Internet/ Intranet	Data for Clinical Research
Australia	2	1	5	3	4	7	6	8
Austria	2	7	1	3	6	5	4	8
Denmark	2	4	3	5	6	1	8	7
England	2	1	3	4	5	6	7	8
Germany	2	1	4	5	3	7	6	8
Netherlands	2	1	5	4	3	6	8	7
New Zealand	4	1	3	5	6	2	7	8
Norway	3	4	2	1	7	5	8	6
Scotland	1	6	4	2	5	8	3	7
Sweden	1	4	3	2	7	8	6	5

GP = general practitioner.
*Rank of 1 being the most important.
†That is, easier to find records.
‡That is, who wrote what.

their data for their own clinical research is seen by some to be another benefit.

Danish physicians report that they have much quicker access to all their patient data – particularly recent reports and results. They are able to finish all that needs to be done while the patient is still present. Recent studies have found that 50 minutes is saved per day in each GP practice, telephone calls to hospitals are reduced by 66% and €2.3 is saved per message, of which there are 60 million per year (Johansen 2006).

In New Zealand, clinical electronic communication such as automated status messages (an update sent back to the GP based on a patient that may have been admitted, for whom a referral has been received or any other clinical update to the patient's care) and electronic discharge summaries have played an important role in the transition to using an EMR and capturing all the visit notes electronically during a patient consultation (Protti and Graham 2003). Similar to the Danish experience, paper discharges used to arrive five to six weeks after discharge from the hospital, and patients would often turn up at the GP clinic for follow-up before the GP had received information regarding the hospital encounter. Even once the paper discharge summary was delivered, the information was, at times, incomplete or illegible. Hospitals are now able to quickly produce electronic discharge summaries and deliver these electronically to the GP office within minutes of the patient being discharged.

Paper-Light GP Practices

As evidenced in Table 2, many GPs are running hybrid systems in which the paper record still plays a part in day-to-day care. This is changing in countries such as England, Denmark and Australia, and is definitely not the case in Norway and Sweden.

Increasingly, GP practices in a number of countries are "paper light"; they still maintain paper files for such things as patient letters and reports from specialists that come in on paper. A number of practices scan such documents. Some practices underline key sentences from a specialist's report, and a secretary enters them into the EMR; others dictate a summary of the consultant's report for later entry into the computer record. Many have a booking module that further eliminates the need for paper. A distinction is made between storing paper and using paper. In many cases, the paper record is kept mainly for legal purposes, not clinical ones.

Very few Norwegian GPs maintain paper records as all their

notes are directly entered into their computers as part of each consultation. Norwegian legislation requires GPs to keep records of patient care, and digital records are legally acceptable.

Networks and Electronic Communications

The electronic exchange of clinical information between primary care and other sectors takes place in all the 10 countries studied – in particular, in those countries that have a national health network, namely Denmark, England, New Zealand and Scotland and, to a lesser extent, Sweden. Though there is a national network in Norway, it currently is only used to transmit accounting data. However, the Norwegian national strategy for 2004 to 2007 is to improve the flow of clinical information between healthcare providers via a national network.

All the countries with no existing national network have regional networks, and in all cases, there are plans to introduce a national network.

Electronic Messaging

The transmission of laboratory results is the most common electronic clinical communication application; in all the countries except Germany and Norway, at least 50% of results are transmitted electronically to physician office computers. Table 4 reveals that it is over 90% in Denmark, New Zealand, Scotland and Sweden.

Beyond sending laboratory results electronically, only in New Zealand, Sweden and Denmark can one find widespread use of electronic communications technology to support primary care. One of the key factors to achieving their success in this arena has been the rigid enforcement of standards, whether EDIFACT, HL7 or XML.

In New Zealand, HealthLink – the country's national network – is used by over 75% of all healthcare sector organizations. All hospitals, radiology clinics, private laboratories and general practices are involved and use HealthLink (a private company) every day. Over 600 specialists, physiotherapists and other allied health workers including maternity providers also use the network. Over 3 million messages a month are exchanged, which is over 95% of the total electronic communication in the primary healthcare sector (Protti and Graham 2003).

All pharmacies in Sweden are part of the state-owned National Corporation of Swedish Pharmacies (Apoteket AB). Through its 900 pharmacies, this organization has the exclusive right to sell medicine to the general public and to hospitals throughout Sweden. Since all Swedish pharmacies are able to receive e-prescriptions, the county councils are working on spreading the use of e-prescriptions among physicians, in cooperation with Apoteket. Today, some 50% of all first-time prescriptions, by GPs and specialists, are transferred electronically through a network called Sjunet (Tillinger 2005).

A new law came into force in Sweden in July 2005 that compels Apoteket to keep a register of all drugs dispensed in

Table 4. Networks and electronic communications

Country	National Health Network in Use	Organizations Connected to the National Network	GPs Receiving Discharge Summaries	GPs Using Electronic Data Exchange	GPs Receiving Laboratory Results
Australia	No	Few	Few	Most	Many
Austria	No	None	Few	Few	Many
Denmark	Yes	Most	Most	Most	Most
England	Yes	Most	Few	Most	Many
Germany	No	None	Few	Few	Few
Netherlands	No	None	Few	Some	Many
New Zealand	Yes	Most	Many	Most	Most
Norway	Yes	Few	Few	Few	Few
Scotland	Yes	Most	Many	Most	Most
Sweden	No	None	Few	Some	Most

GP = general practitioner.

Note: Findings are classified into four categories: *most* = >75% of GPs are using the functionality identified; *many* = >50% are doing so; *some* = >25%; *few* = <25%.

the past 15 months and also allows pharmacies to hold repeat prescription information for the patients. All patients, physicians and pharmacists are able to access the information in the register – with the approval from the patient. The register of drugs dispensed was launched in May 2006.

Denmark clearly leads the way when it comes to the electronic exchange of clinical information between sectors. Virtually all Danish GPs (and by the end of 2006, all specialists as well) use their computers to send and receive clinical electronic messages. Sixty standardized messages (up from 32 in 2002) – including their "one letter solution" – have been implemented in 50 computer systems, including 16 physician office, nine hospital, 12 laboratory and four pharmacy systems. The national network is used by over three-quarters of the healthcare sector, more than 4,000 different organizations. All hospitals, pharmacies and laboratories and general practices take part. The majority of specialists, physiotherapists and the local authority health visitor service now participate in the electronic communication via the healthcare data network. Over 90% of the country's clinical communications in the primary sector are exchanged over Denmark's national network.

Driving Forces for the Evolution of Primary Care Computing

As evidenced by Table 5, there is no one reason why the 10 countries studied have a high degree of computer technology use by their GPs. Financial support did have a role to play in five countries, though the amount of financial assistance varied from Sweden and Scotland, where the county (equivalent to a province) pays for everything, to Australia, which offered modest one-time grants to encourage physicians.

Professional colleges and medical associations played an influencing role in some countries but by no means all of them. The same can be said for peer pressure and the non-financial support that GPs received. The latter point was considered a key success factor in Denmark, Sweden and New Zealand.

Support from the counties (i.e., states or provinces) in Denmark was a significant influencer. Since 1992, the counties have been providing GPs with a diskette of all their patients when they first start their practice. In 2000, the counties started to provide a help desk and training by a data consultant, who visits GPs on a regular basis. The counties fund practice coordinators for each specialty (general practice, psychiatry, general surgery, etc.). These physicians work two to three hours a month and coordinate the wishes of their colleagues to hospitals and vice versa. The physician IT agenda moves forward through them.

In New Zealand, the private company HealthLink goes beyond simply running the national network; it provides proactive support to GPs.

Mandatory Electronic Billing

Though not mandated in all countries, the requirement (or incentives) for electronic billing was an influencing factor in at least five of the 10 countries studied. In New Zealand, electronic claiming was mandated in 1998 – four years after the widespread use of computers for laboratory results delivery.

Table 5. Incentives and influencing forces

Country	Government Billing Mandate	Government Funding Support	College or Association Leadership	Peer Influence	Accreditation of Vendor Systems	Degree of Support Received
Australia	No	Yes	Yes	No	No	No
Austria	Yes	No	No	No	Yes	No
Denmark	No	No	No	Yes	Yes	Yes
England	No	Yes	Yes	No	Yes	No
Germany	Yes	No	No	No	Yes	No
Netherlands	No	Yes	Yes	Yes	Yes	No
New Zealand	Yes	No	No	No	Yes	Yes
Norway	No	No	No	Yes	No	No
Scotland	No	Yes	Yes	No	Yes	No
Sweden	No	Yes	No	Yes	No	Yes

In Germany, mandated electronic billing was clearly a major driving force to the introduction of computer technology in GP offices. In the early days, there were financial incentives to have GPs introduce card-reading devices into their systems. As of 2004, physicians are paid a lower administration charge (2% saving) if they submit their bills electronically.

Most Dutch GP EMRs started out as administrative systems mainly for electronic billing (Protti and Smit 2006). This was considered by many GPs to be the most important reason to buy a computer system in the early days – in part, because all physician investments in technology are fully tax deductible. Quality of care was often mentioned, but there is little evidence to suggest it was more than a "socially acceptable response."

Perhaps the major driver that really stimulated the use of EMRs in Norway was that GPs' income increased – primarily because the accounting systems and the clinical systems were so tightly integrated. When the last patient walked out of the door at the end of the month, the accounting for the month was finished at the same time. It has been estimated that this saved two to four days of work per month.

Government Financial Incentives

Clearly, a major contributing factor to the use of computer technology in Sweden, Scotland and England is that the government pays for all or most of the GPs' expenses. This is not the case in the other seven countries, though some have provided a certain degree of support or financial incentives.

In 1990, the National Health Service (NHS) for Scotland introduced financial rewards for doctors who achieved specific NHS Scotland health priority targets (e.g., cervical cytology screening and immunization). In 1993, additional financial incentives were available to physicians who could demonstrate that they were proactively managing specific chronic conditions such as diabetes and asthma.

In 1998, the Practice Incentives Program was introduced in Australia in response to a series of recommendations made by the General Practice Strategy Review Group that reported to the government. In 1999, the uptake of computers by Australian GPs was further stimulated when the Commonwealth government offered a one-off grant of around AU$10,000 to those practices that purchased a computer, acquired Internet connectivity (an e-mail address) and promised to use e-prescribing software to write the majority of their prescriptions. This increased the numbers of GPs writing prescriptions with the aid of a computer from around 50% in 1999 to more than 90% in 2004.

In the fall of 1991, the Dutch National Association of General Practitioners and the government reached agreement on a plan to stimulate the use of computer-based patient records. There was an extra pro capita fee for each sickness fund patient and an addition to the fee for service for each private patient if the GP used a computer. To qualify, the GP had to (1) use an information system that passed evaluation by the professional organizations, (2) introduce computer-based patient records within two years and (3) provide data for health policy planning. The plan is still in effect today.

Peer Influence

Peer influence – collegial pressure – played a significant part in the Danish GP computer movement. Early adopters often hosted their colleagues to show them how the computer system affected their work life. At the yearly, one-week GP education seminars – referred to as *GP days* – there were IT workshops each day covering topics ranging from basic computer use to advanced use of diagnostic coding.

Peer influence also played a part in the Netherlands, particularly through user groups. Using an EMR came to be considered part of good practice.

The uptake of EMRs in Norway only really took off in the early 1990s – in a large part, due to the fact that influential and respected GPs used them and spoke highly about the experience. Work around the International Classification of Primary Care (ICPC) diagnosis codes also influenced the uptake.

The so-called peer pressure in Sweden in the early days was characterized as "peer inspiration yes, peer pressure no."

Perhaps the major driver that really stimulated the use of EMRs in Norway was that GPs' income increased.

Government Policy: Physician Collectives

Of note was the presence of physician collectives in four of the countries, namely England, New Zealand, Sweden and, more recently, Germany. Since 2000, all English GP practices and community health services have been formed into 300 primary care trusts (PCTs), with influence over the healthcare budgets for their enrolled populations. PCTs are independent statutory bodies with their own boards (Benson 2002).

Since 1995, the majority of New Zealand GPs have been working in collectives called an IPA (independent practitioner association). While many still have small clinics with only two or three practitioners, over 84% of GPs are part of a larger network. The IPAs have, in some areas, included special salary packages to attract doctors to rural and remote areas where primary care coverage is limited. These initiatives have resulted in new resources including the provision of people to support the use of IT in general practice. The past decade has also seen

the emergence of the new position of practice manager within a physician general practice. The practice manager has become a pivotal person to assist with the installation, management and training for any physician office system.

Very few Swedish GPs operate as solo practitioners. Most Swedish GPs are members of a physician group practice of three to eight GPs – referred to as primary health centres (PHCs). All the PHCs also include interdisciplinary practitioners such as nurses, nurse assistants and laboratory technicians as well as secretarial staff. The 1,124 PHCs are geographically based within Sweden.

German GPs tend to work alone – especially older ones and those in rural areas. Only 20–30% of German practices have more than one GP. Increasingly, however, co-operatives are emerging. Government incentives are encouraging physicians to join or form group practices. The most recent development concerning the co-operation of physicians is the so-called medical care centre, which has been introduced by law to reform the German health system. The medical care centre is a multidisciplinary institution that enables physicians to work as employees or as contracted physicians.

The Schoen study reported that "in the Netherlands, national reforms since 2000–2002 have resulted in large-scale, physician-run primary care co-operatives to provide coverage on nights and weekends, with nurses as a first point of contact and family physicians available as necessary."

Other Lessons to Be Learned

As Schoen et al. dramatically reported, Canada and the United States lag significantly behind other OECD countries in general practice automation. Valuable lessons can be learned from studying the driving forces in other countries, many of which are common to a number of them. There are also additional initiatives that are worthy of further investigation and thought that are unique to only a few countries.

England's New Mechanism to Financially Reward Quality Care

It is useful to note that clinical computer use in England has markedly increased since the advent of the new 2003 General Medical Services (GMS) contract containing the Quality and Outcomes Framework (QOF). The most significant change in the GMS contract was the introduction of quality targets in place of the majority of items of service as a mechanism of funding. The QOF has both clinical and organizational targets, giving a total of 1,050 potential points. In 2005–2006, these points will be worth £120 each for an average size practice, thus giving GPs an extra income over the set income (based on patient list size) as a result of achieving quality targets. By implication, as the QOF covers 11 disease areas and practices are financially rewarded for having objective evidence of the quality of care they provide, data entry into GP clinical systems is taking precedence over handwritten records in these areas.

Similar incentives are being introduced in Germany.

Though there is no one answer or reason why these 10 countries have a high degree of use of computer technology by their GPs … clearly, the role of government health policy has played a part.

Conclusions

Though there is no one answer or reason why these 10 countries have a high degree of use of computer technology by their GPs, there are similarities to draw upon. Clearly, the role of government health policy has played a part in most of the countries. The policies may not have been directly related to primary care computing (e.g., out-of-office hours or physician collectives), but, in many instances, they indirectly stimulated the introduction of technology. Closely related were the financial incentives and rewards that were provided to GPs if they automated, though this was not the case in all the countries.

It would appear that a single unifying organization of some type played a key role in Denmark and New Zealand, two of the countries leading the way when it comes to GP computing. Interestingly, Denmark's organization is non-profit and arm's-length from government, while New Zealand's is a private company. Looked at from the other side, the lack of a unifying organization is seen to be a significant limiting factor in a number of countries.

Other important factors include accreditation of vendor systems, providing support to GPs, use of communications standards and use of nomenclatures such as the Read Codes and ICPC.

What is clear in all 10 countries is the recognition that significant progress toward an electronic health record, with all its associated benefits, is impossible without the full participation of GPs. As the Australian minister for health and ageing and leader of the House of Representatives said in a public address on December 8, 2005, "Doctors are at the heart of the health system and there can be no integrated IT-based patient health record while most doctors' case notes remain on cardboard cards."

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References

Benson, T. 2002. "Why General Practitioners Use Computers and Hospital Doctors Do Not – Part 1: Incentives." *BMJ* 325(7372): 1086–89.

Jha, A.K., T.G. Ferris, K. Donelan, C. DesRoches, A. Shields, S. Rosenbaum and D. Blumenthal. 2006. "How Common Are Electronic Health Records in the United States? A Summary of the Evidence." *Health Affairs* 25(6): w496–507.

Johansen, I. 2006. "What Makes a High Performance Health Care System and How Do We Get There?" Presented at Commonwealth Fund International Symposium, Washington.

McInnes, D.K., D.C. Saltman and M.R. Kidd. 2006. "General Practitioners' Use of Computers for Prescribing and Electronic Health Records: Results from a National Survey." *Medical Journal of Australia* 185(2): 88–91.

Protti, D. and S. Graham. 2003. "More Lessons to Be Learned about Primary Care Computing from Another Small Nation." *Electronic Healthcare* 2(3): 27–35.

Protti, D. and C. Smit. 2006. "The Netherlands: Another European Country Where GP's Have Been Using Electronic Medical Records for Over Twenty Years." *Healthcare Information Management and Communications Canada* 20(3): 8–12.

Protti, D., G. Wright, S. Treweek and I. Johansen. 2006. "Primary Care Computing in England and Scotland: A Comparison with Denmark." *Informatics in Primary Care* 14: 93–99.

Schade, C.P., F.M. Sullivan and S. deLusignan. 2006. "e-Prescribing, Efficiency, Quality: Lessons from the Computerization of UK Family Practice." *Journal of the American Medical Informatics Association* 13: 470–75.

Schoen, C., R. Osborn, P. Trang Huynh, M. Doty, J. Peugh and K. Zapert. 2006. "On the Front Lines of Care: Primary Care Doctors' Office Systems, Experiences, and Views in Seven Countries." *Health Affairs* 25(6): 555–71.

Tillinger, K. 2005. "Electronic Prescriptions in Sweden: The Success Story Continues." *British Journal of Healthcare Computing and Information Management* 22(10): 22–24.

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