OECD Health Policy Studies

Improving Health Sector Efficiency

THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

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FOREWORD

This report presents an analysis of OECD countries' efforts to implement information and communication technologies (ICTs) in health care systems. It provides advice on the range of policy options, conditions and practices that policy makers can adapt to their own national circumstances to accelerate adoption and effective use of these technologies. The analysis draws upon a considerable body of recent literature and in, particular, lessons learned from case studies in six OECD countries (Australia, Canada, the Netherlands, Spain, Sweden, and the United States), all of which reported varying degrees of success in deploying health ICT solutions. These ranged from foundational communication infrastructures to sophisticated electronic health record (EHR) systems.

Within the OECD Secretariat, this report was developed by Elettra Ronchi who acted as project manager and principal author, and by M. Saad Khan who provided key contributions. The report, in its various iterations, benefited from comments and suggestions from Martine Durand, Mark Pearson, Gaetan LaFortune, Howard Oxley, Francesca Colombo, Elizabeth Docteur, Peter Scherer, Graham Vickery and the project's Expert Group, which included representatives from OECD countries, the European Commission, the World Health Organisation, and the Business and Industry Advisory Committee to the OECD (BIAC). The Expert Group provided technical input and feedback on the work at three meetings convened during the course of the project. An additional expert meeting was organised by the BIAC at OECD Headquarters in 2007 under the OECD Labour Management Programme.

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Abbreviations

AHRQ	Agency for Healthcare Research and Quality
ARRA	American Recovery and Reinvestment Act
ASP	Application service provider
AUD	Australian dollar
CAD	Canadian dollar
CCHIT	Certification Commission for Healthcare Information Technology
CDM	Chronic disease management
CITL	Center for Information Technology Leadership
CHF	Congestive heart failure
COPD	Chronic obstructive pulmonary disease
CPOE	Computerised Physician Order Entry
EDI	Electronic data interchange
EFT	Electronic funds transfer
eHI	e-Health Initiative
EHR	Electronic health record
EMR	Electronic medical records
EU	European Union
FFS	Fee-for-service
GDP	Gross domestic product
GP	General practitioner
GSGPN	Great Southern General Practice Network
GSMHN	Great Southern Managed Health Network
HIE	Health information exchanges
HIMSS	Healthcare Information and Management Systems Society
ICT	Information and communication technologies
IM/IT	Information Management and Information Technology

MAeHC	Massachusetts e-Health Collaborative
MOA	Medical office assistant
NEHEN	New England Healthcare Electronic Data Interchange Network
NEHTA	National e-Health Transition Authority
NGO	Non-governmental organisation
ONC	Office of the National Coordinator
PACS	Picture Archiving and Communication Systems
PHCTF	Primary Health Care Transition Fund
PIN	Pharmaceutical Information Network
PIP	Australian Practice Incentive Programme
PITO	Physician Information Technology Office
POC	Proof of concept
POSP	Physician Office System Programme
QMAS	Quality Management and Analysis System
QOF	Quality Outcomes Framework programme
ROI	Return on investment
USD	US dollars
VCUR	Vendor conformance usability requirements

EXECUTIVE SUMMARY

Today the range of possible applications of information and communication technologies (ICT) in the health sector is enormous. The technology has progressed significantly and many estimate that ICT implementation can result in care that is both higher in quality, safer, and more responsive to patients' needs and, at the same time, more efficient (appropriate, available, and less wasteful). Advocates, in particular, point to the potential reduction in medication errors as a critical advantage.

In the past few years, however, there has been a significant and growing debate internationally about whether or not these much touted benefits and savings can be gained or, indeed, even measured. Despite the promise they hold out, implementing ICTs in clinical care has proven to be a difficult undertaking. More than a decade of efforts provide a picture of significant public investments, notable successes and some highly publicised costly delays and failures. This is accompanied by a failure to achieve widespread understanding of the benefits of electronic record keeping and information exchange.

With consistent cross-country information on these issues largely absent, the OECD has used lessons learned from case studies in six OECD countries (Australia, Canada, the Netherlands, Spain, Sweden, and the United States) to identify the opportunities offered by ICTs and to analyse under what conditions these technologies are most likely to result in efficiency and quality-of-care improvements.

The analysis takes account of the distinctive features of the participating countries' health care systems and other relevant documentation and contextual information. This information is necessary to understand the similarities and differences in the approaches employed, and helps to establish the potential benefits and drawbacks of policies and frameworks affecting the structure, design, implementation and outcomes of the different programmes and projects. The working documents developed as part of this project provide greater details on many of these issues.

Findings illustrate the potential benefits that can result from ICT implementation according to four broad, inter-related categories of objectives:

- Increasing quality of care and efficiency.
- Reducing operating costs of clinical services.
- Reducing administrative costs.
- Enabling entirely new modes of care.

Increasing quality of care and efficiency

A widely recognised source of inefficiencies in health care systems is the fragmentation of the care delivery process and the poor transfer of information. The efficient sharing of health information is, however, indispensable for the effective delivery of care. This is particularly important for elderly people and those with chronic conditions, who often have several physicians, and are shuttled to and from multiple care settings. The centrality of information in health systems and the diversity of uses to which it can be put, means that ICTs that ensure the timely and accurate collection and exchange of health data are likely to foster better care co-ordination, and the more efficient use of resources.

ICTs can also make important fundamental contributions toward improving aspects of patient safety. Critical elements for providing safe care to patients include ready availability of individual patient medical information, online access to clinical guidelines or drug databases, monitoring the effects of disease and therapies on the patient over time, and detecting and preventing medication errors that could harm the patients.

Although no formal evaluations are available, it is clear from the case studies in this report that these tools are perceived as substantially increasing the safety of medical care by "generating a culture of safety", improving clinical staff actions and workflows, by facilitating tasks such as medication reconciliation, and by bringing evidence-based, patient-centred decision support to the point of care. To maximise the safety benefits from the use of ICTs, most countries have also established special programmes and initiatives to increase provider awareness, including through the promotion of adverse event reporting.

Chronic disease is the biggest obstacle to the sustainability of many public health-care systems. The use of ICTs to increase compliance with guideline- or protocol-based care, particularly for the management of highly prevalent chronic diseases such as diabetes or heart failure, which are strongly

associated with preventable hospitalisations, provides, therefore, an opportunity for significant "quick wins". This was the case in Canada, where through the combined implementation of new approaches to care delivery, guidelines and the use of a web-based chronic disease management "toolkit", the province of British Columbia achieved significant improvements in diabetes care at a nominal cost and in a very short time. Between 2002 and 2005, *i.e.* within the first three years of the programme, the proportion of people with diabetes who were receiving care that complied with the Canadian Diabetes Association guidelines had more than doubled, while the annual cost of diabetes care dropped over the same period from an average of CAD 4 400 (Canadian dollars) to CAD 3 966 per patient.

Reducing operating costs of clinical services

ICTs can contribute to the reduction of operating costs of clinical services through improvement in the way tasks are performed, by saving time with data processing, and by reducing multiple handling of documents. Experience in other sectors shows that these functional improvements can have a positive effect on staff productivity. The evidence in the health sector is, however, generally mixed depending on the context and the technology used.

In the six case studies presented in this report, GPs reported improved access to patients' medical records, guidelines and medication lists, but generally felt ambivalent about the effects on workload as a result of using electronic medical records (EMRs) or electronic health records (EHRs). Only Swedish physicians mentioned savings of approximately 30 minutes a day as a result of using e-prescription, which indicates that specific components or functionalities of EHRs are likely to have more positive effects than others and depending on context. The findings also indicate that integration of these electronic patient management tools into clinical workflows is not always easy and the need for support and training must be taken into consideration in the early phases of implementation in order to optimise provider adoption.

There was less ambivalence about Picture Archiving and Communication Systems (PACS), which are considered an indispensable part of the drive towards a fully functional EHR and for the delivery of high-standard remote care through telemedicine. PACS are recognised as providing a useful way to improve the processing time (or overall "throughput") of medical images and a cost-effective electronic alternative to conventional methods of storing images. Increasing throughput means that turnaround time is shorter, and that there is less waiting around for both tests and results, which also means that there is less delay before treatment can be started. Data from 22 sites in British Columbia show that report

turnaround time was reduced by 41% following the implementation of PACS. This may lead to increased capacity, more effective healthcare, and more satisfied consumers.

Reducing administrative costs

Administrative processes associated with health care such as billing represent a prime opportunity for savings. Among the case studies reviewed here, experts in Massachusetts (United States) reported huge administrative cost savings as a result of introducing electronic claim processing through the New England Healthcare Electronic Data Interchange Network (NEHEN), a consortium of providers and payers established in 1997.

After the introduction of NEHEN, insurance claims that previously would cost on average USD 5.00 per paper transaction were processed electronically at 25 cents per transaction. By 2006, the network was processing more than 4.5 million claims submissions every month, representing 80% of all transactions in the State of Massachusetts. Through this intensive use, NEHEN has been able to significantly reduce the cumulative annual administrative costs for its members. For example, the health care provider Baystate Health was able to save more than USD 1.5 million through lowered transaction fees in less than three years, between September 2006 and April 2009. Savings are driven in large part by achieving administrative simplification and by slashing the time taken to process billing and claims-related information manually.

Despite the evidence of a reduction in costs, by 2009, an estimated 35% to 40% of US physicians still relied on paper claims submissions. Neither of the two major technologies used in electronic payment, electronic data interchange (EDI) and electronic funds transfer (EFT), have been widely implemented in other states. Barriers ranging from lack of nationwide standards, to infrastructure cost and inconsistencies in requirements from the different payers have hindered widespread adoption of these technologies.

Although the level of savings observed in the United States may not be a good predictor of the gains to be expected in other OECD countries, particularly in single payers health care systems, streamlining claims and payment processing through ITs is today widely recognised as a cost-effective way to realise considerable administrative efficiencies and reduce the time and risks associated with manual claims processing.

In Australia, for example, electronic claiming over the internet has been available since 2002 when Medicare Online was introduced. Similarly to the United States, uptake by physicians has been slow. In order to accelerate

adoption and use by physicians, in 2007 the Australian Government introduced a range of incentives. In May and June 2009, Medicare Australia also ran a targeted communication campaign to promote Medicare electronic claiming to the Australian public.

Enabling entirely new modes of care

ICTs can also generate value by enabling innovation and a wide range of changes in the process of care delivery, which may (or may not) improve cost-efficiency (*i.e.* reduce net expenditures). As evidence for these effects has accumulated over the past decade, ICTs have also been defined as technologies with a transformative potential, in that they can open up the possibility of entirely new ways of delivering care. The case studies in this report provide good evidence that governments have significantly leveraged this potential while pursuing three broad health reform agendas:

1. *Primary care renewal*: in the six countries covered by the case studies considered here, ICTs are central to efforts to renew primary care, generally by targeting three areas of considerable need: improving chronic care, encouraging broad-based general practice or multipurpose service delivery and better care co-ordination. These objectives are not necessarily mutually exclusive, and are indeed closely linked. In rural Western Australia, remoteness has increased the need to develop more integrated and comprehensive primary health services, and electronic messaging and telemedicine can facilitate this. In the Netherlands, electronic access to patient summary care records (which are a subset of the full patient medical record) constitute the basis of efficient and safe delivery of care in after-hours primary care centres.

2. *Improved access to care*: ICTs, specifically telemedicine combined with PACS, are also used to great effect in areas with large rural or remote populations to reduce the impact of the shortage of physicians and improve access to care. This was the case in Australia, Canada, Spain and Sweden. In Spain, the Balearic health authority established a telestroke programme in 2006 to deliver specialised care and life-saving treatments to remote areas in the region. Results on outcomes show that efficacy and safety of telestroke is comparable with those achieved with face-to-face care.

3. *Improved quality of care measurement and performance monitoring*: all six countries are aiming to use ICTs also to enhance their health information systems. Electronic data collection and processing can provide data in an accessible form that facilitates reporting on different quality metrics, benchmarking and

identification of quality improvement opportunities. In the United States, the Massachusetts e-Health Collaborative (MAeHC) improved the electronic capture of laboratory, pharmacy and other subset of data necessary for quality reporting and expanded the measurement of outcomes at GP practice level.

What prevents countries from achieving efficiency improvements through ICTs?

The evidence to date suggests that successful implementation and widespread adoption are closely linked to the ability to address three main issues:

1. *Alignment of incentives and fair allocation of benefits and costs:* with a payment system that very often does not reward providers for improving quality of care or support them in making investments in ICT systems, limited resources can deter from pursuing these systems. In particular since the costs and benefits associated with adopting new technologies are not shared equitably among stakeholders, investments which are cost-effective from the point of view of the system as a whole are not automatically going to be undertaken.
2. *Lack of commonly defined and consistently implemented standards:* health care providers struggle with inconsistent medical terminology, clinical records and data storage, as well as a multiplicity of schemes introduced to facilitate interconnection and communication between specific ICT systems. Because of fragmentation in the market and the rapidly evolving nature of technological solutions, in the absence of agreed industry-wide standards and compliance with existing rules, providers investing in technological infrastructure face high risks of failure and poor returns. The ability to share information (interoperability) is also entirely dependent on the adoption of common standards and compliance with them.
3. *Concerns about privacy and confidentiality:* because of the sensitivity of health information, and the generalised uncertainty on how existing legal frameworks apply to health ICT systems, privacy concerns constitute one of the most difficult barriers to overcome if widespread implementation of ICTs is to be achieved.

Case studies indicate that there are a number of actions that governments can take to address these issues. Governments can provide motivation for high-performing projects through targeted incentives. In the case studies, government-funded initiatives were generally aimed at

unambiguous public health priorities with clear benefits and that would not have been achievable without ICTs. This ensured that projects that could have otherwise drifted and become "technology for the sake of technology" in fact had a discernable health focus. Implementation of ICTs to improve chronic care in British Columbia was clearly a motivating factor and an essential component in the successful rate of adoption of EMRs by primary care physicians in the region.

Governments also occupied a central position as initiator, funding provider, project facilitator, and neutral convener. Governments, therefore, may be the only source of leadership to enable the effective use of ICTs to implement new directions for health system change and redesign. Governments can also engage vendors and encourage them to comply with standards to reach a common goal.

Aligning incentives with health system priorities and the fair allocation of benefits and costs

A range of incentives were critical in promoting the implementation and effective use of ICTs. Given the upfront cost entailed in the purchase of EHRs (which may range from USD 15 000 to USD 40 000 depending on the technology, the level of system functionalities, and how prices have been negotiated with vendors), physicians, particularly those whose levels of income are mainly based on their own individual productivity, such as in a fee-for-service (FFS) payment system, may find it difficult to afford to adopt EHRs.

Reducing the financial barriers, shifting or sharing the financial risk, and providing much more robust evidence on the advantages of health ICT can, therefore, be expected to accelerate its adoption. Not surprisingly, in all six case studies, we found that government is intervening to promote the adoption of ICTs either through direct regulation, economic instruments (mainly direct financial incentives) or persuasive measures (including support measures such as providing education and training for change management). OECD governments are evidently using their leverage as purchasers and payers to drive ICT adoption, which reflects the growing consensus about the vital "public good" to be expected from improved health information exchange.

Grants and subsidies are the most common form of financial incentives. Bonuses or add-on payments that reward providers for adopting and diffusing ICTs are also often used, particularly in countries where physicians are remunerated on the basis of fee-for-service.

Case studies indicate that subsidies are best suited to a situation where there is a clearly identifiable capital or fixed assets investment. In the Balearic Islands (Spain), local government subsidies were used, for example, to support the entire cost of developing the ICT infrastructure in the region, including broadband development. This form of financial support is very flexible, and usually does not require complex institutional arrangements. Grants, on the other hand, are rarely assigned unconditionally. There are usually many requirements that have to be met before a grant will be awarded, and this can turn into an onerous and time-consuming process which may limit take-up.

OECD findings tend to suggest that one-off subsidies or grants, while essential to start-up initiatives, may do little to support ongoing ICT use and will not have a lasting impact unless other potentially conflicting incentives (*e.g.* through payment schemes such as FFS) are modified or removed, and the business case for the initiative is clearly defined. However, for many ICT projects, the most significant challenge is precisely the development of a sustainable business model. In other words, once the initial investment has been made, what steps need to be taken to ensure that the ongoing costs of maintaining the system will be met? For example, who will compensate general practitioners for the costs of maintaining electronic health records, when many of the economic benefits are going to be felt by payors and purchasers of health services? These long-term sustainability and financing issues appear to be the most challenging and, in most cases, unknown aspects of the ICT initiatives reviewed in this report.

In the case studies reviewed in this report, policy approaches that link financial incentives (*e.g.* bonus payments) to the adoption and use of ICTs for specific tasks or conditions where the public health benefit is recognised from the very start have proven particularly successful. The evidence collected in Australia, British Columbia, the United Kingdom and the United States indicates that payers' willingness to differentially reward improved quality of care through the use of ICTs is key not only to future sustainability but central to shared reaping of benefits from the investments made. The financial incentive packages in these countries are designed to "insulate" physicians from potential productivity and upfront financial losses from adoption of ICTs. At the same time, they operate to maximise social benefit and act as catalyst of change by requiring (or promoting) electronic data collection and reporting on quality improvement activities. There is a growing body of practical experience across OECD countries that could be further analysed in a more systematic way and modelled to indicate/demonstrate which practices work best to enhance the efficiency and effectiveness of future programmes and reduce the likelihood of mistakes in their design and implementation.

Achieving commonly defined and consistently implemented standards

While health care organisations have access to an ever-increasing number of information technology products, "linkages" remain a serious problem. EHR systems must be interoperable, clinical information must still be meaningful and easy to decipher once transferred, whether between systems or between versions of the same software. It must also be gathered consistently if it is to permit effective secondary analysis of health data. Electronic capture of data through EHRs can facilitate clinical research, as well as improve evidence-based care delivery.

The development of standards to enable interoperability continues to be a political and logistical challenge and a barrier to seamless exchange of information. The problem of lack of interoperability is, however, not one that will be easily solved by the natural operation of market forces. Nor can it be solved by the intervention of health authorities alone: joint industry and government commitment is necessary.

To move the interoperability agenda forward, many governments have set up specific bodies or agencies to co-ordinate standard-setting and have developed strategies at the national level. Under pressure, vendors and users, as well as international standards organisations, have also started to collaborate more openly in the development and progression of standards. This collaboration has resulted in some level of success. However, even when standards are available, they are often applied in different ways by different institutions. Additional mechanisms are needed to promote their consistent implementation in a manner that achieves interoperability. Besides technological specifications, appropriate incentives, consensus-building and other enabling policies all have to be in place.

Four of the case study countries (Netherlands, Spain, Sweden, and the United States) have, therefore, established formal health care ICT product certification processes. In several of these countries, health care payers, ranging from governments to the private sector, are now also offering, or setting out to offer, financial incentives for the adoption of certified EHRs.

A variant to this approach, implemented at present only in Canada in a few provinces, has been to establish a certification process that targets vendors' products and services, and includes a number of "usability" requirements such as service levels, technical support responsiveness, financial viability, etc. This process is a targeted effort, within the context of a specific incentive programme to promote EMR/EHR adoption, rather than a broad product certification scheme, as envisaged in the other countries.

Although these initiatives all appear very promising, there is still limited evidence that they have significantly improved interoperability.

Enabling robust and reliable privacy and security frameworks

Health information can be extremely sensitive and professional ethics in health care demands a strict adherence to confidentiality. A view held by many physicians in nearly all the case studies was that sharing identifiable patient data among different providers in a network raises the question of who should be allowed access to the file and how such access is to be regulated and by whom. There appears to be a generalised need for clear and enforceable rules on these sensitive issues.

Patient consent was also often identified as the main "road block" to creating a co-ordinated information system for patient care. Some of the case study countries require that patients be informed at the time of data collection of all the purposes for which their data may be used. Others, operate on the basis of an implied consent model for disclosure of health information for treatment purposes, coupled with the individual's right to object to disclosure (opt out).

The implementation of privacy and security requirements is proving particularly challenging in the case of EHRs and constitutes a main barrier to system-wide exchange of information in many countries.

In Sweden, which enjoys virtually countrywide e-prescribing, GPs are currently unable to access the full list of medications that their patients have been prescribed due to legal restrictions. As a result, though the technology is available, privacy regulations act as barriers to fully harnessing the health benefits from the e-prescription system.

In Canada, well-intentioned privacy laws have created barriers to data access. In British Columbia, an unintended consequence of this commitment to privacy protection is that privacy is often cited as the reason that government cannot access critical health data and carry out the necessary associative studies to improve services for citizens.

In addition, in most of the case study countries, compliance is complicated by multiple layers of regulations from central to local. This is a particularly difficult problem in Australia, Canada, and the United States where rules for the protection of personal information have been established at both the national and local (state or province) levels. This made it especially difficult, for example, to implement a locally developed web-based electronic messaging and patient management system in Western Australia which cut across several jurisdictions. This is largely because rules for the protection of personal information have been established at both federal as well as state and territory levels in Australia. All regimes are similar but not identical. There are

separate regimes for public sector and private sector organisations and specific legislation applicable to entities which hold health records.

The case studies clearly indicate that appropriate privacy protection must be incorporated into the design of new health ICT systems and policies from the outset, because it is often difficult or impossible to introduce effective privacy protections retroactively. There are a variety of technical solutions already available to protect patients, but if privacy policies are unclear, technology will be of little help. Lack of clarity in the purpose and scope of privacy protection may also have unintended perverse consequences. Although health care organisations have a strong interest in maintaining privacy and security, they also have to balance this interest against the need to ensure that information can be retrieved easily when required for care, particularly in an emergency.

Restoring public trust that has been significantly undermined is much more difficult than building it from the outset. Many OECD countries are in the early stages of health ICT adoption, and this provides a critical window to address privacy and security issues.

Conclusions

The findings discussed in this report point to a number of practices or approaches that could usefully be employed in efforts to improve and accelerate the adoption and use of health ICTs. As these typically imply trade-offs with competing goals, policy makers must determine whether the expected benefits from these practices are likely to outweigh the costs in a particular situation. This study, however, highlights an absence, in general, of independent, robust monitoring and evaluation of programmes and projects. While most of the case studies had included some sort of formal evaluation to justify initial budgets, few had conducted a formal post-implementation evaluation to determine the actual payoff from the adoption and use of ICTs.

Measuring the impacts of ICTs is difficult for a number of reasons. ICT implementation may have effects that are multidimensional and often uncertain in their reach and scope, and difficult to control. In addition, the realisation of benefits from ICT implementation strongly depends on contextual conditions. For example, moving to an EHR in its fullest form is not just a technical innovation; it is a cultural transformation. Change management is vital for successful uptake, and failure to build in processes for effecting the necessary organisational transformations will reduce both uptake and impact. Coupled with this, are inherent difficulties in defining what constitutes health ICTs, the extent of its use and adoption, and the fact

that in many cases health institutions may use both ICT and more traditional practices simultaneously. Benefits of new ICT systems may, therefore, only become apparent after working practices have changed or adapted to take advantage of the new resource and this process could take several months or years, presenting a particular problem for those looking to evaluate projects.

The challenges described above place health ICT investments in a space that is quite different from other capital investments in the health sector, for example a hospital building or medical equipment. But health ICT projects are still often evaluated using traditional appraisal techniques, limiting evaluation to the objectives of sound financial management. However, providing decision makers with direct cost-analysis cash-flow projections, financial figures etc., is not enough, since the ultimate strategic objective is to improve the efficiency and quality of clinical care through health ICTs.

These methodological difficulties are further exacerbated by data limitations, definitional problems and the lack of appropriate sets of indicators on adoption and use of ICTs which can be compared over time, within and across countries. For many of the hypothesized modes by which ICTs might effect efficiency in health care systems, there is little or no available data which would allow measurement. Despite a plethora of anecdotal information, the hard evidence available today on the impact of health ICTs is, therefore, inconsistent, which makes it difficult to synthesise and interpret.

The scale of most ICT projects and the huge sums of taxpayers' money that have been and are being spent on them, make it crucial for governments to address the issues of benchmarking and of accountability so that lessons can be learned. Failure to collect the data necessary to evaluate the impact of ICTs is one of the core challenges to achieving widespread adoption of high-performing ICT initiatives.

Notwithstanding the difficulties entailed, the case studies cast no doubt on the potential ability of countries to make major progress toward key policy goals such as improving access to care in remote areas or better care co-ordination for chronic diseases through implementing ICTs. In particular, they prove that cost-effective solutions for remote and rural areas are possible. The Northern Health Authority in British Columbia was able, for example, to provide a secure, high-speed wireless communications network for over 97% of the region's rural private physician's offices through a CAD 1.2 million (~USD 1.14 million) grant from the federal Primary Health Care Transition Fund. In Australia, the Great Southern "Managed Health Network" developed a secure web-based electronic messaging system that is being now rolled out in the most remote areas of the region with start-up funding of AUD 1.8 million (~USD 1.3 million) from the government's Managed Health Network Grant programme.

One shared characteristic of the programmes reviewed here is that they were all embedded in wider reform projects, and required the support of all stakeholders to achieve their goals. Successful adoption and use generally depended on the simultaneous implementation of new service delivery models, organisational partnerships, changes in GP compensation, clear and dedicated leadership. Notable facilitators included dedicated managers and physician leaders who envisioned the specific changes needed, and were able to overcome organisational barriers and unforeseen technical challenges at implementation. All initiatives had dedicated funding, including for support and training of health professionals, which was widely recognised as a key factor in winning user acceptance.

Although there are limits to the generalisation of results, the case studies covered here illustrate the interdependence between various policy dimensions, which are difficult to disentangle, but must be addressed if countries are to achieve the intended efficiency gains from ICT implementation. The following points summarise the main findings:

- *Establish robust and coherent privacy protection*: a robust and balanced approach to privacy and security is essential to establish the high degree of public confidence and trust needed to encourage widespread adoption of health ICTs and particularly EHRs. Government action is needed to help establish reliable and coherent privacy and security frameworks and accountability mechanisms that both encourage and respond to innovation.

- *Align incentives with health system priorities*: to achieve the intended benefits from ICT technology, governments and payers need to set targets associated with unambiguous public health gains such as improved management of highly prevalent chronic diseases which are strongly associated with preventable hospitalisations, and better align resources, processes, and physician compensation formulae to match the nature of the gains to be achieved. To do this it is necessary to address the fixed costs associated with setting up the system. More important, and more difficult, it is also necessary to ensure that health ICTs are used effectively to deliver evidence-based care leading to better outcomes. This requires what has been termed, for want of a better phrase, a "sustainable business model" which either adapts, or takes into account, the payment systems in place for health care services more generally.

- *Accelerate and steer interoperability efforts*: agreement on and implementation of standardised EHRs remains a challenge, one that must be solved if the improvements in patient safety and integrated shared care are to occur. The effective and consistent collection of

data from the patient's primary care record can facilitate greater efficiency and safety as well as contribute to future research. Resolving interoperability issues will require government leadership and the collaboration of the relevant stakeholders to establish standards and develop innovative solutions.

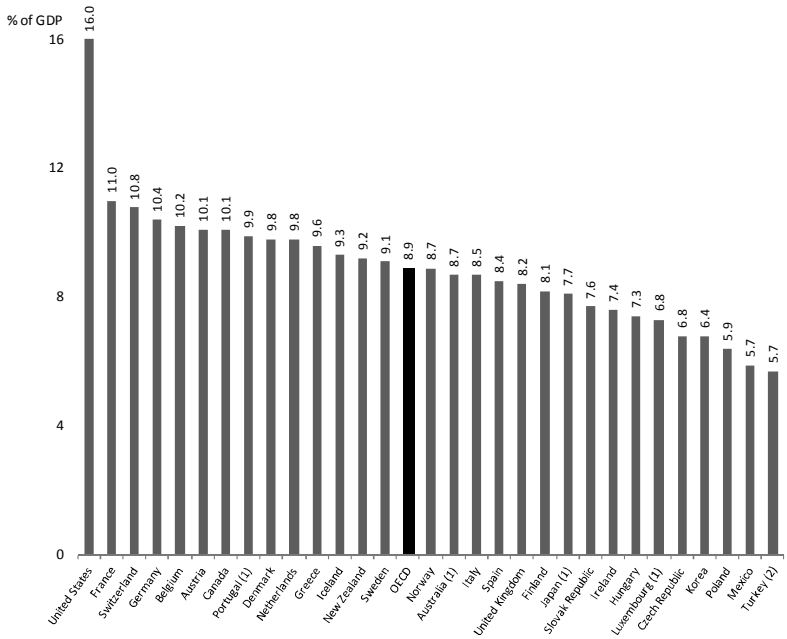
- *Strengthen monitoring and evaluation*: high-quality evidence represents a fundamental source for the decision-making processes. It is a vital tool for assessing where countries stand and where they want to go. Governments have, therefore, much to gain in supporting the development of reliable and internationally comparable indicators to benchmark ICT adoption and ensuring that systems for monitoring ICTs are sufficient to assist in meeting the improvement goals. Risk, delay and cost can be minimised by learning from good international practices.

INTRODUCTION

Policy makers in OECD countries are faced with ever-increasing demands to make health systems more responsive to the patients they serve, as well as improving the quality of care, and addressing disparities in health and in access to care. However, what patients and providers want often does not match what today's health care systems are able to deliver with existing structures at least at reasonable cost.

Although some countries have had some short term success in containing costs, reconciling rising demands for health care and public financing constraints in the context of rapid demographic and epidemiological change continues to be a dilemma.

Figure 0.1. Total health expenditure as a share of GDP, 2007



1. Data refer to 2006.
2. Data refer to 2005.

Source: *OECD Health Data 2009*, June 2009.

From 1990 through 2009, an increasing share of the gross domestic product (GDP) of OECD countries has been devoted to the provision of health care. On average, total health care spending represented just under 9% of GDP by 2007 – up from just over 5% in 1970 and around 7% in 1990 (Figure 0.1). By 2010, this share is projected to average about 10% of GDP across OECD countries.

Unrelenting growth in health care spending has put pressure on policy makers to improve their understanding of the root-causes of current inefficiencies, and to seek fundamental reforms of health care systems.

Significant problems arise because of the fragmentation of the care delivery process and information failures

A widely recognised source of inefficiencies is the fragmentation of the care delivery process and the poor transfer of information. Health care "systems" across OECD countries are largely organised in the form of separate "silos", consisting of groups of large and small medical practices, treatment centres, hospitals, and the people and agencies that run them. At present, nothing really links these isolated structures into a system within which information is easily shared and compared.

The efficient sharing of health information is indispensable for the effective delivery of care (Institute of Medicine, 2001). Health care provision is characterised by complexity and uncertainty. The timely availability of medical records of individual patients helps providers make appropriate medical decisions for their patients and organise referrals. This is particularly important for elderly people and those with chronic conditions, who often have several physicians, and are shuttled to and from multiple care settings. Chronically-ill patients may visit up to 16 physicians in a year (Pham *et al.*, 2007). The provision of care by this multiplicity of providers must be co-ordinated if wasteful duplication of diagnostic testing, perilous polypharmacy, and confusion about conflicting care plans are to be avoided (Gandhi *et al.*, 2000; Bates, 2002).

Recent evidence indicates that the barriers to sharing patients' clinical data have remained unacceptably high despite the many calls for reforms. In 2007, an OECD survey reported that medical records of individual patients are "seldom" used in almost one third of the countries surveyed, and "frequently" used in less than half of them. A more recent survey of sick adults in Australia, Canada, Germany, New Zealand, the United Kingdom and the United States indicates that when discharged from hospital, a sizeable share of patients in all six countries were not told what symptoms to look out for and/or had no follow-up visit arranged (Schoen *et al.*, 2009).

These studies provide examples of the kinds of difficulties in continuity of care that confront patients and their families and caregivers due to the lack of adequate and timely exchange of information. Furthermore, recent evidence also indicates that the co-ordination of care among multiple providers is often flawed, and medication errors are common (Levine, 1998).

Information is essential to achieve a high-quality, value-for-money health care system

Information sharing is also essential for a value-driven health care system, *i.e.* one based on both quality of care and value for money. Information can help to pinpoint which aspects of local health systems are underperforming, offer targets for improvement and identify best practice (Smith and Hakkinen, 2006). Research findings are essential for policy makers considering health system reform, and local practitioners seeking to improve their practice.

Information also has a central role in guiding patient choice. It can, for example, enhance quality and transparency in a health system, helping patients exercise informed choice of provider. It can help national policy makers to pursue national objectives, such as providing "fair" and equitable allocation of resources, reducing disparities in health and health care, and enhancing public health supervision.

The centrality of information in health systems and the diversity of uses to which it can be put, means that information and communication technologies (ICTs) that ensure the timely and accurate collection and exchange of health data are likely to foster better care, and the more efficient use of resources. It is, therefore, surprising to find that in many OECD countries, the health sector has been slow to embrace ICTs, and most physicians are still using their computers mainly for billing or other administrative tasks.

Despite the promise they hold out, the implementation of ICTs in clinical care has proven to be a difficult undertaking with varying degrees of success in leveraging that potential. Adoption has remained remarkably uneven despite more than a decade of promotion and significant public investment.

There are large variations particularly in the adoption and use of electronic health records (EHRs) by general practitioners (GPs). In the United States, a 2008 survey shows an uptake of only 13% of the most basic functions of an electronic health record system by primary care physicians. In Australia, the United Kingdom, the Netherlands and Norway, as in many other Scandinavian countries, EHRs are almost ubiquitous in primary care, but exchanging health information with other parts of the system remains

often largely paper-based. Some of the variations are due to the costs associated with adoption of these new technologies. This may be accompanied by a failure to achieve widespread understanding and acceptance of the benefits of electronic record keeping and information exchange. However, these factors cannot explain all the variations.

The upshot is that in most OECD countries, governments are seeking to better understand what can motivate providers' adoption and the conditions under which ICTs will deliver the anticipated efficiency improvement.

Objectives of the report

This OECD report presents an analysis of the range of incentives and institutional mechanisms that have been applied to influence introduction and successful adoption of ICTs in OECD countries. It is based on case studies in six OECD countries which all reported varying degrees of success in deploying ICT solutions that ranged from foundational communication infrastructure to sophisticated EHR systems, plus a broad overview of the current literature. Five key questions sum up the policy issues considered:

- How can OECD countries reap efficiency and quality gains in the health sector through ICT?
- What are the main barriers to the introduction and effective use of ICT?
- What institutional measures can help to ensure that an ICT initiative is carried through effectively?
- How can policy makers/project managers monitor and evaluate the uptake and impact of ICT?
- Do the "success stories" provide examples of best practice that can be used elsewhere?

Structure of the report

The remainder of this report is divided into five parts. Chapter 1 considers how investments in health ICTs can generate "value" for health systems. Drawing from case studies, Chapter 1 illustrates the types of benefits that can result from implementation of ICTs. It provides examples of how governments are exploiting these technologies as key building blocks in national health reform strategies and to enable innovation in health care delivery. The report then proceeds to review in Chapter 2 the most common barriers to successful adoption and use of ICTs: financial,

technical, legal and organisational. Chapters 3 and 4 report on how governments are intervening to overcome these barriers and the instruments adopted to promote secure exchange of information. The last chapter examines findings on the challenges associated with the measurement and evaluation of ICT use in health care. The report includes an executive summary of main messages and advice for policy makers seeking to accelerate adoption and effective use of these technologies.

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Chapter 1. Generating Value from Health ICTs

Chapter 1 illustrates the types of benefits that can result from implementation of ICTs. It provides examples of how governments are exploiting these technologies as key building blocks in national health reform strategies and to enable innovation in health care delivery.

Introduction

Understanding how ICTs can generate "value" in health systems can help to guide decision about ongoing and future ICT initiatives, underpin the business case for further investment and identify outcome drivers.

The term "value" in this report implies a broader view of how ICTs can produce results than the usual metrics commonly used in return on investment analyses (ROI).

In the health sector there is often no measure of performance analogous to profits for private sector firms. While a non-healthcare business selecting its investments in ICTs might consider only financial return on investment, health care is a sector that places an unusual emphasis on non-financial goals. In health care, a standardised production process is difficult to identify, and, depending on the care setting, there is considerable variation in how and what outputs are produced, and what type and mix of inputs are used to produce them.

For example, if ICT is used by a hospital to raise the quality of care or change the mix of services it provides, the resulting financial costs and benefits to the hospital will depend on how the care is delivered and paid for and the extent of transformation required in workflow and processes. How ICTs are used and the context in which they are used are both critical to maximising potential benefits.

Embedded in this challenge is, however, a substantial opportunity: to improve health care quality and reduce health care costs through ICTs – by improving the efficiency with which health care is delivered, and reducing the delivery of services with little or no value. While the case studies are not perfect, they do illustrate the types of benefits that can result from ICT implementation according to four broad, inter-related categories of objectives listed below:

- Increasing quality of care and efficiency.
- Reducing operating costs of clinical services.
- Reducing administrative costs.
- Enabling entirely new modes of care.

1.1. Health information technology can drive improvements in quality and efficiency in health care

A large body of literature has recently emerged that addresses the experience of specific organisations or providers in implementing a variety of ICT technologies such as electronic medical records (EMRs), e-prescriptions, and Computerised Physician Order Entry (CPOE) systems (Scott *et al.*, 2005; Chaudhry *et al.*, 2006; Shekelle and Glodzweig, 2009). Overall, it demonstrates that, given the right conditions, health ICTs can drive improvements in quality and efficiency in health care.

With regard to the quality of the care delivered, the studies tend to agree that the greatest contribution of ICTs so far has been in significantly increasing patient safety. Three types of medical error are common: errors due to forgetfulness or inattention, errors of judgement in planning (rule-based errors), and errors resulting from a lack of knowledge (knowledge-based errors). In 2001, the Institute of Medicine (Institute of Medicine, 2001) reported that improving patient safety requires an information system that can prevent errors from occurring in the first place, and which makes it easy for health care professionals to acquire and share information related to quality improvement.

Tools that include alerts on a patient's potentially serious health condition or risk, and facilitate communication between providers have been cited as providing substantial benefits in health outcomes (Bates *et al.*, 2001; Bates *et al.*, 2003). Communication between patients and providers is also vitally important for safety, especially at the hospital/primary care interface.

In all the case studies referred to in this report, patient safety elements were built into the various ICT systems being deployed, including greater availability of medical information such as online access to clinical guidelines or drug databases and clinical decision support tools. These features were key requirements in the secure electronic messaging and patient management solutions developed by the Great Southern Managed Health Network in Western Australia (Box 1.1). It is clear from interviews that they can substantially improve the safety of medical care by improving clinical staff actions/workflows and bringing evidence-based, patient-centred decision support to the point of care.

A related major effect of health ICT on patient safety and the overall quality of the care delivered is its role in increasing compliance with guideline- or protocol-based care (Chaudhry *et al.*, 2006), particularly in the management of chronic diseases such as asthma, diabetes or heart failure.

These conditions require regular monitoring of patients to track trends in clinical parameters and rapidly identify any deviations; this task can be dramatically facilitated by ICT. Disease management tools can also play a key role (Balas *et al.*, 2000).

Box 1.1. Integrated medication management solutions

The secure electronic messaging and patient management solution developed by the Great Southern Managed Health Network (GSMHN) in Western Australia includes not only the basic information usually stored in paper records, but also additional safety features such as allergy lists and automatic alerts to warn doctors of potentially harmful drug interactions. These features can also facilitate medication reconciliation, *i.e.* auditing the medications currently being prescribed to a patient before admission with what is continued after admission to hospital. This ensures that any discrepancies are brought to the attention of the prescriber and changes can be made where appropriate.

Key features for improving medication management include:

- Pre-populated online forms and access to, and use of, approved abbreviations.
- Access to, and use of online medicines databases (e-MIMS).
- Access to online treatment guidelines.
- Easily accessible information for reconciling the medications prescribed to a patient.
- Automatic high-risk drug and allergy lists and alerts.

Through the use of a chronic disease management (CDM) toolkit and associated decision support tools, such as flow sheets, the province of British Columbia (Canada) has achieved significant improvements in chronic care guideline compliance at a nominal cost. Findings indicate that, compared with baseline data, the proportion of people with diabetes who had HbA1c, blood pressure and lipid tests complying with guidelines from the Canadian Diabetes Association, improved between 2001/02 and 2004/05 from 21.8% to 48.6% (Box 1.2). Through the combined implementation of new approaches to care delivery, guidelines and the use of the CDM toolkit, over the same period, the cost of diabetes care in the province dropped from an average of CAD 4 400 (Canadian dollars) to CAD 3 966 per patient. In Canada, a relatively modest investment in IT has led to a major rapid change in diabetes care, yielding significant payoffs.

Box 1.2. Improving compliance with clinical guidelines in British Columbia

In 2002, chronic disease research identified a problem of low adherence to recommended clinical guidelines for diabetes, with only 39% of people with diagnosed diabetes in the province receiving two or more haemoglobin (Hb) A1c tests, and only 34% undergoing a microalbumin test. Driven by the need to improve compliance, in 2002 health officials in British Columbia established yearly targets and financial incentives to improve diabetes care, which included two or more HbA1c tests annually.

In addition, British Columbia established patient registers for diabetes and congestive heart failure to encourage health professionals to be proactive in scheduling tests and reporting information. In 2003, as part of a three-year project with funding from the Primary Health Care Transition Fund (PHCTF), British Columbia also implemented an expanded chronic care model. Implementation involved the development of an interim, web-based information system for three chronic conditions: diabetes, congestive heart failure and major depressive disorder. The interim system was later developed to provide the chronic disease management (CDM) toolkit.

The CDM toolkit incorporates clinical practice guidelines in flowsheets, and includes other features that health professionals can use to monitor and evaluate the impact of the care provided on their diabetes patients. The indicators collected for diabetes by the CDM Toolkit improved the management of diabetes by increasing the percentage of diabetic patients who undergo the recommended best practice of at least two haemoglobin A1C tests per year.

The redesign of the delivery system encouraged and expanded the scope of activity of medical office assistants (MOAs), and led to the introduction of a small number of nurses and dieticians into physicians' offices to trial multidisciplinary care, and experiment with Community Collaborative projects and Group Visits. Decision support tools, such as flow sheets, were developed to guide daily work, and substantial efforts were made to foster self-management.

The most frequently cited effect of ICTs on efficiency is related to reduced utilisation of health care services

On efficiency, or value for money, the most frequently cited positive effect is attributed to reduced utilisation of health care services. More effective information sharing, such as rapid electronic delivery of hospital discharge reports or the use of Computerised Physician Order Entry (CPOE) that delivers decision support at the point of care, can reduce the uptake of laboratory and radiology tests (Bates, Leape *et al.*, 1998, 1999; Harpole *et al.*, 1997; Rothschild *et al.*, 2000) – according to Chaudhry *et al.* (2006), sometimes by as much as 24%. In most cases, clinical decision support features can also influence prescribing behaviour, and save money by

informing physicians about "comparative effectiveness" of alternative medical treatments. This could offer a basis for ensuring that existing costly services are used only in cases in which they confer clinical benefits that are superior to those of other, cheaper services. These benefits on utilisation of health services increase as more of the available decision support features are used, and as the time horizon is lengthened (Government Accountability Office, 2003).

Case studies show that the use of Picture Archiving and Communication Systems (PACS) which allows the digital capture, viewing, storage and transmission of medical images was viewed positively by both referring physicians and radiologists. Physicians generally reported that they were able to reduce the number of repeat tests, and make decisions about clinical care more quickly. Efficiency gains included the ability to see more patients and interpret the results of diagnostic tests more quickly – a process sometimes referred to as "throughput". This means that turnaround time is shorter, and there is less waiting around for both tests and results, which also means that there is less delay before treatment can be started. This leads to increased capacity, more effective healthcare and more satisfied consumers (Box 1.3).

Box 1.3. Benefits of investments in picture archiving and communication systems

PACS is a computer system that replaces conventional x-ray film, and greatly improves access to patient information by making it possible for referring clinicians to review their patient's images on PCs from their own offices. Hitherto, in rural areas information such as lab test results and discharge summaries has sometimes taken days or weeks to retrieve and access. PACS also benefits radiologists who also have improved access to patient data and no longer have to forward information to other health care facilities.

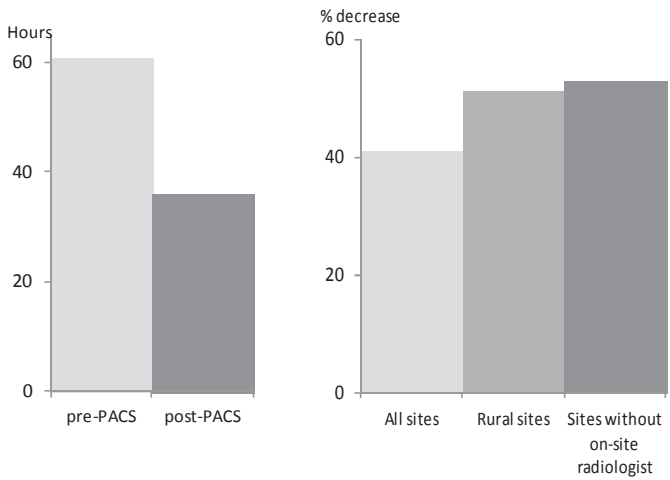
British Columbia has employed both quantitative and qualitative approaches to measuring the benefits of investments in PACS. A PACS Opinion Survey was devised to record end users' opinions about the impact of PACS on such areas as provider efficiency, patient care, report turnaround time and communication. The survey was conducted in three provinces (Ontario, Nova Scotia and British Columbia), and administered to radiologists and referring physicians deemed to be high users of the system. The survey was completed by 78 radiologists (43.1% response rate) and 181 referring physicians (17.6% response rate). The vast majority of radiologists and referring physicians indicated that PACS had improved their efficiency, with 87.2% of radiologists reporting that PACS had improved their reporting and consultation efficiency, and 93.6% indicating that it had reduced the time they had to spend locating exams for review.

According to referring physicians, PACS had also a positive impact on patient care, with two-thirds of respondents indicating that PACS had improved their ability to make decisions

regarding patient care, 80% reporting that PACS has reduced the time they had to wait to review an exam (images), 58% indicating that PACS had reduced the number of exams reordered because the results were not available (*e.g.* lost or located elsewhere) when they needed them, and 43% reporting that PACS has reduced the number of patient transfers between facilities due to the new ability to share images and consult remotely.

A separate analysis of report turnaround time, defined as the time from patient registration in diagnostic imaging to when a draft report is available to the referring physician on the system, was conducted on data extracted for 22 sites in British Columbia. The analysis showed that report turnaround time decreased following the implementation of PACS by 41% (mean turnaround time decreased from 60.8 hours pre-PACS to 35.9 hours post-PACS).

Figure 1.1. Decrease in report turnaround time following PACS implementation



Source: Northern Health Authority (British Columbia).

1.2. Reducing operating costs of clinical services

ICTs can contribute to the reduction of operating costs of clinical services through improvement in the way tasks are performed, by saving time with data processing, reduction in multiple handling of documents etc.

Experience in other sectors shows that this can have a positive effect on staff productivity. The evidence in the health sector is, however, generally mixed. ICTs can reduce some of the work involved in collecting patient information and getting it to where it is needed. Effects on physician's time, however, vary significantly and depend on the technology, the level and

type of decision support tool adopted, and individual's experience (Garg *et al.*, 2005). In the six case studies presented in this report, GPs rarely reported a reduced workload as a result of using electronic medical records, with only Swedish physicians mentioning savings of approximately 30 minutes a day as a result of using e-prescription.

On the other hand, allied health professionals in Western Australia consistently reported that using electronic messaging saved them time in a range of activities. They related this gain to easier access to patient data, faster communication, and the availability of higher quality and more complete data. Similarly, pharmacists in Sweden reported that processing prescriptions had become quicker and easier through the use of e-prescriptions and that they needed to make fewer phone calls to physicians. E-prescribing had reduced dispensing-related costs, since labour typically represents the lion's share of dispensing costs in community pharmacies. This could improve customer satisfaction, while also allowing staff to provide new services that could help diversify the pharmacy's revenue base.

1.3. Reports on cost-savings tend to be anecdotal in nature

In the countries covered by the case studies, the evidence on cost-savings was generally limited. This was due to a lack of systematic project evaluation, and the absence of baseline values and of robust measurement. There are also evaluative challenges in assessing ICTs which include isolating its impact from other, perhaps concurrent, technological improvements and organisational initiatives. The realisation of benefits from ICT implementation also strongly depends on contextual conditions. For example, moving to an EHR in its fullest form is not just a technical innovation; it is a cultural transformation. Change management is vital for successful uptake, and failure to build in processes for effecting the transformation will reduce both uptake and impact. There is also ample evidence to show that many ICT projects fail due to social and cultural issues or the absence of the necessary supporting policy frameworks. Successful adoption and use of the chronic disease management toolkit in British Columbia depended on the simultaneous implementation of new service delivery models, organisational partnerships, changes in GP compensation, and clear and dedicated leadership.

It is also necessary to recognise that there may be lags between ICT investments and benefit realisation (Devaraj and Kohli, 2000). Recent studies, for example, suggest that the financial benefits are not realised until a level of functionality is reached that allows systems to truly serve the needs of clinicians and system planners (Pricewaterhouse Coopers, 2007; Stroetmann *et al.,* 2006).

The upshot is that while most of the case studies in this report had included some sort of formal evaluation to justify initial budgets, few were mature enough or had conducted a formal post-implementation evaluation to determine the actual payoff of the projects or programmes.

There have also been very few studies that have attempted to forecast the economic impact of ICT on the health system as a whole – which is unsurprising given the difficulties in measuring output in this sector. A recent study by the United States Congressional Budget Office states, "no aspect of health ICT entails as much uncertainty as the magnitude of its potential benefits" (Congressional Budget Office, 2008; see Box 1.4).

There is a clear need for a more organised approach to systematic research in this area to assist OECD governments to determine which investment strategies are most likely to achieve savings.

Box 1.4. Report on the costs and benefits of health information technologies in the United States (US Congressional Budget Office)

The CBO report, published in 2008, provides an overview of the current challenges in estimating the value of health information technologies (ITs). The questions of primary concern to the CBO were: If the federal government took steps to stimulate the adoption of health ITs, what would be the likely impact? Would such steps ultimately reduce healthcare costs and, if so, by how much? The report analysed the cost saving estimates from two major studies performed by the RAND Corporation and the Center for Information Technology Leadership (CITL).*

The RAND study, a modelling exercise based on a broad literature survey of evidence of health IT effects, estimated that potential IT-enabled efficiency savings for inpatient and outpatient care could average more than USD 77 billion per year. Additionally, the study noted the potential for significant patient safety benefits from electronic record systems, especially those that can reduce the 200 000 inpatient adverse drug events, some of which are due to poor information transfer, possibly saving about USD 1 billion per year. Avoiding two-thirds of the medication errors and adverse drug events that occur in an ambulatory care setting could result in annual national savings of USD 3.5 billion. RAND also noted the potential for improvements in short-term preventive care through reminders to patients and clinicians about compliance with preventive care guidelines. Although e-increased use of preventive services leads to higher, not lower, medical spending overall, RAND concluded that the additional costs are not large and the health benefits are significant. Widespread adoption of advanced electronic health record systems also creates a platform for significant improvements in chronic disease prevention and disease management. RAND estimated that the potential combined savings of reducing the incidence of chronic disease attributable to long-term prevention and reduced acute care due to disease management would be USD 147 billion per year.

As is the case with any modelling project and prospective estimates, both this study and that of the CITL were subject to numerous assumptions and judgments. The CBO report notes that "both studies appear to significantly overstate the savings for the health care system as a whole – and by extension, for the federal budget – that would accrue from legislative proposals to bring about widespread adoption of health ITs. It concludes that Health ITs appear to be necessary but not sufficient to generate cost savings; that is, health IT can be an essential component of an effort to reduce cost (and improve quality), but by itself it typically does not produce a reduction in costs".

* CITL examined technologies for the electronic flow of information among healthcare organisations focusing on the value of health information exchange and interoperability (HIE&I). Results of the CITL-HIE&I analyses are reported in: Pan (2004) and Walker *et al.* (2005).

Source: Hillestad *et al.* (2005); Linder *et al.* (2007); Walker (2005).

1.4. Health care organisations can reap non-financial gains from ICTs

Despite the difficulty of measuring the cost-benefits associated with investments in ICTs, increasing numbers of health care organisations are reaping "non-financial", intangible gains from these technologies. This means that to appreciate fully the benefits that can accrue from ICT implementation, it is often necessary to look beyond financial results to more qualitative impacts, including patient and provider perceptions. In Western Australia, together with confidentiality, speed of communication was the most commonly perceived intangible benefit (*e.g.* the prompt receipt of discharge summaries from hospitals – previously often arriving after the patient had been seen by the GP following surgery). For some GPs and allied professionals an additional intangible benefit is the possibility to access patient information at multiple locations (*e.g.* their private practice, a residential aged care facility or hospital). GPs in Western Australia and Canada were pleased that they did not need to return to their practices to consult patient data or clinical notes. These time gains may lead to improved quality of life, decision making, and higher quality of care including more patient satisfaction.

1.5. Administrative processes such as billing represent in most countries a prime opportunity for savings

Administrative processes such as billing represent in most countries a prime opportunity for savings. Duplicative requirements and idiosyncratic systems can drive up the cost of care, with insurers and providers sharing the greatest burden of the administrative processes.

Among the case studies, experts in Massachusetts reported staggering administrative cost savings as a result of introducing electronic claims processing through the New England Healthcare Electronic Data Interchange Network (NEHEN), a consortium of providers and payers established in 1997. Claims that cost USD 5.00 to submit in labour costs per

paper transaction, after the introduction of NEHEN, were processed electronically at 25 cents per transaction (Halamka, 2000). By 2006, the network was processing more than 4.5 million transactions every month, representing 80% of all transactions in the State of Massachusetts. Through this intensive use, NEHEN has been able to significantly reduce the cumulative annual administrative costs for its members. For example, the health care provider Baystate Health was able to save more than USD 1.5 million through lowered transaction fees in less than three years, between September 2006 and April 2009. Savings are driven in large part by achieving administrative simplification and by slashing the time taken to process billing and claims-related information manually.

Despite the evidence of cost reductions, by 2009, an estimated 35% to 40% of US physicians still relied on paper claims submissions. Neither of the two major technologies used in electronic payment, electronic data interchange (EDI) and electronic funds transfer (EFT), had been widely implemented in other states. Barriers ranging from lack of nationwide standards, to infrastructure cost and inconsistencies in requirements from the different payers have hindered widespread adoption of these technologies.

In Australia, electronic claiming over the internet has been available since 2002 when Medicare Online was introduced. Similarly to the United States, uptake by physicians has been slow. In order to accelerate adoption and use by physicians, in 2007 the Australian Government introduced a range of incentives. In May and June 2009, Medicare Australia also ran a targeted communication campaign to promote Medicare electronic claiming to the Australian public. Although data was limited, in Western Australia, physicians reported faster communication, fewer telephone calls, and savings in mail handling, stamps, and paper.

1.6. Achieving "transformation" through ICTs

ICTs can also generate value by enabling innovation and a wide range of changes in the process of care delivery, which may (or may not) improve cost efficiency (*i.e.* reduce net expenditures) (Coye *et al.*, 2009). As evidence for these effects has accumulated over the past decade, ICTs have also been defined as technologies with a transformative potential, in that they can open up the possibility of entirely new ways of delivering care. Health ICTs can achieve "transformation" by effectively providing means to implement changes that are otherwise impossible to envisage without these technologies (*e.g.* establishing new models of care delivery/access to care in remote and rural areas).

The case studies reviewed here provide good examples of how governments have significantly leveraged this transformative potential while

pursuing health care reform agendas. In general, there are three broad goals and change agendas that governments have successfully pursued with ICT implementation.

Primary care renewal

In many countries, primary care represents the main entry point into the health care system for all the individual's health-care needs and problems. It provides ongoing person-focused care, and co-ordinates or integrates care provided elsewhere or by others. Starfield's (1994) description of primary care as "first-contact, continuous, comprehensive, and co-ordinated care provided to populations undifferentiated by gender, disease or organ system" encapsulates the main attributes of primary care. Countries with health systems that are more oriented towards primary care achieve better care co-ordination and health outcomes, greater life expectancy, better patient satisfaction and lower overall health care costs (Renders *et al.*, 2001; Davis *et al.*, 1999; Starfield *et al.*, 2002, 2005) The primary health care system also serves essential public health interests by providing an infrastructure for detecting unusual health events, and a vehicle for rapidly disseminating information and care during a national health emergency.

Not surprisingly, in the six countries covered by the case studies considered here, ICTs are central to efforts to renew primary care, generally by targeting three areas of considerable need: improvement of chronic care, multipurpose service delivery and better care co-ordination. These objectives are not necessarily mutually exclusive, and are indeed closely linked. Choosing these targets has ensured that projects that could have otherwise drifted and become "technology for the sake of technology" in fact had a discernable health focus.

As we will discuss later, the implementation of ICTs to achieve change in primary care was without exception combined with the realignment of incentives as well as a strong business case intended to motivate the adoption of ICTs by the many diverse stakeholders. Health ICT adoption was also tightly coupled with a reassessment of the clinical care model as well as directly involving clinicians from start to finish.

Improved access to care

The fragmented approach towards health care delivery, combined with inequities in access to care that reflect geographic, socioeconomic, and cultural disparities can create a care gap for citizens. A range of ICTs can help to bridge this gap by providing a cost effective means to deliver quality care to remote or under-served populations. A number of studies have shown, for example, that telemedicine can be used in many situations to overcome and redress workforce shortage and the often skewed distribution

of physicians, and particularly of specialists, between rural and urban settings (Jackson *et al.*, 2005; Balamurugan *et al.*, 2009; Shea *et al.*, 2006; Izquierdo *et al.*, 2003; Bashshur *et al.*, 2009).

In all six case study countries, telemedicine services are being used to great effect in areas with large rural or remote populations. In the Balearic Islands, for instance; telemedicine is now providing emergency stroke care to patients who previously had no access to this (Box 1.5).

The introduction of telemedicine in British Columbia has allowed patients in rural areas to be assessed closer to where they live. Figure 1.2 shows how the number of patients who were seen following thoracic surgery increased significantly after telemedicine was introduced in December 2003. It also shows how in 2004, just one year post implementation, telemedicine gradually became the preferred mode of service delivery.

Similarly, in Australia, telemedicine is a critical component of the Western Australia Country Health Service's strategic plan for delivering care to the indigenous population.

Box 1.5. Improving access to emergency stroke care in the Balearic islands through telemedicine

Tissue plasminogen activator (tPA), a powerful clot-busting drug used in stroke treatment, is effective in improving outcomes in patients if used within three hours of stroke onset. Despite the evidence, prior to the introduction of the telestroke programme the number of patients actually receiving tPA in the Balearic Islands was limited. Two of the limiting factors were the shortage of available acute stroke expertise in emergency departments and limited access to a hospital stroke unit. Neurologists often cover several hospitals, making it difficult for them to evaluate acute stroke patients on site when needed. In addition, emergency room physicians typically do not have the requisite experience to make decisions about thrombolytic therapy without the backup of a vascular neurologist.

The regional health authority's (Ib-Salut) drive to modernise health care IT began in 2004, and physicians recognised an opportunity to extend stroke care services to the more scattered parts of the region. To do so, they exploited the new regional patient electronic health records to make critical patient data available not only at the point of care, but to all essential care providers. For stroke care, this has meant that physicians can now share a patient record instantly across the region with stroke team neurologists at Hospital Son Dureta. This has eliminated fragmentation, and provided a continuity of care that did not exist before.

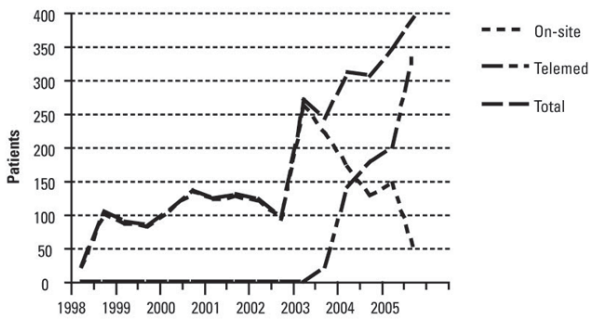
A Picture Archiving and Communication System is used to allow the rapid sharing of essential radiological imagery to make the confirmatory diagnosis of the stroke and its category by neurologists at Son Dureta.

The Balearic network merges audio, video, and data transmission to enable Son Dureta neurologists to be "virtually" present at the bedside of a stroke patient anywhere in the region.

Furthermore, the Balearic telestroke programme has turned out to be much more than just a technology project; it has brought about a fundamental change in the attitude to and understanding of stroke within the community. Through the use of community education and awareness campaigns, Ib-Salut has created a community awareness that was virtually non-existent before. In addition, Ib-Salut has provided stroke management training to over 500 primary care physicians in the region, as well as training physicians and nurses in emergency response teams,. Care providers are now not only better able to recognise and evaluate strokes, they also now realise that treatment is possible and that time is critical. Ib-Salut officials noted that the attitudes of physicians and nurses seeing stroke patients have gone from being "nothing can be done" to "every second counts because there is so much we can do". As a result, the programme has been the catalyst for community building and organisation centred on improving stroke outcomes.

Telestroke care, like telehealth in general, transcends distance and geographic boundaries. Patients outside the Palma area now have an equal chance of receiving timely stroke treatment. Twenty-six patients were treated between July 2006 and November 2008. Results on outcomes show that the efficacy and safety of telestroke care is comparable to those of direct care, with three months post-stroke cure rates of 59% for patients receiving face-to-face care versus 55% for those receiving telestroke care.

Figure 1.2. Thoracic surgery patients seen at outreach clinics per six-month period, 1998-2005



Source: Humer *et al*. (2006).

Improved quality of care measurement and performance monitoring

The delivery of quality health care is a fundamental goal of all health systems. Increasingly, both hospitals and other medical practices are being judged by systematic measurement and reporting of their performance. However, across most OECD countries, measuring the quality of the health care is a labour-intensive and time-consuming process and generally occurs retroactively.

Case studies show that automated data collection and processing can provide richer data in an accessible form that facilitates benchmarking and identification of quality improvement opportunities. It can also enhance

documented adherence to quality assurance criteria and the efficiency of surveillance, population and outcomes research (Kukafka *et al.*, 2007).

In the United States, the Massachusetts e-Health Collaborative (MAeHC) has enhanced the information-gathering capabilities of physicians, and improved the electronic capture of laboratory, pharmacy and other data sources necessary to expand measurement of outcomes. The MAeHC's effort to extract health care quality data from the community level database, which is an agreed-upon subset of data stored in physicians' EHRs, offers an opportunity to engage providers effectively and increase alignment between incentives programmes (Box 1.6).

Health authorities and payers can now have a more timely view of how the health system is performing, enabling them to make more relevant decisions about which areas call for clinical improvement, how best to allocate finance, training, and other resources.

Box 1.6. Real-time tracking of the quality of clinical care delivery

Clinical audit has an increasingly important role in the quality of care being offered to patients. Only good quality data can enable valid conclusions to be drawn, which in turn enable changes to be made for the better. In the United States, the development of health ICTs such as EHRs, and collection and analysis of quality of care data have traditionally followed divergent paths. Although more and more patient data are held on computer systems, traditionally, quality data is collected and analysed retrospectively on the basis of insurance claims. Structured electronic data sources can, however, provide useful, and in principle, more accurate and granular complementary information. Improving quality of care measurement has, been a key goal of the Massachusetts e-Health Collaborative (MAeHC) since its inception. Consequently, in implementing EHRs and health information exchanges (HIE) the Collaborative has been attempting to bring these divergent paths back together. The MAeHC has worked with quality and performance experts to develop standardised and nationally-recognised metrics that can be used to monitor impacts on quality and cost of care. Most of the data today is sent directly to a central quality data warehouse, from HIEs via EHRs deployed in physician's practices, together with data from their billing system.

The shorter-term end product has been the production and distribution of EHR clinical performance feedback reports to participating providers, which help them to monitor their own performance and identify clinical areas calling for improvement. These efforts to extract health care quality data directly from HIEs has opened a live window on the performance of the local health system and provided a shorter feedback loop for clinicians who can adjust their working practice as appropriate. It also offers an opportunity to engage providers effectively and increase alignment between incentives programmes, as service delivery data can now be captured in real-time.

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Chapter 2. What Prevents Countries from Improving Efficiency through ICTs?

Chapter 2 reviews the most common barriers to successful adoption and use of ICTs: financial, technical, legal and organisational. The process of ICT implementation is a notoriously complex and expensive undertaking. At each stage of the implementation/adoption/use cycle, various social and economic factors can disrupt the process.

Introduction

The process of ICT implementation is a notoriously complex and expensive undertaking. At each stage of the implementation/adoption/use cycle, various social and economic factors can disrupt the process.

Many initiatives end up only as "successful technical pilots" and never achieve more widespread implementation and economies of scale. Although the end-users are satisfied with the technology and initial objectives are reached, often projects never make it to a more mature stage, and fail to achieve the expected benefits (in spite of the ICTs being successfully piloted and implemented).

The evidence to date suggests that successful implementation and widespread adoption are closely linked to the ability to address three main issues:

- *Misalignment of incentives and the need for fair allocation of benefits and costs*: with a payment system that very often does not reward providers for improving quality of care or support them in making investments in ICT systems, limited resources can deter from pursuing these systems. In particular since the costs associated with adopting new technologies are not shared equitably among stakeholders, investments which are cost-effective from the point of view of the system as a whole are not automatically going to be undertaken.
- *Lack of commonly defined and consistently implemented standards*: health care providers struggle with inconsistent medical terminology, clinical records and data storage, as well as a multiplicity of schemes introduced to facilitate interconnection and communication between specific ICT systems. Because of fragmentation in the market and the rapidly evolving nature of technological solutions, in the absence of agreed industry-wide standards and compliance with existing rules, providers investing in technological infrastructure face high risks of failure and poor returns. The ability to share information (interoperability) is also entirely dependent on the adoption of common standards and compliance with them.
- *Concerns about privacy and confidentiality*: because of the sensitivity of health information, and the generalised uncertainty on how existing legal frameworks apply to health ICT systems, privacy concerns constitute one of the most difficult barriers to overcome if widespread implementation of ICTs is to be achieved.

2.1. Are there any financial gains to be made – and if so, by whom?

This question is pivotal to the adoption of health ICT. In 2006, a report by the US AHRQ concluded that "it is not possible to draw firm conclusions about which health information technology functionalities are most likely to achieve certain health benefits – and the assessment of costs is even more uncertain. Existing evidence is not sufficient to clearly define who pays for and who benefits from health information technology implementation in any health care organisation – except those, such as Kaiser and the Veterans Administration, that are responsible for paying for and delivering all the care for the defined population" (Agency for Healthcare Research and Quality, 2006).

One significant barrier to investment in ICTs is the widely recognised fact that any resulting cost savings may not always accrue to the implementer, but may be passed on to a third party. Benefits may appear at one site and in one budget, while a large share of the cost commitments appear at another site and in another budget. In addition, there are no incentives, and may even be disincentives for care providers to be the first to adopt ICTs (Taylor *et al.*, 2005). This key misalignment of incentives, the extent of which depends on the way health care systems are structured and reimbursed, is a major barrier to the adoption of ICT and, more generally, to health care transformation (Ash and Bates, 2005).

Using a simulation model of the adoption of electronic medical records (EMRs) Hillestad *et al.* showed in 2005 that providers (*e.g.* physicians or hospitals) in the United States would suffer short-term revenue losses as a result of investing in these systems, while consumers and payers (*e.g.* health plan and employer) are the ones most likely to reap the significant savings. The authors examined disease management programmes for four conditions: asthma, congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD) and diabetes, and estimated the potential impact of 100% participation of those eligible for each programme. By controlling acute care episodes, the programmes would generate potential annual savings in the billions. However, most of these savings would come out of care provider receipts (Simon *et al*., 2007; Ash and Bates, 2005).

2.2. Purchase and implementation costs for EMRs can be significant

The purchase and implementation costs for patient management systems (EMRs and EHRs) can be significant, and considerable investment is required both initially and on an ongoing basis. For many small to mid-size primary care practices this means that they cannot afford to implement an EMR system as the costs are often prohibitive. Furthermore, as noted earlier,

in many cases there is little or no financial incentive for them to do so, given that it is the payers and purchasers of health care services that have the most to gain financially. While costs for these systems can vary from country to country, given the presence of large multi-national vendors and prevailing market rates, system prices are relatively similar. The case studies describe two major implementation models: traditional in-office installation of software/hardware, and patient management systems provided over the web via an application service provider (ASP).

In the United States, the MAeHC has performed traditional in-office implementations of EHRs in each of the physician's practices located in the three pilot communities. MAeHC reports hardware and software costs of approximately USD 30 700, plus another USD 12 100 for support per physician.

In Canada, the Physician Information Technology Office (PITO) programme established by the B.C. Government in 2006 to "*c*o-ordinate, facilitate and support information technology planning and implementation for physicians" has adopted a different approach based on the ASP model. PITO has since contracted and certified a panel of five vendors from which primary care physicians must purchase their EMR if they wish to receive PITO funding.

PITO negotiated prices with these vendors on the basis of one time hardware and software start-up costs of approximately USD 15 500 plus an annual fee of almost USD 4 000 the first year, rising to almost USD 6 000 thereafter.

It should be noted that definitions of EMR and EHR vary significantly across countries. Rather than attempting to provide a single overarching definition, this study has adopted the approach developed by Blumenthal and colleagues of the Institute for Health Policy (Boston, United States) in 2008 (DesRoches *et al.,* 2008), which is based on defining and comparing the key functions that constitute an outpatient EHR (see Box 2.1). As evidenced in the request for proposals (RFP) through which vendors were selected, the EMRs funded by PITO include all of the core elements of a fully functional EHR, with the exception of three of the main functions (prescriptions sent electronically, orders sent electronically and electronic images returned). On this basis, a rough comparison of costs in the United States and Canada for these systems is possible and is shown in Table 2.2.

Box 2.1. Functional characteristics of an electronic health record

One the basis of advice from an expert panel, in 2008 DesRoches and colleagues defined the key functions that constitute an outpatient EHRs. Using a modified Delphi process, the panel reached consensus on functions that should be present to qualify the system into two functional categories, a basic system and a fully functional system. The functions that should be present to qualify a system as "fully functional" consist of 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). The four domains are associated to a total of sixteen unique functions. The distinction between the two types of EHRs is defined by the absence of certain order – entry capabilities and clinical-decision support in a basic systems while a fully functional system has all sixteen functions present (Table 2.1).

Table 2.1. Functions qualifying EHRs as basic or fully functional systems

Health information and data: five functions	Basic system	Fully functional system
Patient demographics	x	X
Patient problem lists	x	X
Electronic lists of medications taken by patients	x	X
Clinical notes	x	X
Notes including medical history and follow-up		X
Order-entry management: five functions		
Orders for prescriptions	x	X
Orders for laboratory tests		X
Orders for radiology tests		X
Prescriptions sent electronically		X
Orders sent electronically		X
Results management: three functions		
Viewing laboratory results	x	X
Viewing imaging results	x	X
Electronic images returned		X
Clinical decision support: three functions		
Warnings of drug interactions or contraindications provided		X
Out-of-range test levels highlighted		X
Reminders regarding guideline-based interventions or screening		X

Source: DesRoches *et al*. (2008).

Table 2.2. EMR/EHR costs in the United States and Canada

	United States MAeHC (USD)	Canada PITO (USD)
Hardware	22 800	6 364
Software & implementaion	17 200	9 091
Annual support/License	5 600	3 709 (1st year)/ 5 836 (2nd year & beyond)

Source: MAeHC and PITO (the PITO programme is only available to physicians in British Columbia).

Although there is a significant difference between the initial start-up costs between the two implementation models, expenditure over the long run are comparable and continue to cause concern. This is due to the ongoing burden of annual support and licensing costs which add up as well as costs for eventual major upgrades or system replacement. Physicians in all six of our case studies repeatedly referred to cost, and said that without the incentive programmes, subsidies, or free implementation (as in MAeHC), they would not have had the impetus to undertake EHR adoption. Thus, the substantial initial and ongoing cost of EHRs, the loss of productivity and consequently reduced revenues during the transition period, are likely to continue to hamper the adoption of health ICT, particularly for smaller primary care practices, unless the appropriate funding mechanisms are put in place.

2.3. Physician incentives differ under different payment systems

Given the upfront costs entailed, the decision by physicians to adopt EHRs will depend both on the foreseeable financial returns on their investment, and the potential collateral benefits, which, in most circumstances, are unlikely to carry any substantial weight if there are net financial losses. Such collateral benefits could include enhanced professional standing, improved patient satisfaction, better health outcomes and patient retention, and intellectual satisfaction.

Physicians will face different incentives under different payment systems (Institute of Medicine, 1997). Each model of payment generates its own incentives depending on how providers produce health services, how efficiently and equitably services are provided, the quality of care, and how intensively patients make use of health services.

In 2003 Wang *et al*. performed a cost-benefit study to analyse the financial effects of electronic medical record systems in ambulatory primary care settings at Partners Health Care Systems in Boston (United States). The authors reported that while some savings to the health care organisation were obtained under both capitated (or per capita) and fee-for-service (FFS) reimbursement, the extent of these savings depended on the reimbursement mix. Among fee-for-service patients, a large portion of the savings accrued to the payer rather than to the care provider. Under per capita reimbursement systems, benefits from EMR adoption would instead more readily accrue to the physician's practice and/or provider organisation, primarily as a result of avoiding costs that would otherwise result from lower uptake.

Under a per capita reimbursement scheme, physicians receive an annual fixed fee per patient, and, therefore, have an incentive to attempt to minimise costs. Capitation also encourages GPs to provide the best possible preventive and long-term care, because this can be expected to reduce future costs. In addition, capitation provides an incentive to expand the patient list, because every new patient brings in extra income. In this context, ICTs can help in achieving and managing these health and business opportunities.

On the other hand studies have shown that FFS schemes create incentives for GPs to provide shorter consultations and more services than would otherwise be provided in an incentive-neutral environment. This means that they do not provide the appropriate incentive environment for physicians to engage in complex cases, co-ordination of care or in services outside of the traditional office visit, such as phone consultations or using electronic media to communicate with patients. The empirical evidence that FFS payment schemes tend to result in the over-provision of services and the under-provision of co-ordinated, complex care is now fairly persuasive (Gosden *et al.*, 2001).

FFS also creates a culture where the use of new technologies requires new fees. If new treatments have not yet been classified by the fee-for-service system, GPs will have no financial incentive to carry them out even when there is a clear benefit to patients.

In contrast, a physician operating under an FFS scheme will have a financial incentive to manage time efficiently (Brennan *et al.*, 2000). Evidence of significant productivity gains through EHRs would, for example, provide a considerable incentive for GPs to adopt this approach.

Countries with FFS payments for primary and specialist ambulatory care are those that are more likely to encounter difficulties in implementing health ICTs. The lack of fees or other incentives for responding to patient e-mail, working with data from new sources, and facilitating

informed/shared decision-making are key components of the problem of introducing ICTs in these countries. According to a recent OECD survey, these are the countries that consider that they have care co-ordination problems at these same levels of health care provision (OECD, 2007).

A substantial number of OECD countries fall into this category. FFS is the most widely used form of payment in primary care, followed by salary and mixed schemes (Table 2.3). Specialist care provided in an ambulatory setting is also most frequently paid for on a FFS basis, while specialist care provided in a hospital outpatient environment is mostly salaried.

In a salary-based system, a physician is paid a fixed amount of money per hour worked. Salary payment has some advantages. Contrary to capitation and FFS, it is administratively simple, offers the physician a fixed income, and does not contain any incentive for deliberately cost-generating behaviour (Rosen, 1989). A major problem with salary-based remuneration systems is that there are no incentives for physicians and other health care personnel to perform over and above the minimum that is required of them in order to keep their jobs.

Governments and payers can adopt some measures to mitigate some of the adverse effects and reinforce some of the positive effects of a salary-based remuneration system:

- Integrate financial bonuses into a salary system. One example of such incentives are performance-related financial bonuses, that have been successfully tried in many countries.
- Offer non-financial incentives to physicians, like awards, promotions, etc.
- Set in place a system of quality control to monitor and maintain quality levels.
- Improve monitoring to ensure greater availability of physician time.

Under a salary-based system, because the physician does not bear the financial risk, the decision to finance and adopt ICT, including which of the available technologies to adopt and for what purpose, will generally be taken by the government/payers.

As will be further discussed in the following parts of the report, given the absence of an effective market in health care, the disincentives inherent to all existing reimbursement schemes, and the current risk-averse culture, public and private payers cannot simply rely on physicians "willingness to pay" for ICTs. This is particularly unlikely to occur in a context of FFS (Box 2.2).

It is, therefore, in the interest of payers to help health care providers finance the switch to ICTs because of the benefits that would accrue both to themselves and to the people on whose behalf they purchase health care. In so doing, they should give careful consideration to the possibility of sharing some of the risks and potential savings with health care providers.

Table 2.3. Payment schemes in primary and specialist care, 2008

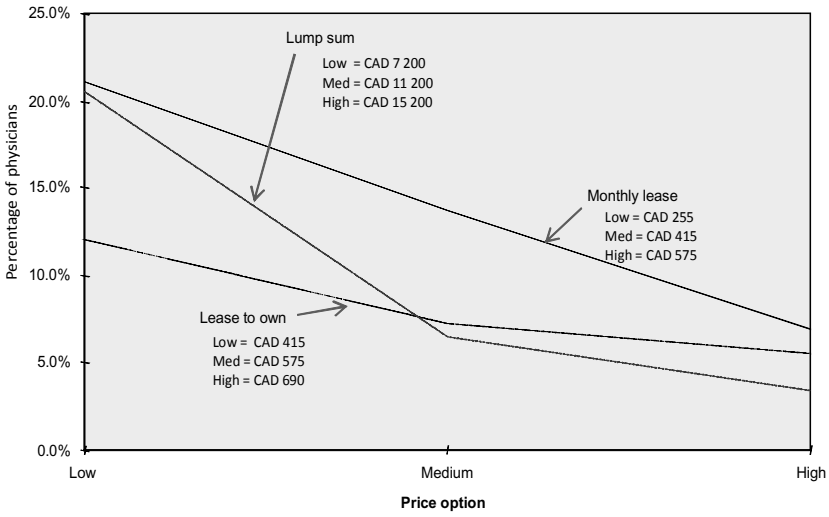
	Primary care physicians payment	Specialist care (ambulatory)	Specialist care (hospital)
Australia	FFS	FFS	Salary
Austria	FFS/Cap	FFS	Salary
Belgium	FFS	FFS	
Canada	FFS	FFS	FFS
Czech Republic	FFS/Cap	FFS/Sal	Salary
Denmark	FFS/Cap	Salary	Salary
Finland	Sal/Cap/FFS	Salary	Salary
France	FFS	FFS	Salary
Germany	FFs	FFS	Salary
Greece	Sal	FFS/Sal	Salary
Hungary	Cap	Salary	
Iceland	Sal	FFS	Salary
Ireland	Cap	FFS	Salary
Italy	Cap	Salary	Salary
Japan	FFS	FFS	Salary
Korea	FFS	FFS	
Luxembourg	FFS	FFS	
Mexico	Sal	Salary	Salary
Netherlands	FFS/Cap	FFS	FFS
New Zealand	FFS/Sal	FFS/Sal	FFS/Sal
Norway	FFS/Cap	FFS/Sal	Salary
Poland	Cap	FFS	
Portugal	Sal	Salary	
Slovak Republic	Cap		Salary
Spain	Sal/Cap	Salary	Salary
Sweden	Sal	Salary	
Switzerland	FFS	FFS	
Turkey	FFS/Sal	FFS/Sal	FFS/Sal
United Kingdom	Sal/Cap/FFS	Salary	Salary
United States	Sal/Cap/FFS	FFS	

Note: Cap = capitation, FFS = fee-for-service, Sal = Salary.
Source: OECD survey on health system characteristics 2008-09 and OECD estimates.

Box 2.2. Physicians' willingness to pay for electronic medical records in Ontario, Canada

In 1998, the Centre for Evaluation of Medicines, an academic research institute affiliated with McMaster University, investigated physicians' willingness to pay as a component of a larger provincial programme for the computerisation of medical practices (known as COMPETE, the Computerisation of Medical Practices for the Enhancement of Therapeutic Effectiveness Study). The study was based on interviews of a randomly selected small sample of physician in Ontario. Only 20% of physicians reported that they were willing to purchase an EMR system Those who were willing to purchase said that they would be willing to pay between CAD 255 and 415 per month. At higher prices, interest dropped off dramatically. Improved efficiency, better access to medical information and faster chronic patient data charting and health trend analysis all act as drivers of physician interest.

Figure 2.1. Willingness to pay



Source: Keshavjee *et al.* (1998).

2.4. Cross-system link-ups remain a serious problem

While health care organisations are increasingly equipped with ICT products and systems, linking them remains a serious problem. Information systems in separate health care business entities must be able to exchange clinical information on patients, *i.e.* be interoperable, if value is to be attained as a result of introducing ICT in clinical settings. Consistent

implementation of standards and appropriate organisational changes are necessary to facilitate this process.

Different computer systems are said to be interoperable when they can exchange data with and use data from other systems. Simply converting data from a paper format to a digital format is not enough to ensure interoperability. Interoperability depends primarily on all the computer systems that need to exchange information being able to communicate. The rules that specify how to send information back and forth need to be defined. This obviously involves technology issues, but it also includes other kinds of issues, such as legal and business rules that need to be co-ordinated between organisations in order for them to feel comfortable exchanging confidential patient data (Chaudhry, 2005).

At present, both health care delivery and the ICT that supports it are fragmented. The current health care delivery system is composed of a patchwork of care and services where patients interact with providers in a variety of settings (*e.g.* GP practice, specialist office, and clinical laboratory) that are rarely linked up.

Over the years, different patient management and data systems have been developed in each of these many clinical settings, often involving different technologies and very different levels of sophistication. Today, providers are often still using legacy systems introduced decades earlier. These systems were not designed to work together in a co-ordinated fashion, and this now makes it difficult to achieve adequate electronic data exchange among different patient management and/or other clinical data systems.

All of the case study countries reported that they had to customise their equipment and perform extensive systems integrations in order to achieve the level of interoperability required (Box 2.3). Indeed, some noted "who could have envisioned that patient management systems put in place ten years ago would now need to interoperate with portals or other more sophisticated medical records?". The technological challenges of making different systems (legacy and recent) communicate with one another are far from trivial, and require substantial development resources to be added or diverted from other work. Even with such an investment, differences in the underlying architecture of EHR systems, and the way that the systems are configured and used in individual institutions limit the quantity and quality of data that can be conveyed. While users have long complained about the situation, few appear to be willing to pay more for what many feel should somehow be a standard capability of the product. Furthermore, prospects are slim that private market competition alone will produce the necessary standardisation of EHRs – as further discussed below.

Box 2.3. Dealing with legacy systems: the Dutch approach

In the Netherlands, the decision to launch the national electronic health records system began with a proof of concept (POC) phase in which the various components of the planned exchange of patient information between existing health care information systems were tested for their compatibility. At that time, a major concern for public authorities was the relatively large number of vendors and EMR systems on the market. In 2005, although two vendors supplied ICTs to nearly 60% of the Dutch hospitals, a total of about 20 companies were selling a variety of EMR systems to physicians. These EMR software platforms were largely incompatible with each other, and were not interoperable. They had to be modified to a greater or lesser extent to enable smooth data transfer into the planned national database facilities. The POC was intended to demonstrate that the national facilities could operate properly and securely with the modified EMR systems.

During the POC, all components were tested. ICT suppliers were invited to take part in the POC, and were financially reimbursed for doing so. The POC process acted essentially as a needs assessment process, and helped to identify "gaps", technical and information needs requiring additional effort and/or investment in research, development, testing, and evaluation.

In the Netherlands, a great deal of up-front effort and co-ordination went identifying of the technical requirements for interoperability, and assessing ways to overcome problems with pre-existing legacy systems. The fragmentation of technology and lack of interoperability was recognised early on, however, the key to the success of this approach lies in the fact that the private sector responded positively to the call by public authorities for greater co-ordination. In fact, the private health sector has been calling for greater co-ordination since the beginning of the decade. In addition to technical issues, other requirements, including the potential need for new framework conditions, were addressed through this process in the Netherlands. These included: *1)* operational requirements (*e.g.* ease of use, cost-benefit, privacy, and human resource/education); *2)* clinical requirements (*e.g.* reliability of patient records, and risk management).

2.5. Lack of commonly defined and consistently implemented standards plagues interoperability

Although, many of the standards required to progress toward interoperability do already exist (Hammond, 2008), there is still no international consensus around which standards should be adopted, and exactly how they are to be implemented. A lack of commonly defined standards and the consistent implementation of those standards continue to be a major impediment to setting up widely distributed interoperable systems. The need for standards has been recognised for a number of years now (Institute of Medicine, 2001; Government Accountability Office, 2005). However, the development, approval, and adoption of standards for health ICT are proving a difficult and drawn-out process.

One key factor is that standard setting has the potential to regulate the market and enhance the market value of a technology/vendor which is certified against the standards. Standards can be set through the market (*de facto*) or through formal standard-setting activities (*de jure*). In sectors such as banking and manufacturing, it has often been the market that has set the standards, and a commercial "consensus" has been reached about the right standards to adopt. However, this has not yet happened for health ICTs, despite the urgent need for such standardisation. In settings where compatibility requirements are high as in the heath sector, adopting a *de jure* standard led by government through a participatory approach which takes into account views from all stakeholders, may be very important as the choice of the standard could virtually eliminate, not merely disadvantage, technologies that do not adopt or comply with such requirements. However, industry position so far has been that standards adoption should remain market driven. At the same time there is growing and widespread agreement that governments have a key role to play in creating a legal framework that could foster what has been termed, for want of a better phrase, "organic evolution" of industry standards (Comments of the Business and Industry Advisory Committee to the OECD, 2009).

Under pressure, vendors and users as well as international standards organisations have nonetheless started to collaborate more openly in the development and progression of standards. This collaboration has resulted in some level of success. The open standards[1] of DICOM for digital images and HL7 for clinical messaging are slowly becoming universally available, and were developed through a voluntary industry and user-driven process. In both cases, health professionals and technology manufacturers collaborated in developing the common formats and protocols for sharing clinical information. Another area where industry collaboration is gaining traction is the development of open source health care software with several initial successes. Open source software is developed with an open code that is made available, at no cost, in the public domain to download and change as needed and again share with the community. Combined with open standards for health records systems, open source could provide a possible reference point

1. The term "open standard" as used here refers to the nature of the standard's development with multi-stakeholder input and broad industry recognition; availability for use by all interested stakeholders (users, vendors); and the high level of access to its specifications for ready promulgation in a variety of hardware and software. It does not necessarily imply freely available or royalty-free. The term "open standard" is sometimes coupled with "open source" with the idea that a standard is not truly open if it does not have a complete free/open source reference implementation available.

for compatible information systems and ensure broader interoperability. Making open source software such as EHRs available as an option for physicians offers significantly lower upfront costs. This, however, does not mean free software for everyone, nor it necessarily implies higher guarantees of reliability and quality than commercial products. The success of any open source software depends on the community of developers who participates in its development (California Health Care Foundation, 2006). Recently, a growing chorus of policy makers have been advocating government support for more open source development of EHRs (see Box 2.4).

Even when standards are available, they are often applied in different ways by different institutions. Conversion to a new standard-based technology comes at a cost – and for many organisations, it is cheaper to maintain the *status quo*. We repeatedly heard from national officials that uniform standards have still not been implemented, and that organisations continue to tailor standards to their immediate needs. Despite the aforementioned recent efforts by HL7 and others to enhance and provide more clarity as well as implementation guidance for their standards, there is no assurance that this information will be conveyed reliably across different vendor systems or enterprises. Given these problems along with the changes in the marketplace and the proliferation of proprietary ICT tools, the transition to interoperability continues to be a challenge (Goldsmith *et al.*, 2003).

Box 2.4. Open source health ICTs

Examples of open source software that have been developed and are being widely deployed, include EMR software such as OSCAR, FreeMed, VistA and other software such as MedLine, Epi-X and others. To this effect, a 2002 NHS Information Authority paper on "Open Source Software and the NHS" concluded: "Open source health care applications would provide healthy competition to the existing closed source commercial market, encouraging innovation whilst promoting compatibility and interoperation. This ultimately will lead to systems that are lower cost, better quality and more responsive to changing clinical and organisational requirements (Smith, 2002)."

More recently in the United States, the success of the open source VistA EHR software developed by the US Veterans Administration, which is widely used both within the VA and by a range of other health care providers throughout the world, has spurred action. Several law makers there have proposed legislation calling for grant programmes to support open source EHR development as well as encouraging federal agencies to evaluate implementations of open source technologies for their own use. In another sign of increasing support for open source software, the Certification Commission for Healthcare Information Technology (CCHIT) has recently created three separate pathways to electronic health records certification. The first is still the traditional route for most commercial products but the other two pathways were created with open source developers in mind, making their software potentially eligible under incentive programmes with funding guidelines calling for such certification.

Mechanisms must, therefore, be found to enforce standards if we are to have any hope of achieving interoperability. These standards will need to be defined at the national (or international) level (Hammond, 2008), but their implementation will be local. Therefore besides technological specifications, appropriate incentives, consensus building on specifications, including co-operation with private sector alliances or consortia, and other enabling policies all have to be in place, as further discussed in Chapter 4.

What is also abundantly clear from the case studies, is that there is some value to be gained at every stage in a progressive shift to full interoperability, particularly if high clinical value areas are targeted first (Box 2.5).

Box 2.5. The progressive introduction of interoperability provides a continuum of added value

To clarify the potential value of health information exchange (HIE) and interoperability a conceptual framework describing how health care entities can share information has been developed by the Center for Information Technology Leadership (CITL). This provides a functional taxonomy based on three factors in data exchange: the amount of human involvement, the sophistication of the ICT, and the adoption of standards.

The taxonomy has four levels, as depicted in Table 2.4. At the third level of interoperability or below, the data can be used by humans, but for the most part cannot be used by machines to provide automated decision support, active guidance, or pattern analysis. At present, most typical health care entities are communicating at Levels 1 and 2, and this limits the opportunities for reducing the error rate or cutting costs. Although Level 4 may be the ideal state, and indeed seen as the goal for health systems, there is a continuum of benefits to be obtained at all four levels of interoperability. This means that Level 4 corresponds to a direction of travel rather than being an end in itself. For frequently used services such as clinical laboratory tests, Walker *et al.* (2005) predicted that connectivity and effective HIE between providers and labs would provide reduction of redundant tests, and also reduce the delays and costs associated with paper-based ordering of tests and reporting of results. They also estimated that the potential savings in the United States would result in an annual national benefit of USD 8.09 billion at Level 2, USD 18.8 billion at Level 3, and USD 31.8 billion at Level 4.

Another study by Hillestad *et al.* (2005) also projected significant savings with approximately USD 1.1 billion and USD 1.7 billion in savings predicted for the adoption of EMRs in physicians' offices interoperable with clinical laboratories and imaging centres respectively.

Table 2.4. Healthcare information exchange and interoperability taxonomy

Level	Attributes
1	Non-electronic data – no use of ICT to share information. The most commonly used manual process for sharing information is either in writing or orally. Human facilitation is exclusively relied upon to aggregate, review, and abstract data from paper sources. Examples: postal mail, phone
2	Machine transportable data – transmission of non-standard information via basic ICT; information within the document cannot be electronically manipulated. Clinicians can access the information, but no computerised data processing or logic can be applied. Examples: PC- based exchange of scanned documents or manual faxing, pictures, portable document format (PDF)
3	Machine-organisable data – transmission of structured messages containing non-standardised data; requires multiple interfaces that can translate incoming data from the each of the sending organisation's vocabulary to the receiving organisation's vocabulary; usually results in imperfect translations because the vocabularies used have incompatible levels of detail. Data content is indexed down to single fields, however human translation is required to convert actual data in each field from the vocabulary of the sending organisation to that of the receiving organisation. Examples: secure e-mail of free text, or PC-based exchange of files in incompatible/proprietary file formats, HL-7 messages
4	Machine-interpretable data – transmission of structured messages containing standardised and coded data; the ideal situation in which all systems exchange information using the same formats and vocabularies. All systems exchange data using the same messaging, format, and content standards, removing the need for multiple customised interfaces. All content can be extracted and converted electronically in each field and no longer requires human intervention. Examples: automated exchange of coded results from an external lab into a provider's EMR, automated exchange of a patient's "problem list".

Source: Center for Information Technology Leadership; Walker *et al.* (2005).

2.6. Privacy and security are crucial

How health care organisations handle their digital information environment affects the uptake of health ICTs. Sharing sensitive patient data in a large and heterogeneous environment through the use of web-based applications raises a series of privacy and security issues. For treatment purposes, an individual's health information will need to be accessed by a variety of health providers: physicians, nurses, radiologists, medical students, or others who are involved in the patient's care. In this process, the main challenge is to create a smooth interface between privacy and confidentiality policy and security requirements for defining access to and use of personal health care information. These requirements must be very obvious to users, and must be high on the list of information that patients are provided with.

As a recent Microsoft survey revealed, a large majority of the US public wants electronic access to their personal health information – both for themselves and for their health care providers – because they believe such access is likely to increase the quality of the care they receive (Microsoft Corporation, 2009). The same people express, nonetheless, concerns about the privacy of their medical records; in some cases this is justified by

well-publicised serious lapses in existing systems and stories about security breaches.

Similar results were reported by Canada Health Infoway, based on a 2007 survey of Canadian attitudes towards electronic health information and their privacy (EKOS, 2007). The survey found that 87% of Canadians agreed that timely and easy access to personal health information is integral to the provision of quality health care, with over 50% also concerned about serious mistakes in diagnosis or treatment due to incomplete, inaccurate, or illegible patient information. Hand-in-hand with these views is the enormous premium patients place on the necessity for safeguards to protect health privacy. The survey found strong agreement that there are few types of personal information more important to protect than personal health information. Other concerns voiced include:

- 45% felt that information could be accessed for malicious or mischievous purposes.
- 42% were concerned about information being used for purposes not related to their health.
- 37% also worried that privacy and security procedures may not always be followed by those with access to their records.
- The survey also found a range of initiatives that could be used to allay many of these concerns. The top three possibilities were:
- Making it possible to find out if anyone had accessed their health record, and if so who.
- Introducing new legislation that would make unauthorised accessing of personal health records a serious criminal offence.
- Having the option of being informed of any potential privacy or security breaches affecting the system.

The case studies clearly indicate that appropriate privacy protection must be incorporated into the design of new health ICT systems and policies from the outset, because it is often difficult or impossible to introduce effective privacy protections retroactively. As discussed in Chapter 4, there are a variety of technical solutions already available to protect patients, but if privacy policies are unclear, technology will be of little help. Lack of clarity in the purpose and scope of privacy protection may also have unintended perverse consequences. Although health care organisations have a strong interest in maintaining privacy and security, they also have to balance this interest against the need to ensure that information can be retrieved easily when required for care, particularly in an emergency.

Restoring public trust that has been significantly undermined is much more difficult than building it from the outset. We are now in the early stages of health ICT adoption, and this provides a critical window for OECD countries to address privacy (Center for Democracy and Technology, 2008).

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Chapter 3. Aligning Incentives with Health System Priorities

Chapter 3 reports on how governments can intervene to promote the adoption and use of ICTs through direct regulation, economic instruments and persuasive measures.

Introduction

There are three ways governments can intervene to promote the adoption and use of ICTs: direct regulation, economic instruments and persuasive measures.

- With *direct regulatory measures*, also known as "command and control instruments", the government prescribes a specific outcome or target and/or the process or procedure by which it is to be achieved, and enforces compliance by appropriate regulation.

- *Economic instruments* may include both financial incentives and market stimuli to persuade users to change their behaviour. They also may involve using disincentives, such as withholding payments for non-compliance, to stimulate the desired behaviour. To be of any use, and to have an impact, economic incentives need to affect the cost-benefit structure of the economic activities of the target. The greatest advantage of economic instruments is that they allow individuals to respond to the instrument in the way that is most cost-effective for them.

- *Persuasive measures*, which are often combined with economic instruments, include support measures such as providing education and training, and the use of social or peer pressure and recognition. They are intended to change an individual's perceptions and priorities by increasing awareness and conferring ownership of decision-making. They help to address the information asymmetry often associated with technological innovation.

To date, there has been no comprehensive study of the outcomes of any of these measures on the adoption of ICTs by physicians, despite the fact that most governments have recognised the need to introduce incentives. The existing body of analysis is small and fragmented, and any conclusions are inevitably preliminary in nature. As a result, countries have not benefited fully from past experiences. In this part, we attempt to address this gap by reviewing the incentives that achieved the high rates of ICT adoption that were sometimes observed in the case studies, and the lessons that could be learned. However, where take-up has been high, the long-term sustainability of the various ICT initiatives is often in question. The emerging "business models" which might ensure that those who benefit from the success of the system also bear a fair share of its ongoing cost are considered.

3.1. A range of financial incentive programmes have emerged to accelerate ICT adoption

As we have already seen, physicians, particularly those whose income is mainly based on their own individual productivity, may find it difficult to afford to adopt EHRs. In most cases they have no financial incentive to do so, given that it is payers and purchasers who have the most to gain financially. Physicians also need help in making informed choices, and in dealing with the logistical and technical hurdles of ICT implementation. Reducing the financial barriers, by shifting or sharing financial risk, can therefore be expected to speed up ICT adoption.

Not surprisingly, the range of financial incentives used in the various case study countries is broad, and depends on factors such as the choice of the technology, the structure of the health care system, and the prevalence of a particular payment scheme (*e.g.* per capita, or fee-for-service schemes).

A distinction can be made between direct and indirect incentives. The former are designed to affect cost-benefit structures and directly influence physicians' returns on investment. Indirect incentives on the other hand, work by setting or changing the overall framework, for instance by removing structural impediments such as broadband availability, or market inefficiencies and distortions, such as a lack of standards for EMRs. There are, however, some overlaps, as we will discuss in this and in Chapter 4.

Most of the financial incentive programmes in operation today rely on some combination of the following main types of arrangements:

- *Direct subsidy through private and/or public grant programmes*: which was the main mechanism used to encourage the implementation and adoption of health ICT by GPs in all the case studies.
- *Payment differentials:* bonuses or add-on-payments that reward providers for adopting and diffusing ICTs (*e.g*. Australia, Canada, Netherlands) or for improved quality, where ICTs are a required tool and resource (United States, United Kingdom).
- *Payment for electronically-delivered care (e.g. consultations by email)*: which offers direct payment for new categories of care or services related to the use of ICTs (*e.g.* use of emails or telemedicine).
- *Withholding payments from providers*: which amounts to financial "penalties" following poor compliance, for example, part of the reimbursement or fees paid to the care provider is at risk.

Table 3.1 illustrates the use of these incentive mechanisms across the six case study countries.

Table 3.1. Most common financial incentives in six OECD countries

Area of focus	Australia	Canada	Netherlands	Spain	Sweden	United States
Payment differentials (bonuses or add-on payments	✓	✓	✓	✗	✗	✓
Grants and Subsidies	✓	✓	✓	✓	✓	✓
Direct reimbursement of e-care	✗	✓	✗	✗	✗	✓
Shared withholds (penalties)	✓ (planned)	✗	✓ (planned)	✗	✗	✓

Source: OECD.

3.2. Grants and subsidies

Grants and subsidies were the most common form of financial incentives in the case study countries, and appear to be critical in driving the implementation and effective use of ICTs. These types of financial interventions are needed to defray upfront investment costs and initial productivity losses.

Subsidies are very flexible, and usually do not require complex institutional arrangements. Most government subsidies are meant to align the private costs and social benefits of a given action. They may meet the full cost of an activity, or may subsidise enough of the cost to make it feasible for the recipient to go ahead. They can be applied to an input, an output or to a direct action. All levels of government can employ subsidies, and local bodies may play an active part in allocating subsidies to appropriate activities in their areas. For example, the key to the rapidly growing adoption of ICT in the Balearic Islands (Spain) has been the local government subsidies that met the entire cost of developing the ICT infrastructure in the region, including for both hospitals and ambulatory practices. The central planning and funding of the activities also allowed a strategic approach that was critical to the effective implementation of the plan of Ib-Salut, the local health authority.

Despite the apparent simplicity of subsidies, they do pose some problems. First, subsidies are best suited to a situation where there is a clearly identifiable capital investment. Second, sometimes it can be difficult to judge the appropriate level of a subsidy. If it is too low, the action will not be carried out, yet if it is too high then the overall benefits of a programme might be outweighed by its cost. Also, up-front subsidies will do nothing to support ongoing ICT use, and will not have a lasting impact unless the potential misalignment of other incentives (*e.g.* payment schemes, as we discussed above) are modified or removed, and the public health objectives are clearly defined. Ideally, public and private incentive systems should be aligned to maximise benefits, fostering long-term use and continued investment in ICT and health information exchange. In Canada, the B.C. Government adopted a mix of strategies in association with direct cash subsidies, that included bonuses linked to the electronic reporting of quality of care measures targeting priority health areas, payment to attend learning sessions, training and support, etc.

In addition to subsidies, government grants were the primary source of start-up funds reported by four out of the six case study countries. Unlike subsidies, grants are rarely assigned unconditionally. A very large national grant programme, such as the Primary Care Transition Fund in Canada, which funded initiatives related to primary care renewal, calls for agreements between federal government and provincial governments. In addition, there are usually many requirements that must be met before a grant will be awarded. Grant programmes may also have strict rules governing the accountability and disposal of the funds. Meeting these requirements and rules, and demonstrating the suitability of projects for grants can be onerous and time-consuming.

Grants can be given from any level of government – or indeed awarded by regional bodies, private entities or non-governmental organisations (NGOs). In the United States, the Massachusetts e-Health collaborative was funded through a USD 50 million grant from Blue Cross Blue Shield of Massachusetts. However, most grant programmes for health information exchange (HIE) in the United States in 2008 were funded by state governments. Similarly, in the case studies they also tended to be funded from the public purse. This could be interpreted as a sign that OECD governments are using their leverage as purchasers and payers to drive ICT adoption, which appropriately reflects the growing consensus about the vital "public good" to be expected from improved health information exchange.

3.3. Payment differentials

Payment differentials are bonuses or add-on payments that reward providers for adopting and using ICT either directly or in association with the achievement of specific quality of care targets. In the latter case, this is essentially a "payment by results" scheme, and is especially common in countries where physicians are remunerated on a fee-for-service basis. Quality targets generally reflect the high health payoffs of some types of preventive care, such as for diabetes and heart failure, and the high concentration of expenditure on individuals with chronic conditions (Khunti *et al.*, 2007).

Linking payments specifically to conditions where improvement is clearly needed, and can be monitored and reported effectively through credible quality measures has proven particularly successful as an incentive measure amongst GPs. Perhaps physicians are not easily persuaded to undertake change until they are presented with facts and can see for themselves that ICT can indeed help to fill the gaps between best practice and the medical care they are actually delivering.

In the sections that follow, examples of the current use of add-on payments in a few OECD countries to promote ICTs are presented. What will become apparent is that they have often been applied in combination with a range of other incentives geared towards quality improvement in all the case study countries reviewed.

The Quality Outcomes Framework programme in the United Kingdom

The Quality Outcomes Framework programme (QOF) in the United Kingdom has raised considerable international interest, because it is both a payment-by-results and pay-for-reporting incentive scheme. It was introduced in the United Kingdom as part of the new General Medical Services (GMS) contract in 2004. It is a voluntary annual reward and incentive programme for all GP surgeries in the United Kingdom. QOF provides one of the clearest examples of how incentives can be put in place to reward both quality measurement and quality improvement, and at the same time act as a stimulus for ICT adoption. Without a doubt, the high-quality ICT infrastructure and almost universal computerisation in UK primary care have been critical to its successful implementation. QOF is measured by the Quality Management and Analysis System, known as QMAS, a national IT system developed by the National Health Service (NHS) Connecting for Health programme. QMAS ensures consistency in the calculation of quality achievement and disease prevalence, and is linked to payment systems. Data used to calculate clinical quality indicators are extracted from the individual GP clinical IT systems, and sent automatically to QMAS monthly. The information is then pooled at the practice level.

One year after its introduction, QOF had already made a difference to the quality of patient care provided in two out of the three conditions that had been routinely monitored both before and after the introduction of incentives (asthma and diabetes; see Box 3.1 below).

Box 3.1. The UK National Quality and Outcomes Framework

The UK National Quality and Outcomes Framework (QOF) includes four domains, each of which consists of a set of measures (referred to as indicators) against which practices can score points according to their level of achievement. The four domains are:

- *The clinical domain*: 80 indicators across 19 clinical areas (*e.g.* coronary heart disease, heart failure, hypertension).
- *The organisational domain*: 43 indicators across five organisational areas – records and information; information for patients; education and training; practice management and medicines management.
- *The patient care experience domain*: consisting of four indicators that relate to the length of consultations and to the findings of patient surveys.
- *The additional services domain*: consisting of eight indicators across four service areas including cervical screening, child health surveillance, maternity services, and contraceptive services.

In 2004-05, GP practices were scored against 146 performance indicators, with clinical quality accounting for more than 50% of the total. Each point earned had a financial bonus associated with it, and GPs stood to achieve additional income amounting to 30% of their salary. This required a 20% increase in the NHS GP budget.

Results for 2004 show that GPs greatly exceeded projections of their performance, and achieved a mean of 91% compliance with clinical guidelines. This result may also be partly attributed to the multiple interventions that preceded QOF, such as the development of national guidelines for major diseases, a process called Clinical Governance, and a national inspection process.* It is probably still too early to judge the final outcomes of QOF. However, more recent studies continue to document improvements in quality of primary care in the United Kingdom (*e.g.* Khunti *et al.*, 2007) though, none can adequately assess the relative importance of the QOF incentives and the introduction of electronic patient management systems compared to other quality improvement measures.

In the longer term, the new contract seems likely to change the behaviour of GPs as demonstrated by other similar schemes implemented in the United States (Beaulieu and Horrigan, 2005). However, in the light of the substantial costs of the new contractual framework, countries intending to introduce similar changes should carefully assess their requirements and align compensation to match the nature of the gains to be achieved.

* There has been some controversy over the utility and cost of the programme, as some felt that many doctors might already have been improving the quality of care they were providing in any case. This was impossible to ascertain as there were few indicators to assess GP performance in a systematic way prior to the introduction of the new contract.

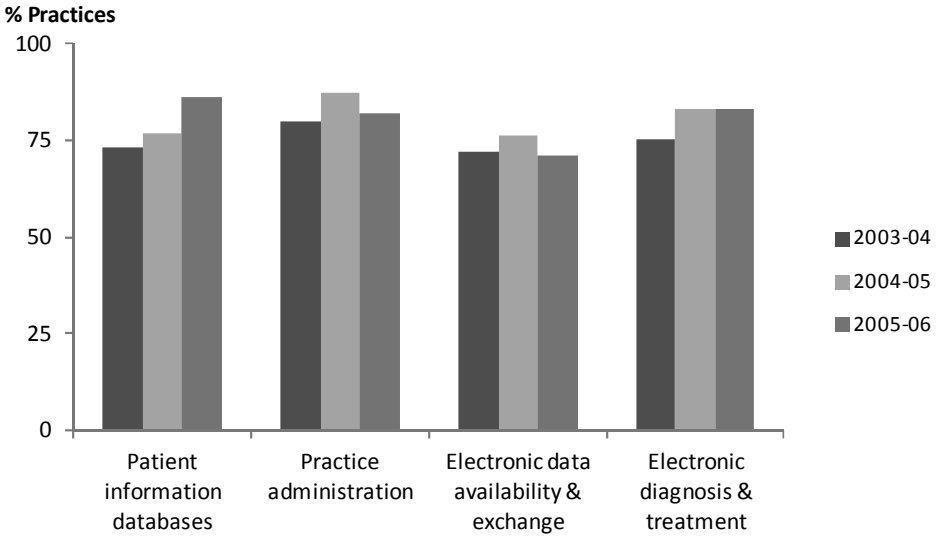
The Australian Practice Incentive Programme

The Australian Practice Incentive Programme (PIP) is a blended payment approach for general practice which aims to compensate for the limitations of fee-for-service arrangements and to improve the quality of care provided to patients. Accreditation is the gateway to PIP. Since 1999, the PIP includes a number of incentives to encourage practices to keep up-to-date with the latest developments in Information Management and Information Technology (IM/IT). It encourages the adoption of new technology as it becomes available, to assist practices to improve both their administration processes, and the quality of care provided to patients. It also encourages incremental compliance by software suppliers with the National e-Health Transition Authority (NEHTA) standards and specifications, with the ultimate aim of establishing secure messaging and interoperability. Payments are made by Medicare Australia to eligible, accredited practices as part of each quarterly PIP payment. Like the other PIP components, the specific components of the IM/IT incentive and the financial rewards they entail have evolved over time. Starting from August 2009, payments under PIP e-health will be calculated at AUD 6.50 per Standardised Whole Patient Equivalent (SWPE) per year, and are capped at AUD 12 500 per quarter.

In 2006, a study by McInnes *et al.*, based on a cross-sectional national stratified random sample of 3 000 Australian GPs in primary care settings, reported nearly universal computerisation, with 89% of GP practices using computers for clinical purposes. Most practices had computer software and hardware to perform administrative and clinical functions, and most (78.3%) had a high-speed Internet connection. Over half these practices (55.6%) had received a PIP payment for information technology/information management, and nearly a third (31.5%) had received payments through another incentives programme intended to stimulate broadband uptake (Broadband for Health). An earlier study by Nielsen in October 1997 had found that only 31.0% of practices had computers, most of which were being used for administrative purposes only. This evidence depicts a rapid uptake of computers to access crucial patient information at point of care and to support clinical decision in general practice over about half a decade from implementation of PIP.

These incentive programmes, which were generally administered with the support of Divisions of General Practices, have also been largely responsible for the significant levels of adoption of computers and patient management systems by GPs in rural Western Australia. By 2003 more than 80% of WA practices were using computers for clinical care and not just for practice administration (Figure 3.1). This number has been growing since.

Figure 3.1. Western Australian practices using IM/IT



Source: Primary HealthCare Research and Information Service (*www.phcris.org.au*).

The Physician Information Technology Office in British Columbia, Canada

In British Columbia (Canada) the Physician Information Technology Office (PITO) was established in 2006 as a voluntary programme to assist physicians with the adoption and use of EMRs.

PITO provides reimbursement of 70% of the cost of adoption and use of an eligible EMR. A total of CAD 108 million was committed for 2006-12, to be disbursed gradually over the duration of the programme. The programme is largely modelled on the Physician Office System Programme (POSP), launched in the province of Alberta, Canada, in 2001. The main goals being to support *i)* the transition to EMRs, including for change management; and *ii)* the provision of effective tools for professional development, practice and knowledge management.

In addition, PITO provides an implementation support programme that includes:

- Pre-implementation planning.
- Tools to assist in selecting an appropriate EMR.

- Coordination during implementation to ensure that all the key aspects come together at the right times.
- Privacy and security tutorials.
- Post-implementation review.

Added-up, the basket of the PITO premiums is substantial, and can pay up most of the costs of the IT systems, with a remaining funding gap for physicians of only about an equivalent of USD 12 750 over five years (Figure 3.2). To ensure reasonable pricing, as will be discussed in later parts of the report, the six vendors included in the PITO reimbursement programme agreed to fix prices for the duration of the programme. The eligible costs themselves were established through an extensive research of actual costs experienced in British Columbia, and in the Alberta, and Ontario provinces. The hardware reimbursement levels were established based on real costs incurred by a representative group of practices, large and small in British Columbia (*source*: B.C. Ministry of Health Services).

Given the bottom-up approach for costing/reimbursement taken in British Columbia, PITO's reimbursement levels are remarkably comparable to those determined for similar incentive programmes in Alberta and Ontario.

It should be noted that in addition to PITO, physicians in British Columbia can access a number of other financial incentives measures linked to the use of ICTs, and which, if combined, may help to fill the gap in funding (Box 3.2).

Box 3.2. Incentives to encourage the adoption and use of ICTs in British Columbia

In addition to PITO, The B.C. Government has adopted a number of additional incentive measures including: direct cash subsidies, compensation to attend learning sessions, training and support (*e.g.* by providing help with data entry). The "basket" of incentives, described below, had a significant effect on user acceptance. Direct and indirect monetary incentives have expedited the chronic disease management (CDM) toolkit adoption and use, particularly in the early stages of adoption. The toolkit is a web-based software developed by the B.C. Health Ministry with a Health Canada's Primary Health Care Transition Fund grant. It provides a host of functions to support chronic disease management. It allows physicians to securely access a list of patients with chronic conditions, such as congestive heart failure, diabetes, asthma and hypertension. It reports on the extent to which the care provided is consistent with B.C. clinical guidelines and provides an easy set of tools to help physicians and their care teams to manage care for their patients according to clinical best practices.

Compensation for attending learning sessions

Adoption of the CDM Toolkit is one component of the "CDM Bundle", a series of learning sessions specifically related to issues in chronic disease management (CDM). There are six to eight learning sessions in the CDM "bundle", with each session lasting 3.5 hours. Physicians and medical office assistants (MOAs) are compensated for their investment in making changes in their practices. Learning Sessions and Action Periods are paid at GP sessional rates. MOA time is compensated at CAD 20/hour as an expense to the GP.

Direct payments to spur use of the CDM Toolkit

To spur the use of the CDM Toolkit, the complex care incentive package includes one-off incentive payments linked to completing patient flow sheets for diabetes, congestive heart failure and hypertension. As of 30 June 2006, GPs who had provided care for at least ten patients with diabetes or congestive heart failure and completed the patient flow sheets since the inception of the programme in 2003, received a one-time payment of CAD 7 500.

The complex care e-mail/telephone follow-up management fee

To encourage the use of "e-visits", from 1 January 2008, a complex care e-mail/ telephone follow up management fee at a rate of CAD 15 (payable up to a maximum of four times per year/per patient) was also made available. This fee enables the practice to use two-way telephone or e-mail communication with the patient or the patient's medical representative to follow-up case.

The American Recovery and Reinvestment Act of 2009

A "carrot and stick" approach was adopted in 2009 by the United States to push for provider adoption of interoperable health information technology through the "Health Information Technology for Economic and Clinical Health Act" provisions within the American Recovery and Reinvestment Act of 2009 (ARRA). ARRA provides financial incentives through the Medicaid and Medicare programmes[2] encouraging eligible hospitals and clinical professionals to adopt certified EHR technology and use it in a meaningful way. The statute also requires that the Medicare programme implement reimbursement penalties for hospitals and non-hospital-based physicians who do not achieve meaningful use by 2015. "Meaningful use" is a statutory term which requires further definition through regulations to be issued by the US Secretary of Health and Human Services. According to the ARRA legislation, "meaningful use" to earn the incentive will generally require the use of a certified EHR technology that enables electronic prescribing, electronic exchange of health information, and the ability to submit data on

2. These programmes provide health coverage for eligible individuals and families with low incomes and resources and for people who are 65 and over or who meet special criteria.

clinical quality and other measures. The proposed regulation formally defining the requirements of meaningful use is expected to be published for public comment by the end of 2009.

The bonus payments authorised by ARRA offer significant inducement for providers to adopt and use EHRs and begin to engage in health information exchange, and to do so in the next few years, when positive incentives are highest. Taking for example the incentive under Medicare, eligible (non-hospital-based) physicians who are early adopters and meet the requirements for meaningful use in 2011-12 are eligible for payments based on an amount equal to 75% of their allowed Medicare FFS professional service charges, up to a maximum of USD 18 000.

Under the programme, maximum incentive payments for providers who adopt in 2013 or 2014 will be reduced, while those demonstrating meaningful use after 2014 will no longer be eligible. In addition, physicians who do not adopt/use an EHR system before 2015 will face a reduction in their Medicare fee schedule of -1% in 2015, -2% in 2016, and -3% in 2017 and beyond (American Medical Association, 2009).

Incentive payments are also being offered through Medicaid to a group of eligible professionals (non-hospital based) whose patient panels consist of at least a minimum threshold of low-income individuals and families who cannot afford health care costs. Medicaid incentives will take the form of up to USD 21 250 for EHR purchase and USD 8 500 per year for five years for EHR operations up to a total cap of USD 65 000. Under Medicaid, the statute does not provide for a reimbursement penalty for professionals who fail to become meaningful users, whether or not they avail themselves of the purchase-support incentive.

Professionals eligible to pursue the incentive under either/both programmes must choose either the Medicare or Medicaid incentive, but Medicaid funding for the initial purchase is not contingent upon the eligible professional achieving meaningful use requirements.

Eligible hospitals can also earn incentives under Medicare and Medicaid if they adopt and meaningfully use certified EHR technology and engage in HIE pursuant to statutory and regulatory stipulations, and a hospital otherwise qualifying under both programmes may receive payment under both programmes – under a formula that accounts for payment under each programme to be proportionate to that programme's share of the hospital's total service volume.

The ARRA also authorises the US Department of Health and Human Services (DHHS) to make competitive grants to states and qualified state-designated entities to support establishment of sub-national

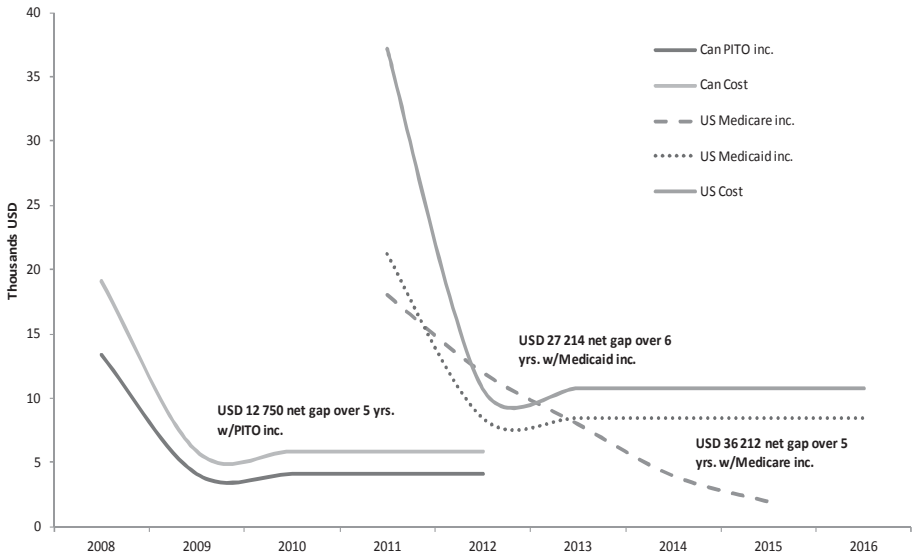
HIE infrastructure. According to the e-Health Initiative (eHI) Sixth Annual Survey of Health Information Exchange, the ARRA provisions have already influenced a number of health ICT efforts in the United States to consider becoming regional health information exchange centres (e-Health Initiative – eHI, 2009).

Bridging the gap

As indicated by Figure 3.2 below, the incentives authorised by ARRA would not be sufficient to cover in full cost of purchase and maintenance of a physician's EHR. In the absence of other incentives, such as those introduced in British Columbia, the funding gap per physician appears quite substantial, ranging from USD 27 214 to 36 212 over five years (Figure 3.2).

It should be noted that the US incentives in this figure are compared to costs associated with in-office installation of EHR software/hardware which are more significant than those incurred for an ASP-based EMR by physicians in British Columbia as discussed in previous sections (see Table 2.2).

Figure 3.2. EHR/EMR cost vs. incentive gap per physician in Canada and the United States



Source: EHR/EMR approx. cost & maintenance from PITO for Canada and Gans *et al.* (2005) for the United States. All amounts in USD exchange rate: USD 1.10 CAD.

In addition, a Medical Group Management Association (MGMA) study found that for practices that have implemented EHRs, the average initial cost was approximately USD 32 606 per physician but noted that for smaller practices cost could rise to USD 37 204 with maintenance costs of about USD 1 500 per physician per month. Added to the monthly maintenance cost, the initial cost, even if amortised over five years at 8% interest, would translate into about a 10% reduction in take-home pay each year for physicians in most primary care practices. Because of the structure of the US tax code, most practices do not have retained earnings, and, consequently, the capital equipment expenditures are funded directly from physician income. If the practice were to pay the initial costs in the first year, the reduction in take-home pay would be quite large (Gans *et al*., 2005).

Given the fact that the majority of ambulatory medical practices in the United States are made up of no more than three physicians and have limited capital budgets, bridging the gap without additional funding or revenue streams would be a major challenge. Potential further widening of this gap through loss of productivity during the early implementation stages carries a risk that EHR will not be adopted. The same MGMA study found that together with lack of capital resources, concern about loss of productivity during transition to an EHR system is rated among the top five barriers for practices that have implemented EHRs and those that have not (cited in Gans *et al*., 2005). While the financial incentives from the ARRA make EHR implementation more financially realistic for providers, the true key to successful adoption is in knowing how to implement and use the technology in a clinical care setting.

The vast majority of physicians are not ICT specialists and usually have no desire to become one. Consequently, between focusing on delivering patient care and practice administration, physicians cannot be expected to navigate the complex health ICT acquisition process from analysing their requirements to installing the requisite systems. Indeed, studies have suggested, albeit anecdotally, that anywhere from about one-third to one-half of vendor-based EHR implementations have ended in failure (Goroll *et al.*, 2009; Keshavjee *et al.,* 2006; Tripathi, 2007). These failures result in wasted time, money, and effort that cannot be recouped. As suggested by the case study in Massachusetts, one way to make productive use of the incentives, at least in the short-term, could be through support organisations such as the MAeHC. The Collaborative has helped physicians through the entire adoption process, from EHR selection, change management and training, to post-implementation assessment and support. In the longer term, steps that link payment-for-results to IT initiatives may provide the additional necessary financial stimulus and sustainable business model to motivate adoption and continued use of EHRs by physicians.

3.4. Long-term sustainability and financing

For many ICT projects, once the initial funding runs out, the most significant challenge is developing a sustainable business model. Long-term sustainability and financing appear to be the most challenging and, in most cases, unknown aspects of the ICT initiatives reviewed in this report.

While many of the people involved in the case studies discussed their project's progress and success in moving from planning to implementation, most could not clearly forecast its long-term sustainability or revenue models.

Most stressed that once they have understood how the technology is used and health information exchange benefits the various stakeholders, they will be better placed to see how fiscal and financial responsibilities could be shared equitably. In other words, the focus has been on technical feasibility and achieving successful adoption with the economics of the approach often playing a secondary role. Ultimately, however it is the economics and the value to society which will determine whether a system can survive or not.

There is no magic bullet today with respect to the options or strategies required to achieve long-term financial sustainability. Many initiatives are still struggling to begin exchanging health information, whereas the more mature initiatives are faced with challenges about how to expand their services in a financially sustainable way. Financial sustainability is a critical issue for all initiatives, even those that are relatively more mature and directly funded by government and stands out as a persistent concern.

Health care organisations, public or private, need to project a positive return on investment (whether financial or otherwise), to gain ongoing financial, institutional and political support for their efforts. Yet, although health care organisations could (and in many cases do) improve care and address unmet public health needs (the "social case") through the implementation of ICTs, the same organisations typically have a hard time to demonstrate an economic benefit (the "economic case") including whether their own financial performance improves.

It would seem that the return on investment from implementation of ICTs should be relatively straightforward to assess, yet, the evidence today is weak and poses unique challenges to interpretation. One common problem is that while the costs in implementing health ICT solutions are incurred up front, the benefits (financial or otherwise) are not always immediately realised (see Box 3.3 below). Moreover, any returns might not go to the investors but might be realised by other parties who might not have

been involved in the intervention at all. One health care entity's short-term ROI may also be another one's loss. For example, if an ICT can save money by reducing emergency department and inpatient care for congestive heart failure, the local hospital may well suffer a loss of revenue.

Understandably, many health care organisations still question the value proposition for ICTs. Building a business case for ICT primarily on patients' improved quality of care and satisfaction in the absence of clear evidence of cost savings or of cost-effectiveness is proving particularly challenging. Health care organisations may be reluctant to take on the costs of implementation and maintenance of ICTs if better quality is not accompanied by better payment or improved margins, or at least equal compensation (Leatherman *et al.*, 2003). The Catch-22 is that there is no real way to find out until good measures are in place and robust data have been obtained. This conundrum is addressed later in the report.

Box 3.3. Delayed benefit realisation

Studies suggest that the financial benefits from ICT implementation are often realised only many years after the investment was made or until a level of functionality is reached that allows the systems to truly serve the needs of clinicians and system planners. In its report for Canada Health Infoway, *Pan-Canadian EHR: Projected Costs and Benefits*, Booz Allan Hamilton suggest that the national, systemic fiscal cost-benefit after ten years is actually negative at CAD 1.5 billion, having reached a positive cash flow by year seven and breakeven only by year 11. By year 20, the systemic (national) savings is estimated at almost CAD 20 billion.

This is further supported by a 2007 study by Pricewaterhouse Coopers of nearly 2 000 hospitals in the United States, which found that the attainment of productivity improvements and improved service efficiency followed on average two years behind initial health care ICT investment. The same study, however, concludes that the financial breakeven point will strictly depend on the levels of investment. Above a certain level of ICT investment – or tipping point – the cost impacts levels off and is associated with cost reductions. The levelling off occurs despite the added costs of more ICT capital; that is, ICT capital at some point pays for itself by displacing costs elsewhere in the hospital.

The European Union's e-Health Impact Project, covering ten case studies in different countries and contexts, identified a 2:1 return on e-health investment when benefits were given a euro value; the average breakeven point for the ten e-health initiatives studied was five years.

Source: Pricewaterhouse Coopers (2007); Stroetmann *et al*. (2006).

The changes needed to redress this situation require a more active role and a financial commitment of private payers and government. This was indeed the case for most of the initiatives included in this report for which four general categories of business models appear to emerge:

- *Not-for-profit*: the not-for-profit initiatives are driven by their charter to help the patients and the community in which they provide services. Their tax-exempt status can help to reduce funding challenges and costs, may also provide special tax credits/incentives. (The Great Southern Managed Health Network in Western Australia is a good example.)
- *Public utility*: these initiatives are created and maintained with the assistance of central government/local state funds. This is the case of most European initiatives.
- *Physician and payer collaborative*: this type of collaborative model is created for/by physicians and payers within a geographical region. These initiatives can be set up as either for-profit or not-for-profit organisations; however, the key to this category is the collaboration between and mutual benefits for participating payers and physicians. (*e.g.* the MAeHC case study in the United States).
- *For-profit (often resulting from the conversion of a not-for-profit initiative at a mature stage):* for-profit initiatives are created with private funding. These organisations look to reap financial benefits from their transactions (envisioned as a future development in the case study in the United States).

Irrespective of their specific nature, the way these various approaches align costs and revenues and extract value from ICT implementation for each stakeholder will determine their sustainability in the long term. This requires, therefore, an assessment of the viewpoints and respective roles of the main stakeholders but also clarifying whether there is a social case, that is, whether the activities or interventions enabled by ICTs provide a "benefit to the individual (patient) or to society of improved health status and productivity regardless of cost. It also requires attention to the financial implications for the multiple organisations involved (purchaser, plan, hospital, physician) in order to understand if realignment of financing is needed so that there can be fair cost sharing and gain sharing of any savings.

Table 3.2 lists the viewpoints of main stakeholders on payoffs from ICTs in four of the case studies which are representative of the aforementioned models. With the exception of allied professionals in Western Australia, physicians generally reported that in the absence of

subsidies or incentives they expected neutral or unfavourable returns from ICT adoption and use. As previously discussed, this is mainly due to the significant upfront costs in implementing ICTs, the loss of productivity experienced during the early implementation stages of ICT systems and the financial disincentives embedded in compensation schemes. Private payers and governments are, on the other hand, the ones who stand to benefit the most from ICT implementation. Payers have, for example, a more direct return from reduced hospital readmissions, testing and emergency room visits and more cost-effective use of medication (as long as the costs of those actions do not exceed the savings expected from them or the value of the improvements in care). Unsurprisingly, they are also the main source of funding. The sections below will consider in some detail the different business models and how they are attempting to achieve long term sustainability.

Table 3.2. Attitudes about payoffs according to main stakeholders

	Payoffs according to each stakeholder				Funding source	Business model
Case study	Users	Individual patients	Society	Payer		
E-Messaging (Western Australia)	Neutral/ Favourable (physicians, allied health professionals, nurses)	Favourable	Favourable	Favourable	Shared	Not-for-profit
Chronic disease management toolkit/EMRs (Canada)	Neutral/ Unfavourable (physicians)	Favourable	Favourable	Favourable	Government	Collaborative
Telestroke (Spain)	Neutral/ Unknown (physicians)	Favourable	Favourable	Favourable	Government	Public utility
EHR adoption (MAeHC; United States)	Unfavourable (physicians)	Favourable	Favourable	Favourable	Private payer	Collaborative

Source: OECD based on case studies.

The public utility model

The strategy of the Health Ministry in the Baleares (Spain) has been to adopt a public utility business model: the telestroke programme is entirely developed and maintained with the assistance of national/local government funds. The significant role of government as purchaser and regulator of

health care in Spain clearly makes government a critical stakeholder in electronic health information and a benefactor to its potential positive impacts. The Baleares Government is, therefore, taking on a substantial share of the financial risk.

This level of government intervention also reflects the "public good" nature of the initiative. The infrastructure necessary to support telehealth is a "true public good", *i.e.* it is both "non-excludable" and "non-rivalrous" in that multiple entities can benefit from the technological advance at the same time without reducing its value. The significant societal benefit of the telehealth system, coupled with the interest of government in developing a network infrastructure that allows multiple businesses to strive, form the basis of a potentially sustainable business model.

The not-for-profit model

It is the nature of ICT projects that if there are too few active participants scattered over a very dispersed area, it would no doubt be uneconomic to offer or maintain services like the one offered in Western Australia by the Great Southern health Managed Network (GSHMN). Hence, the main elements to the sustainability strategy used by the GSMHN strictly relies on reaching large volumes of participation and partnering with other community stakeholders (such as community groups, public health agencies, and others) to improve quality and reduce disparities, both for its own ROI and for the broader social good. Partnerships lower the intervention costs (and risks) for any one health care organisation and increases the likelihood of effectiveness and sustainability of interventions. The not-for-profit status of the GSMHN is an essential facilitator of the process.

The user base has been steadily growing. In 2009 the network had over 5 700 users registered in the system from across 30 Australian regions. In addition, in 2009 the GSHMN entered into partnership with private sector.

GSHMN charges GPs and Specialists AUD 750 (~USD 696) per user per year for the use of the full clinical patient management functionality; Allied Health and GPs just using the messaging functionality pay AUD 250 (~USD 232) per user per year. An additional fee of AUD 200 (~ USD 185) per user per year is charged for the license, and the use of the clinical databases. Physicians' costs are more than offset by the Australian Government e-Health incentives for GP practices. Given the steadily increasing user-base, the sustainability and costing model put forward seem to have met the necessary objectives.

The collaborative model

A Health Information Exchange (HIE) is a multi-stakeholder organisation that enables or oversees the business and legal issues involved in the exchange and use of health information, in a secure manner, for the purpose of promoting the improvement of health quality, safety and efficiency. All stakeholder groups share the challenges and benefits of an HIE network model (see Table 3.3 below).

There are essentially two financial challenges for an HIE: *1)* obtaining initial seed money to plan and build the HIE system and, *2)* building a sustainable business model to keep the HIE in operation once the initial money has been spent.

To date, initial funding has generally come from national and state governments in the form of grants. In other cases, interested parties have made sizable contributions to start-up funding and demonstration projects. One example of the latter is the Massachusetts e-Health Initiative included as one of the case studies in this report. The initiative was funded by one of the largest payers in the state, the Massachusetts BlueCross and Blue Shield. These grants are attractive because they can typically be treated as sunk costs, which do not need to be recouped once the initiative becomes operational.

A necessary but not sufficient condition for the future sustainability of MAeHC is the effective use of EHRs for health information exchange and the generation of enough clinical information to be valuable to both physicians and payers. Patients' decision making will, therefore, play an increasingly important role in determining how much information is shared and how it is shared.

In this case the business model is as good as patients' willingness to allow their data to be shared in ways that clinicians and payers find valuable. The business model also depends on incentives that adequately reward physicians for their participation in quality improvement activities which require data collection and reporting. Payers and purchasers willingness to differentially reward improved quality of care is, therefore, key not only to future sustainability but central to shared reaping of benefits.

The approach adopted by the MAeHC, in effect, hinged largely on evidence of community commitment to widespread health information exchange. The original request for applications (RFA) for volunteer communities made sure of this. It included requirements to recruit at least 80% of community practices, and obtain the participation of the local hospital, other community health facilities, and local leadership. Candidate communities were evaluated along three key dimensions: *1)* breadth and depth of participating provider network, *2)* organisation and commitment of

stakeholders, including physicians, health care institutions and community leaders, and *3)* participation in other relevant activities, such as clinical data exchange (*e.g.* MedsInfo) or Computerised Physician Order Entry (CPOE – *e.g.* main hospital implementing or planning CPOE system). Furthermore, the selection placed an emphasis on local physician and community leadership to ensure participation and co-ordinated effort.

Table 3.3. Attitudes about HIE in the United States according to main stakeholders

Stakeholder	Major value	Attitudes about HIE	Major constraints
Patients	High-quality, affordable health care	Favourable	Privacy, confidentiality, and security concerns
Federal government	Control costs, Improve quality	Favourable	Financial, organisational
State/local governments	Control costs, improve quality	Favourable	Financial, organisational
Hospitals/Physicians/ Providers	Accurate patient information at point of care	Favourable but constrained by lack of near-term ROI	Financial, organisational, competitive
Labs	Deliver results faster and cheaper	Favourable	Financial, organisational, competitive
Payors/Health plans	Accurate patient and treatment information	Favourable but concerned about ROI and investment expectations	No immediate ROI and high upfront costs
Pharmacies	Enhance efficiency and accuracy of drug delivery	Favourable	Financial, organisational
Medical data repositories	Accurate patient medical data	Very favourable	Other stakeholder co-operation

Source: Adapted from Deloitte Center for Health Solutions (2006).

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Chapter 4. Enabling a Secure Exchange of Information

While health care organisations have access to an ever-increasing number of information technology products, achieving system-wide secure exchange of health information remains a serious problem. Drawing from case studies, this chapter examines the actions that governments can take to address this issue.

Introduction

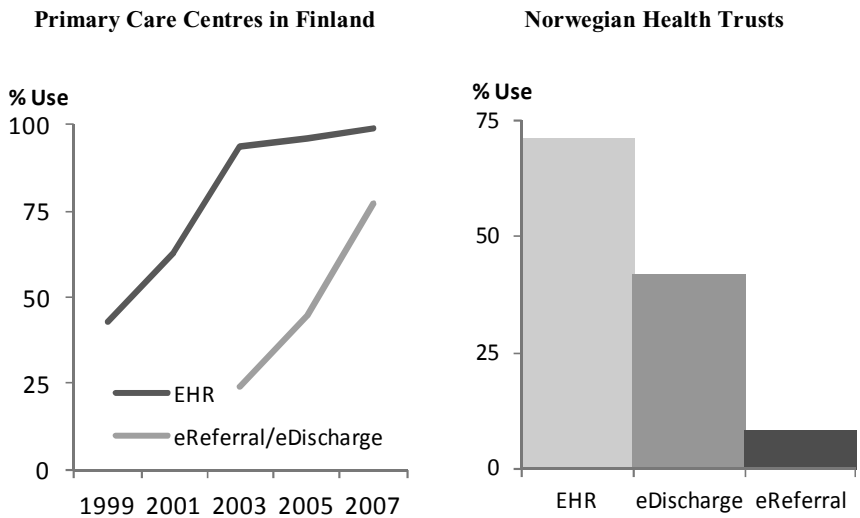
While health care organisations have access to an ever-increasing number of information technology products, many of these systems cannot talk to each other, and health information exchange remains a serious problem. This problem is common to all OECD countries, even those where deployment of EHRs has proven particularly successful. As noted earlier, although several Nordic countries have high levels of EHR penetration, health information exchange has been slower to come. Finland has 100% adoption of EHRs in hospitals and nearly the same in primary care. However, electronic exchange of key documents such as referrals and discharge letters between these settings has lagged. Similarly, in Norway, though EHR adoption and use levels are remarkable, there is a stark gap in the use of e-discharges and particularly e-referrals (Figure 4.1). And this despite the fact that electronic exchange of discharge summaries and referrals between hospitals and GPs has been a goal for over ten years now.

There has been, therefore, a growing consensus that any national EHR strategy should go hand-in-hand with efforts to achieve system-wide secure exchange of health information, if it is to realise the promise of ICTs. This, in turn, crucially depends on compliance with standards and interoperability.

How is this challenge to be addressed? There are no easy answers to this question – nor indeed is there an easy answer to any of the problems related to interoperability. Freely functioning private markets will not find a solution without public intervention. Indeed, authorities in the case study countries indicate that they are now intervening and in a number of ways (Table 4.1), though perhaps no single approach can produce the optimum outcome:

- Through government leadership in adoption of standards.
- Certification of products.
- By setting vendor conformance requirements along with incentives for use of interoperable systems.

Figure 4.1. Use of EHRs and of electronic discharge and referrals by Primary Care Centres in Finland and Norwegian Health Trusts, 2007



Source: FinnTelemedicum & STAKES.

Source: Office of the Auditor General of Norway.

Table 4.1. Measures to address lack of interoperability by country

Area of focus	Australia	Canada	Netherlands	Spain	Sweden	United States
Certification of products	✗	✗	✓	✓	✓	✓
Standards-setting activities	✓	✓	✓	✓	✓	✓
Vendor conformance and usability requirements	✗	✓	✓ In proof of concept stage	✗	✗	✗

Source: OECD.

4.1. Governments' role in the adoption of standards

Many governments have set up specific bodies or agencies to co-ordinate standards-adoption activities and develop strategies at the national level.

In Europe, the European Commission (European e-Health Action Plan, April 2004) has provided a roadmap for the development of interoperable e-health solutions in and across member states. The plan also calls for the creation of interoperable e-health solutions and a European network of centres of reference to promote co-operation across medical institutions. Interoperability issues are high on the agenda of most e-health strategies of European Union countries, and have been identified as a priority area for action. In 2008, follow-up recommendations related to cross-border exchange of information in the EC detailed specific principles necessary for interoperability to be achieved by the end of 2015.[3]

In the United States, the Office of the National Coordinator (ONC) has been given the task of providing "leadership for the development and nationwide implementation of an interoperable health information technology infrastructure to improve the quality and efficiency of health care". The ONC has been working on interoperability for several years now, and has demonstrated some solutions, adopted an initial set of standards, established a certification process, and has funded direct use of standards. Building on this, the American Recovery and Reinvestment Act of 2009 requires the ONC to develop standards by 2010 that allow for secure, interoperable, nationwide electronic exchange of health information (Department of Health and Human Services).

Despite the encouraging progress in the United States towards furthering the national agenda on standards and interoperability, communities attempting to establish interoperability among competing vendor systems still need to commit considerable technical and organisational efforts to achieve even the simplest clinical data exchange (Box 4.1) (Goroll *et al.*, 2009).

In Canada, the focus has similarly been on developing common standards and architectures for interoperability at the national level. Canada Health Infoway, an independent, not-for-profit corporation, was formed in 2001 by the Government of Canada to accelerate the development and adoption of information technology.

3. European Commission Recommendation of 2 July 2008 on cross-border interoperability of electronic health record systems, Brussels, COM(2008)3282 final.

Box 4.1. Compliance with standards: lessons learned from the MAeHC

From its inception MAeHC has had in place a Data Exchange Standards Workgroup. The goal of the Workgroup was to establish interoperability standards that systems must meet that will allow for adequate data exchange to achieve the goals of clinical data sharing and access, as well as meeting software and hardware compatibility requirements. However, though the MAeHC had done an extensive job researching the vendors and making final selections based on strict criteria, it appears from interviews that there were still limitations that had to be dealt with. Some of these included system incompatibility issues related to the EHRs and the HIE vendor solutions implemented, the inability of some products to conform to specifications requiring extensive modifications, and lack of agreement between vendors.

The MAeHC experience with vendors has been that stipulation of standards and specifications is not enough. Achieving interoperability of health information technology solutions requires detailed negotiations between the vendors involved. This must also be coupled with a highly developed community and practice support organisation to provide the overarching leadership from start to finish which is essential to enabling successful EHR deployment in physician practices.

Infoway released in 2003 the EHR Solution Blueprint. The result of months of extensive consultations and collaborations with over 300 stakeholders across Canada, the Blueprint is a framework that defines standards (*e.g.* the requirements and enabling solutions for privacy and IT security) setting the conditions for the development of interoperable EHR systems across Canada. In British Columbia, interoperability is being driven by the adoption of these Pan-Canadian standards defined by Infoway. To participate in British Columbia's PITO incentive scheme, vendors and service providers are, for example, required to make a commitment to align with the Infoway architecture and with the Pan-Canadian standards.[4]

In Australia, efforts led by the National e-Health Transition Authority (NEHTA) since 2005 have also been underway to develop uniform national standards and infrastructure requirements for the electronic collection and secure exchange of health information. These requirements are scheduled to be universally adopted by the Australian, State and Territory Governments. NEHTA has been working in collaboration with Standards Australia, and has released various standards and specifications for a range of clinical and administrative functions including a unique patient identifier.

4. British Columbia Ministry of Health, Request for Proposals Electronic Medical Records Project (February 2007).

4.2. Certification of products

EHR product suitability, quality, interoperability, and data portability can often be very difficult to judge, and physicians sometimes find that the product they purchased does not perform as hoped. Among the various instruments available to governments, certification helps mitigate risks and increases the confidence of users that the purchased systems will indeed provide required capabilities (*e.g.* ensuring security and confidentiality) including interoperability with emerging local and national health information infrastructures (Classen *et al.*, 2007). As such, certification of health ICT products can be seen as the first step in helping to ensure that systems deliver the benefits that providers, payers, purchasers and government officials seek and expect.

In several OECD countries, health care payers, ranging from governments to the private sector, are now also offering financial incentives for the adoption of certified health ICT systems – for example, for the use of certified EHR and CPOE. The certification of commercial vendor EHR products could, therefore, potentially boost participation in these incentives programmes and simultaneously reduce the risks facing health ICT purchasers, thus acting as a two-stroke catalyst to accelerate adoption.

As depicted in Table 4.1 above, four of our six case study countries have formal health care ICT product certification processes. All these countries have established specific certification organisations for this purpose. These are generally non-profit organisations sponsored by government (*e.g.* CCHIT in the United States, Box 4.2) or government entities and are playing an increasingly significant role in regulating the ICT market and in the adoption of ICTs by GPs.

Box 4.2. Health care IT product certification in the United States

The Certification Commission for Healthcare Information Technology (CCHIT) is an independent, not-for-profit organisation that certifies health IT products. HHS entered into a contract with the commission in October 2005 to develop and evaluate the certification criteria and inspection process for electronic health records.

Inspection of actual vendor products for compliance with CCHIT criteria occurs in a series of three steps. In the first step vendors self-attest by supplying documentation of their system and formally signing an accuracy attestation. The second step involves jury-observed demonstrations of the vendor EHR products, according to the test scenarios and scripts, running at vendor facility with jurors and proctors observing via simultaneous Web conference/audio conference. Each vendor sets up a test environment that replicates the live environment of its EHR system, and provides appropriate personnel during the demonstration portion of pilot

testing to execute all the procedural steps in the published test scripts, as well as to review the elements subjected to technical testing. In the third and last step, independent technical tests of vendor products are performed using off-site laboratories under the oversight of independent testing organisations and using the test scripts outlined above.

In 2006, the commission certified the first 37 ambulatory – or clinician office-based – electronic health record products as meeting baseline criteria for functionality, security, and interoperability. In 2007, the commission expanded certification to inpatient – or hospital – electronic health record products, which could significantly increase access by both patients and health-care providers to the health information generated during hospital admission or exams. To date, the commission has certified over 200 electronic health record products.

Since the recent American Recovery and Reinvestment Act was passed, which outlines the creation of a certification body, it is unclear what role CCHIT will play.

Source: Certification Commission for Healthcare Information Technology 2009, *www.CCHIT.org*, accessed 12 July, 2009.

Although numerous products have already been certified in these countries, there are still some shortcomings in the process. For example in the Netherlands some of the most common GP, pharmacy and hospital systems have not yet been certified, which places the hope for a national, unified system sometime in the future (Healthcare Information and Management Systems Society – HIMSS, 2008). The Health IT Policy Committee in the United States (Certification and Adoption Work Group meeting of 14 July 2009)[5] recently noted the issues listed below pertaining to certification of EHRs that are equally reflective of commonly-held certification concerns in other countries:

- The overall goal and purpose of the current certification process is often not properly understood.
- The certification process is excessively detailed. There is too much attention to specific features and functionality.
- Certification addresses the full range of products – open source, self-developed, modular, and other vendor. Home-developed systems and open source developers, often don't understand why they need to go through the expense of detailed certification processes and possibly developing unneeded functionalities for the sole purpose of meeting certification criteria.

5. *http://healthit.hhs.gov/portal/server.pt/gateway/PTARGS_0_11113_881027_0_0_18/CA_summary_071409.pdf,* accessed January 2010

- The timeframe and cost involved in certification and re-certification are a concern.
- There is limited evidence that the current certification process has significantly improved interoperability.

Furthermore, US officials from the ONC have recently noted that many certified EHRs are neither user-friendly nor designed to meet ARRA's ambitious goal of improving quality and efficiency in the health care system (Blumenthal, 2009). This last point highlights a specific inherent weakness common in most countries' product certification process, in that it certifies the product (*i.e.* EHR, CPOE, etc.) and the specifications and functionalities required, but fails to address how the product will be used to improve performance by clinicians. Actual system implementations can vary considerably from one organisation/ product to another; all certification can ensure is a baseline of core functionalities and specifications that could be used to achieve interoperability. For this reason, a few countries such as Canada, as described below, have chosen to establish a certification process that targets the vendor, and includes a number of "usability" requirements such as service levels, technical support responsiveness, financial viability, etc. On 14 August 2009, the US HIT Policy Committee introduced several important decisions regarding the certification process to address a number of the issues listed above, including expansion of the certification process to improve its objectivity and transparency, and a proposed short-term certification transition plan.[6]

4.3. Setting vendor conformance usability requirements

Like the certification process, vendor conformance usability requirements (VCUR) define minimum levels of mandated functionality for provider systems, as well as describing technical, interoperability, security, privacy and other requirements. In Canada, the only case study country currently setting VCURs, the process is a targeted effort within the context of a specific health ICT incentive programme rather than a broad product certification scheme, as envisaged in the other countries. The functional areas currently being tested include; billing, scheduling, EMR, workflow, ergonomics, and clinical decision support.

In Alberta, the products that were tested and conform to VCUR are placed on a list of acceptable vendors for the Physician Office System

6. Health IT Policy Committee: Recommendations to the national co-ordinator for health IT: *http://healthit.hhs.gov/portal/server.pt?open=512&objID=1269&&PageID=16501&mode=2&in_hi_userid=11113&cached=true,* accessed January 2010.

Programme (POSP) (Box 4.3). This list is updated from time to time whenever there is a successful application by a vendor to have its product(s) tested for conformance to VCUR, or whenever there is either a significant change in the VCUR or the underlying technical standards that have been adopted by the Alberta Government. Three vendors have so far been selected through the programme's request for proposal (RFP) process, and are qualified POSP service providers.

Box 4.3. Physician Office System Programme (POSP)

POSP is an initiative based on an agreement between the Alberta Medical Association, Alberta Health and Wellness, and Alberta's regional health authorities. The role of the POSP is to enable physicians who provide insured services in Alberta to use electronic medical records to improve patient care and to support best practice care delivery within Alberta's electronic health environment. Through a combination of funding, information technology services and change management services, POSP has helped nearly half of Alberta's practicing physicians to incorporate information technology into their practices.

Some of the initiatives that POSP supports include:

- Developing solutions to move patient data from one physician office system to another.
- Reducing the risk of data loss in physician offices caused by human, hardware or software failure.
- Working with stakeholders to update the Vendor Conformance and Usability Requirements (VCUR) for physician's offices. These requirements are reviewed regularly to ensure they continue to reflect the needs of all stakeholders.
- Collaborating with Alberta Health Services and Alberta Health and Wellness to ensure integration and interoperability with provincial systems (*e.g.* the Pharmaceutical Information Network (PIN), lab test results and diagnostic imaging text reports).
- Providing a broad range of change management services to support those physicians who are already automated, and who depend on their EMR solutions to be fully functional every day.

For more information see: *www.posp.ab.ca/,* accessed January 2010.

Failure to adhere to the VCUR does not mean that a vendor's product(s) cannot be marketed within Alberta. However, any physician who purchases a product that does not conform to the VCUR will not be eligible for funding under POSP. Consequently, by establishing a market advantage for three to six certified vendors, the programme tends to create a barrier to further entries, and closes the market to new vendors.

Both POSP and the VCUR programme are recognised as being critical components of the high adoption rates of EHRs by GPs in Alberta. Phase one of POSP ran from October 2001 to March 2003, with 1 500 physicians enrolled in the programme. In phase two, which ran from March 2003 to March 2006, a further 1 800 physicians joined the programme. Now over 61% of Alberta physicians are using EHRs in their practices, making Alberta the leading jurisdiction in physician electronic health information exchange in Canada. Government funding support and vendor accreditation are generally recognised as key factors in influencing health IT adoption in the Province (Protti *et al.*, 2007).

4.4. Addressing the challenges with the implementation of privacy and security requirements

Once technical challenges are overcome and a system is capable of sharing information effortlessly and is interoperable, a policy decision needs to be made on how that information should be shared. As noted above, results of surveys and studies indicate that citizens are concerned about the privacy of their health information, and for good reason. As the contents of electronic health records are shared more widely, the risk increases that stigmatising disclosures could affect areas such as employment status, access to health insurance and other forms of insurance, and participation in community activities. Researchers have also noted that patients may engage in "privacy protective behaviors", avoiding screening tests, treatment, or taking part in research protocols if they are not confident that the privacy of their medical information is adequately safeguarded (Goldman, 1998; Beckerman *et al.*, 2008; G.W. School of Public Health and Health Services, 2009).

There is, therefore, a need for coherent and consistent policies around the storage, exchange, and access to patient health data, and on patient consent. Interpretation of privacy and security requirements are still often determined locally within countries and vary significantly between countries. If privacy policies are not consistent, sharing data becomes more difficult because stakeholders may have differing views of what can be shared and with whom. The implementation of security requirements is proving particularly challenging (and cumbersome) in the context of EHRs, and one of the main barriers to the system-wide exchange of information.

Countries are struggling to comply with privacy regulations that have not kept pace with technology

Although all of the case study countries in this report have achieved great success in implementing a variety of health ICT solutions, security/privacy issues have been the biggest challenge. Officials from every

country consistently noted that privacy and security concerns were an overriding factor in every aspect of the technology deployment from start to finish. In Sweden, which enjoys virtually countrywide e-prescribing, GPs are currently unable to access the full list of medications that their patients have been prescribed due to legal restrictions. As a result, though the technology is available, privacy regulations act as barriers to fully harnessing the health benefits from the e-prescription system.

In Canada, well-intentioned privacy laws have created barriers to data access. In British Columbia, an unintended consequence of this commitment to privacy protection is that privacy is often cited as the reason that government cannot access critical health data and carry out the necessary associative studies to improve services for citizens.

To overcome some of the obstacles to the secondary use of data, in May 2006 the B.C. Government passed Bill 29 which introduced changes to the Freedom of Information and Protection of Privacy legislation to authorise indirect collection of patient personal health information through the creation of "health information banks" for the purposes of managing chronic diseases, and for use in health service development, management, delivery, monitoring and evaluation.

In addition, as noted above, in most of the case study countries, compliance is complicated by multiple layers of regulations from central to local. This is a particularly difficult problem to resolve in Australia, Canada, and the United States where rules for the protection of personal information have been established at both the national and local (state or province) levels. This made it especially difficult, for example, to implement a locally developed web-based electronic messaging and patient management system in Western Australia which cut across several jurisdictions. This is largely because rules for the protection of personal information have been established at both federal as well as state and yerritory levels in Australia. All regimes are similar but not identical. There are separate regimes for public sector and private sector organisations and specific legislation applicable to entities which hold health records.

While many countries are taking a top-down approach to address privacy challenges, in Massachusetts a bottom up approach has highlighted the importance of consulting users and identifying key concerns to improve the implementation process. The MAeHC case study interviews indicated that the most pressing privacy issue, and the one that most engaged consumer councils, was the issue of consent. MAeHC, therefore, stipulated from the outset that the consent process would be a major design criterion for the HIE, in order to ensure that it was neither an afterthought nor something that could be "traded away" during deliberations.

Four options can be considered in making the decision about whether and how consumers consent to the electronic exchange of health information:

- *Option 1 – Opt In*: seek advance consent from consumers to include their health information in an HIE;
- *Option 2 – Opt Out*: provide consumers the right to "opt out" of having their health information in an HIE;
- *Option 3 – Notice Only*: include all consumers' health information in an HIE, with notice to or education of consumers about the process; or
- *Option 4 – Combination*: take a blended approach, employing Options 1-3 as appropriate, depending on the particular uses of information and who has access to the HIE.

The most common approaches today involve the first two options. With the opt-in approach to consent, patients declare what data they are willing to share. With the opt-out approach, patient demographics and medical record numbers are stored without patients' approval, but would give the patient the option at the point of care to prohibit a clinician from looking up data. Both approaches have risks and benefits.

The MAeHC decided to use a global opt-in approach for patient participation in the HIE. As such, the burden of proof was on the institutions that wanted to share patient data, rather than on the patients themselves, since no data could be shared without written permission from the patient. From the MAeHC perspective, the consent form would educate individuals about how health information is exchanged, who will have access to it, and what consumer rights are vis-à-vis the HIE and the participants in the HIE. This proactive education through the consent process was also likely to reduce liability to an HIE in the event a participant misused the exchange.

MAeHC had to ensure, however, that patients would also see some advantage in HIE while determining the extent of data sharing that most patients would be willing to accept. The risk that large numbers of patients would refuse to opt in had been an issue in other countries (*e.g.* the United Kingdom and the Netherlands) where the development of EHRs had been stalled by debate over whether patients should explicitly give consent to having an EHR or whether consent should be presumed with patients having the ability to opt out of the system. To address this concern the MAeHC adopted a "turning consent to demand" approach investing significant resources in an information campaign (Box 4.4). The extensive privacy protection measures, clinician consensus building and patient education have paid off for the MAeHC. Patient opt-in has averaged about 90% in all three pilot communities.

Box 4.4. MAeHC turned consent to demand

Following extensive discussion within the MAeHC's own privacy and security committee, with the communities, and consumer councils, the MAeHC decided to utilise a global "opt-in" approach whereby a signed patient consent form is required for patient's clinical data to be copied or "uploaded" to the HIE community database. As such, patient recruitment became a preeminent concern for the HIE enterprise, if it was to be viable. To address this concern the MAeHC adopted a "turning consent to demand" strategy investing significant resources in an information campaign, as would be done with any customer in other sectors, describing the benefits of the system so that patients would want and demand to participate.

To engage patients, the MAeHC enlisted the assistance of outside professionals with experience in other sectors to communicate consent conditions clearly, and provide simple but clear educational material. Focus groups in each pilot community identified what worked and what did not in the HIE draft consent forms and explanatory material. The input received from the focus groups guided MAeHC's further communication strategy and consent process in the three communities.

The MAeHC has focused on the core messages that appealed to all of the focus groups: convenience and data security. Instead of making security concerns the main feature of the patient brochures, the MAeHC placed these issues in a familiar context, by comparing HIE security provisions to what banking institutions have in place today (Tripathi *et al.*, 2009).

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Chapter 5. Using Benchmarking to Support Continuous Improvement

This chapter reviews the principal information needs of policy makers and lessons learned about the challenges to measurement and evaluation of ICT use in health care. It considers options on how to improve the availability and comparability of data on health ICTs at OECD level.

Introduction

As discussed earlier in this report, evidence of the impact of health ICTs remains limited. For many of the possible ways in which ICTs might affect the efficiency of health care systems, there is little or no available data that could allow any quantitative estimation. It is equally difficult to obtain reliable figures on the "success rate" of health ICT projects or programmes. The result is that after more than a decade of large investments in health ICTs, OECD governments are still unable to provide reliable evaluations of the financial and social returns on their investments.

This chapter reports main findings of an analysis of the challenges associated with the measurement and evaluation of ICT use in health care in nine OECD countries and at EU level (OECD, 2008). The evidence collected shows that the currently available national and international data on health ICTs is often not comparable for a whole range of statistical reasons, including the use of different sampling techniques and definitions, and the scope of the surveys. This leads to difficulties in drawing general conclusions on ICT adoption and use, especially when more complex analyses are being undertaken, such as those attempting to evaluate the impact of ICT use on health care.

Agreement on indicators and definitions are essential to allow for better quality monitoring and improvement. Comparable measurements can be useful for national policy to identify areas where government intervention is needed and to accomplish the quality improvements laid out as essential in the initial part of this report. Without concerted international action this is, however, unlikely to occur any time soon.

5.1. Building a common understanding of what needs to be measured

What do policy makers need to know to accelerate adoption of health ICTs and realise the benefits intended from investment in these technologies? On the surface, the answer appears simple. Most OECD countries today are at an early stage of implementation, integrating the different systems that clinicians use at the point of care to document clinical patient data. Consequently, policy makers, developers and managers have thus far been primarily concerned with addressing the many challenges associated with programme implementation.

It is difficult to obtain reliable figures on the rate of success of health ICT projects. Nonetheless, more than a decade of implementation efforts provide a picture of significant public investment (Box 5.1), some notable successes and highly publicised costly failures. Hence, reliable measures or indicators on adoption score high on policy makers' list of information needs. These indicators can inform action on how to overcome barriers and help in the development of future projects.

Box 5.1. Implementation efforts provide a picture of significant public investment

Health ICT investments costs are difficult to determine. Costs are usually provided as rough estimates only and it is often difficult to separate health ICT costs within overarching budgets. In some cases national and local projects are phased and only the budgets for the first phase (feasibility study) can be estimated. The actual budgets clearly depend on the final scope of the projects. The sums indicated may be a mix of capital or operational expenditure and may or may not include purchase and implementation costs such as training. Notwithstanding these difficulties Table 5.1 below provides estimates of current budgets of three major national ICT agencies funded by government. In 2008-09 government funding of these agencies was similar, ranging between 0.1% to 0.3% of total expenditure on health in the three countries – investment per capita varying from USD 5 to 13.

In a strategic planning document, Canada Health Infoway in 2006 reported a rough assessment of total investment costs per capita to establish a fully functional EHR system that ranged from an estimated CAD 133 in Canada as of 2009 to CAD 570 per enrolee in Kaiser Permanente (United States) in 2005. The level of spending depended on the degree of sophistication of the system. Anderson *et al*. (2006), developed similar estimates for six countries including Canada and the United Kingdom.

Striking in both the Infoway and Anderson estimates as well as those from this present study shown below (see Table 5.2) is the relatively large per capita health ICT investment in the United Kingdom. Although similar to the per capita being spent by Kaiser Permanente, it stands out from other countries. This may in part be explained by the fact that the total costs reported for the UK programme run through 2015.

In addition, the total includes central costs paid and recorded by NHS Connecting for Health, as well as estimates of the local costs incurred in deploying the systems. Although a recent UK NAO report (NAO, 2008) report suggests that there is some uncertainty around the local estimates and the annual costs, it appears that unlike many other countries the United Kingdom is better at reporting total health ICT expenditure particularly given its maturity and funding projections for approximately 13 years. The top down and centralised nature of the UK programme makes it perhaps easier to measure total costs compared to other countries where multiple federal and local agencies and the private sector may be engaged in funding health ICT initiatives. For example, in Canada, Infoway has only been in existence for the past eight years, is funded only periodically in varying amounts, and cost shares (up to 25%) the majority of its projects with provincial authorities making it almost impossible to separate exact amounts being spent on health ICTs. The figures for Canada in Table 5.1, therefore, inevitably underestimate the true public investment. Other countries may well be investing comparable amounts per capita but arriving at a reliable figure is elusive.

Table 5.1. Current budget for ICT initiatives in three OECD countries

	United States	Canada	Australia
Agency/initiatives	Office of the national co-ordinator (2010)	Canada Health Infoway (2009)	National e-Health Transition Authority & Practice Incentives Programme (2009)
Total expenditure on health (million USD at exchange rate) & % of GDP[1]	2 198 764[2] (16.0% of GDP)	150 121[3] (10.3% of GDP)	76 827[4] (8.7% of GDP)
Current budget for ICT initiatives (million USD at exchange rate)	2 061[5]	455[6, 7]	115[8, 9]
Current investment per capita (USD)[10]	6.83	13.80	5.47

Table 5.2. Total budget allocated by national government in two OECD countries

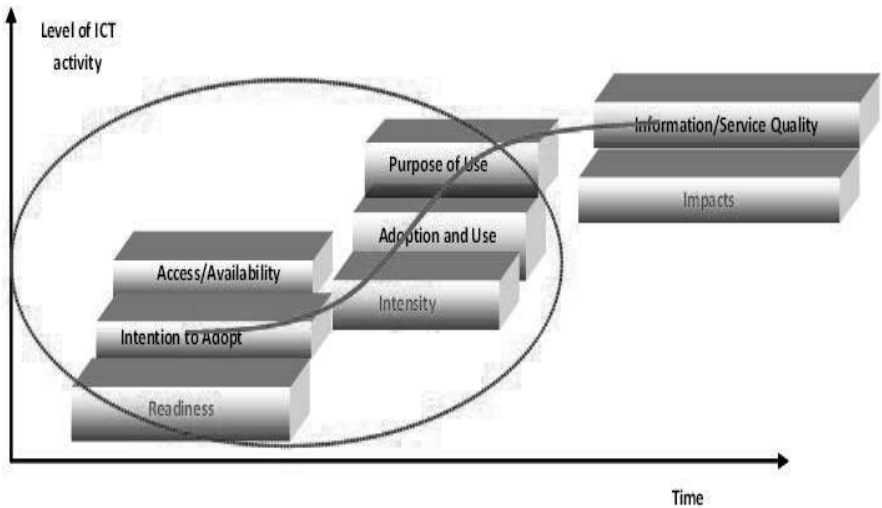
	Canada	United Kingdom
Agency/Initiative	Canada Health Infoway (2001-10)	NHS Connecting for Health Programme (2002-15)
Total expenditure on health (million USD at exchange rate) & % of GDP[1]	150 121 (10.3% of GDP)	193 292[13]
Total budget allocated (million USD at exchange rate)	1 792[11]	20 748[12]
Total investment per capita (USD)	54.34	340.27

Note: The budget allocation amounts shown for Canada in both Tables 5.1 and 5.2 do not include 25% or more cost sharing money provided by provinces for local Infoway health ICT projects.

1. *OECD Health Data 2009*; 2. 2007; 3. 2008; 4. 2006; 5. *Source*: HHS, FY 2010, Congressional Justification for Departmental Management, includes ARRA funds; 6. *Source*: Canada Health Infoway, *Building a Healthy Legacy Together, Annual Report 2008/2009*; 7. 2009, exchange rate CAD 1.10; 8. *Source*: Department of Health and Ageing, Australia; 9. 2009-10, exchange rate AUD 1.19; 10. OECD Population Data, 2007; 11. Through March 2010, exchange rate CAD 1.10; 12. NAO, through December 2015, exchange rate GBP 0.61; 13. 2007.

The main information needs today – as listed by policy makers in response to an OECD questionnaire – are reflected in the areas encircled in Figure 5.1 below. The figure illustrates through an S-curve describing the diffusion of ICT innovations over time and the related level of ICT activity – how such needs may also evolve. This framework was developed by the OECD in the early 1990s, and recognises that indicators concerning infrastructures or the "readiness" for ICT of individuals and businesses is of greater interest in a situation/country where ICT use is in its infancy. As the use of ICT progresses, countries place greater emphasis on the level of ICT use and on its impact (and less on readiness indicators). There is likely to be some demand for all three types of indicator, but priorities will differ over time.

Figure 5.1. Principal information needs



Source: OECD.

Although the model was developed initially for OECD work on e-commerce, it can be applied to ICT-related activity in any field.

Access is related to the availability of equipment and internet connections. Availability, relates to the question of how many different types of ICT application are available and what they can be used to do. "Intention to adopt" addresses the propensity of users to adopt these applications in their clinical work, and this propensity may in turn, be linked to the level of skill and competence of providers, as well as to incentives. These questions address the state of "readiness" of the environment.

"Use" refers to the applications of the technologies in clinical activities, as well as the types of technologies used and for what purpose. Information on "purpose of use and user satisfaction" reflects the intensity of ICT-related activities and can inform specific policy and institutional questions, particularly related to the presence or absence of incentives for use, such as privacy frameworks.[7]

A review of strategic plans and documents with respect to the introduction and dissemination of ICTs across OECD countries further highlights areas where countries may find it useful to share information to monitor progress by ways of international comparisons. These are:

- Adoption and use of electronic health records and related applications;
- Rate of health information exchange;
- Privacy and security measures;
- Adoption and use of standards for interoperability;
- Adoption of organisational change management initiatives;
- Secondary use of data for monitoring public health.

5.2. Countries have adopted a range of different approaches to monitor ICT adoption

Analysis of surveys from nine OECD countries (Australia, Canada, Czech Republic, France, Finland, New Zealand, Norway, Sweden, and United States) and at EU level shows that the major types of data collections are:

- Stand-alone surveys of health care providers (businesses or personnel),
- Surveys of the population,
- Use of administrative data.

7. An example of how this model can be applied to health ICT is Finland, where the number of GPs using EMRs has not been an appropriate measure for tracking progress in this country for some time now. EMRs were used by nearly 100% of the doctors in Finland by 2008 *i.e.* indicators on ICT availability have reached saturation point. Finland has clearly moved from the "readiness" to the "intensity" stage of the model, and is now more interested in indicators that can, for example, inform policy makers about how ICT is being used to connect physicians to other parts of the health care sector (intensity), and to improve the quality of health care services provided to patients (impacts).

With the exception of Finland, where ICT adoption has been monitored since 2005 on an annual basis and across various segments of the health sector, most OECD countries have not yet set out to collect national data on health ICT adoption on any systematic basis. In addition, most surveys are conducted as stand-alone surveys, on an *ad hoc* basis and in most cases target the primary care sector. Surveys of populations are less common, although there appears to be some demand for indicators to track population access to ICTs, patients' opinions and attitudes, including for health-related information.

Three out of the nine countries (Norway, Spain and Sweden) included in the OECD study also use routine administrative data to monitor ICT adoption. This approach may represent a low cost alternative way for compiling indicators. The downside is that data compiled from such sources are constrained by the fact that in most cases administrative data collection has been designed for other purposes than monitoring ICT use and impact.

Activity by OECD countries national statistics offices to monitor ICT use in the health sector has been generally limited.[8] With few exceptions (namely Canada and the United States), current surveys on ICT by national statistics offices do not include the health care sector within their scope and cover ICT use in general, while the issues of relevance to health care policy relate to specific applications such as EHRs.

The major advantage of adopting a stand-alone survey approach is that the survey can be designed to meet the specific needs of the user, in this case, health care policy makers. The main drawback is that the data is generally not comparable with other data sets that might be available for the same country or across countries for statistical reasons, including the use of different sampling techniques, definitions and the scope of the surveys. This was true of the surveys analysed, which, although generally funded by government, were carried out by academic institutions, private research or consulting entities.

8. There are four examples of surveys undertaken by national statistics agencies that have been expanded to cover ICT use in the health sector. These are the regular Survey on ICT Use by Business conducted by Statistics Canada, the short module related to the ICT usage in health care facilities developed by the Czech Statistical Office (the module was integrated in the 2007 questionnaires used for the census surveys carried out by the Ministry of Healthcare of the Czech Republic), the Services Industries surveys undertaken by the Australian Bureau of Statistics and a 2008 mail survey of office-based physicians by the National Center for Health Statistics (NCHS) in the United States (the purpose was to obtain a preliminary estimate of use of EMRs by GPs). These countries represent an exception.

The scope of the surveys and the methodologies used therefore vary significantly, and include sample surveys of medical practitioners and medical practices, inventories of the use of ICT for administrative/clinical purposes in hospitals, self-administered surveys, censuses or large samples of service providers in public and private sectors, population surveys.

Table 5.3 below presents a simplified comparative analysis of the different data sources in terms of: *a)* relevance, *i.e.* how well the data reflects the information priorities of policy makers; *b)* feasibility, *i.e.* how easily data can be gathered (cost and time); *c)* prevalence, *i.e.* whether the type of data collection is frequently used or not; *d)* extent of comparability.

Table 5.3. Overview of main data collections reported by countries

Data collections	Relevance	Feasibility	Prevalence	Comparability
National statistics surveys of ICT use	Low	Low	Low	High
Use of administrative data	Medium	High	Low	Low
Surveys of the population	Medium	Low	Low	Low
Stand-alone surveys of health care providers (businesses or personnel)	High	Medium	High	Low

Source: OECD.

The OECD study also reviewed how countries define ICTs in their surveys. With the exception of the term "electronic health record" and "electronic medical record", there was very little or no overlap in the lists provided by countries. Notably, none included any general definition for ICTs or health care. Even for the term EHR, the definitions used in questionnaires were inconsistent. A few questionnaires characterised EHRs and EMRs by their attributes, the scope or nature of their information/content, the source of their information, and the features and functions they offer – an approach which was also endorsed in 2008 by the Office of the National Coordinator in the United States.

5.3. Common information needs are reflected in a core set of widely used indicators

The OECD analysis clearly shows that the way countries are currently monitoring ICT adoption and use, inevitably makes it difficult to compare data, within and across countries, or to link survey data to other data sources.

Nonetheless, it is possible to identify a core set of indicators widely used in these surveys. These indicators were assessed against a set of criteria listed in Box 5.2 and assigned to three broad priority groups of policy objectives.

Box 5.2. Criteria for the selection of indicators

- Be relevant to actual or anticipated policies.
- Reflect an important aspect of the technological, social, economic or contextual elements of ICT use and adoption.
- Measure something of obvious value to users and decision makers.
- Be clearly definable, simple to understand and easily communicated.
- Have durability and long-term relevance.

To promote access and availability of health ICTs

ICTs can enable integration and collaboration across the health care sector. This integration, however, is dependent upon the state of ICT infrastructure and of the "ICT readiness", particularly of the least advanced organisations in the network. Variation in the level of readiness can create a significant barrier to the entire enterprise of regional/national integration. Until the least advanced participants, be they hospitals or primary care providers, are brought up to a minimum level of ICT infrastructure, the progress towards full integration will be impossible.

Indicators about "access and availability" (readiness) can, therefore, help identify requirements and opportunities to promote efficiencies and reduce redundancies in the establishment of a national/local e-health strategy. They are commonly used by countries since they can inform decisions on the need for:

- Installation, training and support.
- Increased capacity for ICT services.
- Support for organisations whose state of ICT-readiness is low.
- Opportunities to leverage shared capacity.

To steer and stimulate adoption and use of ICTs

A first challenge for many countries is the adoption gap, particularly in relation to the use of EMRs/EHRs. Some clinicians may adopt EMRs/EHRs more readily than others, creating an adoption gap based, in large part, on the setting (public vs. private) and size of practice. This problem, as previously discussed, depends to a large extent on the structure of the health care system and the nature of national implementation efforts (centralised *vs*. decentralised), including the proper alignment of incentives. Nonetheless, all surveys analysed in this report included indicators to gather relevant data to address the adoption and use gap. A number of surveys have adopted a "purpose of use" approach in their questions on the use of EMRs or EHRs – which is essential to better understand the tasks for which these tools are used and the barriers to adoption (Box 5.3).

Box 5.3. Adoption of basic and fully functional EHRs

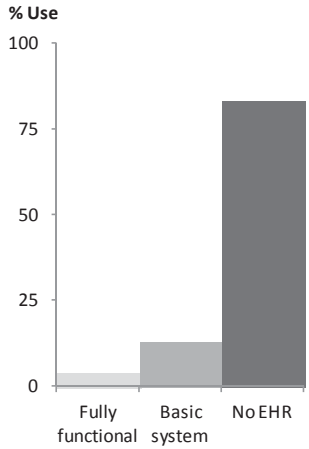
In 2008, DesRoches *et al.* assessed US physicians' adoption of outpatient electronic health records, their satisfaction with such systems, the perceived effect of the systems on the quality of care, and the perceived barriers to adoption. The investigators defined the key functions that constitute a "fully functional" electronic health record.

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).

Recognising that relatively few physicians might have fully functional electronic health record system and that less complete electronic records might nevertheless convey benefits for patients' care, the investigators also defined a minimum set of functions that would merit the use of the term "electronic health record", calling this a "basic" system.

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. Based on the above criteria, 4% of respondents reported having a fully functional electronic-records system, and 13% reported having a basic system (Figure 5.2).

Figure 5.2. **Rates of adoption of electronic health records by physicians in the United States, 2007**



Source: DesRoches *et al.* (2008).

A second challenge is to achieve exchange of health information and data transfer across settings. The efficient application of e-health solutions is predicated on the seamless sharing of patient information across the health care system. Studies reviewed in previous parts of the report suggest that the financial benefits through productivity improvements are not realised until a high level of integration and functionality is reached and the information silos between providers disappear. Inter-provider data sharing is a challenge that is only just beginning to be tackled in many OECD countries, including, as previously noted, in those countries that can claim 100% uptake of EHRs.

A substantial number of surveys employ indicators that respond to the need of improved measurement of exchange of information through ICTs. These indicators score generally well in terms of availability. Few countries, however, use indicators to capture information in relation to inter-provider (including cross-regional) exchange of information and the impacts of standards-setting activities.

To make it possible to understand barriers and incentives

Understanding the barriers and incentives to ICT use is an important component in understanding the performance of the systems. Hence, information at the level of individual actors on relevant parameters, for instance, user satisfaction, is important to address key policy questions such as the need to provide any additional financial incentives or technical support. Answers about perceived barriers and their evaluation (*e.g.* no importance,

some importance, much importance) are inevitably qualitative in nature and limit the use of these indicators for purposes of international comparisons. Nevertheless, they can aid in detecting common obstacles to the diffusion of new information technologies and may be used with other types of quantitative indicators to explain differences in the intensity of use of new technologies across countries.

The surveys analysed appear to focus on two main issues: *i)* usability of the ICT tools (predominantly EMRs, EHRs, e-prescription), *i.e.* how easily and reliably these tools can be integrated in the workflow; *ii)* impact on the quality of the care delivered.

It should be noted that none of the surveys included indicators that would assist governments in monitoring the impacts of subsidisation or incentive programmes. This, given the widespread use of financial incentives, appears as an incongruous omission.

5.4. Improving comparability of data on ICT in health: What options?

Evidence-based policy analysis for health ICTs appears still a distant prospect. While some countries – most notably, Canada, Finland and the United States – are leading the way in devising means of monitoring health ICTs, albeit in varying and somewhat diverging ways, other OECD countries have not kept pace. As recently confirmed by an extensive study at EU level sponsored by the European Commission (Meyer *et al.*, 2009), survey activities across countries and the indicators used are by no means ideal, and the necessary data cannot be gathered from existing national statistics or data collections.

There is clearly much work to be done to gather relevant information for: *a)* improving the quality of existing data and indicators; *b)* improving the linkages between policy and indicators; *c)* developing indicators for unmet information needs. However, in addition to producing better data, it is important to improve the comparability of data and consequently the methodologies used to collect and analyse this data. Data should be more easily accessible to the relevant users – not only policy makers, but also health care providers, and analysts and researchers, who serve as important intermediaries in processing the information for evaluation and policy analysis.

The creation, initial testing and subsequent use of an indicator entail high fixed costs (initial tests, survey design and implementation), and these are hard for a small group of initiators to bear. This means that OECD countries have a lot to gain from pooling their efforts and sharing the burden of developing and testing indicators in this sector. Risk, delay and cost can all be minimised by learning from good international practices.

Developing and implementing a "model survey" (OECD, 2005, see Box 5.4 below) provides one possible way to establish a common set of international guidelines to improve the availability and comparability of data on health ICTs. In the model survey approach an agreed set of indicators, including their definitions can be developed to aid international comparability between survey results. The scope of what is considered will be determined by the main policy issues confronting policy makers. The model survey is designed to be a flexible tool which can evolve with time and allows country-specific features to be included. This approach was developed in 1999 by the OECD and has proved successful in establishing a common set of guidelines to measure ICT usage in enterprises and in households and is today widely adopted by national statistics offices.

Box 5.4. Improving comparability of data on ICT in health: working towards an OECD "model survey"?

Developing and implementing a "model survey" (OECD, 2005) provides one possible way to improve the availability and comparability of data for a core set of indicators on health ICTs.

Model surveys are intended to serve as guidelines, rather than rigid prescriptions, since different questions, wording or explanations may be necessary in different environments.

To be useful in all contexts, a "model survey" is composed of separate, self-contained modules to ensure flexibility and adaptability to a rapidly changing environment. While the use of core modules allows measurement on an internationally comparable basis, additional modules and new indicators within existing modules can be added to respond to evolving or country-specific policy needs in this area.

As developed for application to the surveys of the use of ICTs by business, the model survey includes three main features that are of general applicability and are relevant to efforts to improve the comparability of health ICT data internationally. These features are reviewed below.

- *Link of indicators to user needs:* the model survey reflects common elements of national ICT usage that in turn are guided by national policy priorities.
- *Flexibility and adaptability:* the model survey is a flexible tool composed of separate, self-contained modules to ensure flexibility and adaptability to a rapidly changing environment. While the use of core modules allows the measurement on an internationally comparable basis, additional modules and new indicators within existing modules can be added to respond to evolving or country-specific policy needs in this area.
- *Minimise burden*: the model survey is designed to reduce respondent burden and enhance international comparability by being short, by making use of filter questions and by using a very limited amount of quantitative questions.

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Annex A. Country case studies

The Great Southern Managed Health Network (GSMHN) in Western Australia

Key achievement

The GSMHN is delivering web-based patient management systems and secure electronic messaging solutions to clinicians in the vast rural expanse of Western Australia. In providing these services GSMHN has also established one of the few examples in OECD countries of a not-for-profit self-sustaining "e-health network" where health providers pay an annual fee to join the information exchange.

Determinants of success

The significant role of Divisions of General Practice and of the University of Western Australia

The Great Southern General Practice Network (GSGPN, formerly the Great Southern Division of General Practice) played a significant role in implementation. The Division had received a seeding grant to develop a business case and to consult broadly on requirements for the GSMHN. Consultations helped establish the most pressing needs and priorities for GPs and other health providers. It also provided an early understanding of the support that would be required to drive and manage change. The University of Western Australia's Centre for Software Practice (UWA Centre) provided dedicated technical support under a not-for-profit partnership agreement.

Targeted financial incentives

The Practice Incentive Payments (PIP) Information Management and Information Technology (IM/IT) scheme facilitated effective computerisation and widespread information transfer and storage.

The broadband for health subsidy supported, in the form of a financial incentive, the take-up of broadband services in general practices in the region. Payments depended on adoption of either satellite or terrestrial (including ADSL, cable) and wireless technology. In addition, they were based on a Rural Remote and Metropolitan Area Classification Systems.

High rates of basic computerisation

A 2001 study found that 86% of Australian general practices had at least one computer and projections indicated that within two years, 95% of practices would be fully computerised. Five years later, another study confirmed these projections and found that most practices had the computer software and hardware to perform administrative and clinical functions, and most (78.3%) had a high-speed internet connection. Furthermore, GSGPN survey results from 2006 indicated over 80% of Western Australia practices using computers for both clinical and administrative functions.

Background and benefits

The Great Southern Managed Health Network (GSMHN) was established in 2007 as a not-for-profit association between the Great Southern General Practice Network (GSGPN) and the University of Western Australia (UWA) Centre for Software Practice.

The goals of the project were to achieve:

- Secure messaging and increased collaboration between health professionals.
- Reduction in time spent on preparing, forwarding and receiving hospital discharge reports.
- Reduction in the risk of clinical errors through improved legibility and reduced double-entry of patient information.
- Improved patient data capture.
- Improved medication reconciliation.

A wide variety of benefits and impacts of electronic messaging have been noted by GPs, allied professionals, staff in hospitals and the Western Australia Country Health Services. The most commonly cited effects can be categorised according to five groups: speed of information exchange, confidentiality, cost (*e.g.* reduced phone calls, faxing and mailing), workload and quality of care (improved patient notes, better care co-ordination, quicker delivery of hospital discharge reports, improved medication management). Together with confidentiality, speed of communication was the most commonly perceived benefit (*e.g.* the prompt receipt of discharge summaries from hospitals – previously often arriving after the patient had been seen by the GP following surgery). Positive changes in workload were also observed but mainly by allied health professionals, which related this effect to easier access to patient data (they were able to access information about their patients that was previously

unavailable, at least routinely), faster communication, higher quality of data and more complete information. GSMHN allowed health providers to improve how, and what, they communicate with each other and is perceived as a key enabler of multipurpose service delivery in primary care centres in rural areas.

Business case

Western Australia has a relatively small population – 2 million people– living mainly in the capital city, Perth. Over one-quarter are dispersed through the remainder of the state, scattered across huge distances, in mining communities which survive on seasonal fly-in, fly-out workforce arrangements, small villages or remote farming properties. There are also a number of very small and isolated Aboriginal communities in the northwest of the state with unique health problems and poor access to public services. These communities are difficult to reach by road and are often completely cut off by seasonal flooding. No other state in Australia has such a sparse population spread over such large expanses of land. Providing access to health services in WA presents, therefore, many challenges. These include:

- *Hiring and keeping doctors*: overall, the state has only half the GPs needed and has forecasted a shortage of more than 35% of medical practitioners and nurses by 2020. In 2007 there were 20 full-time unfilled GP positions for the areas of greatest need such as the Kimberley – the state's most northern region with the highest proportion of Aboriginal people.
- *Achieving economies of scale and viability of services in a dispersed or isolated population*: recent evidence suggests that a critical minimum population base of about 5 000 inhabitants for rural regions and of 2 000-3 000 people for remote communities is necessary to support quality assurance in services and a comprehensive and sustainable range of health care services.
- *Improving access to specialist services, mental health services and aged care*: access to specialist services remains a problem for many residents of isolated settlements which often have to relocate to utilise these services. Inability to readily access specialist services when required can result in health needs not being adequately met, lack of continuity of care and worse health outcomes. The poorer health status and higher mortality rates in the Kimberley region compared with the state's average is largely attributed to poor access to secondary and tertiary health services and the greater health needs of the local aboriginal population.

The challenging circumstances of rural Australia have resulted in unprecedented innovation in health care service delivery over the past ten years, which can be classified according to three broad categories.

- *Integrated services* provide single point access to a range of services significantly broader than those delivered by general practice. They comprise a variety of models. For example, the "shared care" model of mental health care addresses access to and co-ordination of services across primary and specialist care.
- *Comprehensive primary health care services* are best typified by the Aboriginal Community Controlled Health Services (ACCHSs). ACCHSs have adopted a primary health care approach to healthcare delivery over the past 30 years, which includes preventive and health promotion activity, as well as education and capacity building.
- *Outreach models* are characterised by the periodic supply of a range of health services from one location which has these services to other locations which do not. The arrangement may include either a "hub and spoke" arrangement, where a centrally located service provides services to satellite communities or some other visiting mechanism, such as where a GP resident in one community may visit a second community for short periods. Services can also be supplied on a virtual basis (virtual outreach) or on a fly-in, fly-out basis.

Policy context and sustainability

The 2007-10 strategic plan for Western Australia's Country Health Service includes plans for:

- Implementation of a "hub and spoke" service concept, which specifies regional health networks and roles for hospitals and health services within these networks.
- Integration of services by achieving greater collaboration between medical, nursing and allied health staff across regions, to ensure that patients receive seamless health care irrespective of how they enter the system and to ensure small communities receive good access to primary health care.
- Effective care networks in each region by strengthening outreach services including through telehealth.

The Divisions of General Practices (DGP) have received substantial funding to support adoption of health IT and have been involved in a range of IM/IT activities. This has been further bolstered by the Practice

Incentives Programme (PIP) which is one of the most comprehensive and flexible primary care incentive programmes established to date in any OECD country. First introduced in 1999, the PIP IM/IT incentives encourage GPs to better use IT. By 2006/07, after less than a decade since its establishment, the PIP had succeeded to "recruit" nearly all of the accredited practices in Australia with approximately 98% of PIP practices receiving IM/IT funding. Coupled with recent changes to the incentive programme, the effort is now shifting its focus to motivate practices to move from adoption to more effective use of clinical resources, particularly decision support tools.

Despite the rapid uptake and high rate of utilisation, there are still some sustainability challenges that remain if GSMHN is to ever be scaled up. This includes broadband connectivity in rural WA, where it remains a challenge and will need to be further addressed, as this may clearly be a barrier to participation and inclusion in the GHMSN and wider project activities for practices in remote areas. In addition, seamless health information exchange between hospitals and GP practices is currently not possible due to technical and protocol issues. This is further complicated by a number of uncertainties inherent in complying with a diverse range of legal obligations *i)* on privacy and security and *ii)* on clinical protocols.

Governance

The GSMHN is a not for profit collaboration between GSGPN and the UWA. The University was not new to this type of partnerships as it had managed for over three decades population health data in Western Australia on behalf of the Department of Health. It was acknowledged that the UWA Centre for Software Practice had been a critical, if not major factor in the successful implementation of the project, both for the enthusiastic dedication of its staff, the not for profit nature of the partnership and the extensive expertise in software development.

Physician Connect and the chronic disease management toolkit in British Columbia (Canada)

Key achievement

Today Physician Connect links private physicians to the health authority via a low-cost, high-speed communications network enabling quick and secure retrieval of laboratory results, and has spurred adoption of EMRs. A tangible by-product of Physician Connect has also been the capability to access web-based clinical decision support tools such as the chronic disease management (CDM) Toolkit.

The effort has been a catalyst for the development of new service delivery models, organisational partnerships, and increased compliance with clinical guidelines.

Determinants of success

Enabling critical partnerships and a shared vision

Notable facilitators included the presence of grass root initiatives, dedicated managers and physician leaders who envisioned the specific changes needed. In addition, The Northern Health Authority (NHA) developed a shared vision focused on clearly defined problems with identifiable deliverables of value to all the potential beneficiaries, engaging physicians in the work of jointly pursuing primary care renewal and better care for patients in the North.

Simultaneous system changes and health care reforms

In order to move providers and patients to adopt a new model for chronic care management, the B.C. Ministry of Health set out a number of strategies to align policy in the following areas:

1. Physician compensation.
2. Information technology.
3. Privacy legislation.
4. Guidelines development.
5. Implementation of new service delivery models.

Targeted support and incentives encouraged and sustained change

To encourage the adoption and use of information technologies, the B.C. Government adopted a mix of financial incentives and strategies: direct cash subsidies, including payment to attend learning sessions, training and support (*e.g.* by providing help with data entry), reimbursement for complex care e-mail/telephone follow-up, direct payments to spur use of the CDM Toolkit, reimbursement of 70% of the cost of adoption and use of an eligible electronic medical record within the context of the Physician Technology Office Incentive Programme (PITO).

Incremental change

Experience with "home-grown systems" and a supportive environment contributed to acceptance and successful implementation of EMRs. Prior to the launching of Physician Connect, over 50% of family physicians in Prince George were already using a "home-grown" patient management system developed by a local physician. These grassroots initiatives laid the groundwork for ICT advancement as physicians had already been primed for incorporating technology into their practice since the early 1990s.

Adoption of the chronic disease management (CDM) toolkit

The CDM "self-evaluation" toolkit is a web-based software developed by the B.C. Health Ministry. It is available for free to all B.C. physicians and their staff and provides a host of functions to support chronic disease management. Many physicians started with the CDM "self-evaluation" toolkit and although it provides less clinical information than an EMR, it provides an excellent entry to the world of information technology and getting a first glimpse of what an EMR can do before fully investing.

Background and benefits

In 2000, British Columbia launched a broad agenda of primary care renewal. The Northern Health Authority (NHA) in the province took a leadership role by developing collaborative, evidence-based approaches, which included the deployment and use of information technologies. These efforts, including those aimed at addressing care gaps and the rapidly increasing chronic disease trends, were sustained by the Canadian Government through the Primary Health Care Transition Fund (PHCTF).

Physician Connect began in 2004 with a CAD 1.2 million Primary Health Care Transition Fund (PHTCF) grant. Four years later, by March 2008, the project was nearing completion, having enrolled nearly 97% of the physicians in the region. The aim of the project was to deploy a high speed communications network between private physicians' offices and the NHA's information systems to enable quick and secure retrieval of laboratory results, and spur adoption of EMRs.

A tangible by-product of the adoption of Physician Connect has been the capability to access web-based clinical decision support tools such as the CDM toolkit. By tracking patient care processes using best practice guidelines and flow sheets, the toolkit allowed physicians to conduct systematic patient monitoring, improve their practice, and particularly the management of chronic diseases such as diabetes.

Although widespread use of the CDM toolkit was not the primary objective of Physician Connect, over 60% of the NHA's general practitioners (GPs) in 2008 were using this electronic clinical decision support tool. The

toolkit experience enabled providers to produce more integrated and efficient care, acted as "tipping point" and spurred widespread interest in the adoption of EMRs with over 50% of NH's GPs today having adopted EMRs. Beyond adoption, the effort has resulted in noticeable health care benefits. Over the project timelines, in less than three years, people with diabetes who had HbA1c, blood pressure and lipid tests complying with Canadian Diabetes Association guidelines improved from 21.8% to 48.6%. In addition, by linking physicians to the hospital portal and the PACS system, operative reports turnaround time was nearly halved in two months allowing faster decision making and responsiveness for patient treatment.

Business case

Implementation of Physician Connect takes place within a broader agenda for change in the province: the need to pursue primary health care renewal, improve chronic disease management, recruit and retain physicians in rural areas. Chronic disease is the biggest obstacle to the sustainability of British Columbia's public health-care system. While people with chronic conditions represent around 34% of the B.C. population, these individuals consume approximately 80% of the provinces' public health expenditure. With diabetes alone, one of the most common chronic diseases in the province and steadily increasing, the direct cost of providing health care services for people with complications is approximately CAD 776 million each year. By 2016, direct health care costs to treat patients with diabetes in British Columbia are forecasted to rise 78%, reaching an estimated cost of CAD 1.38 billion.

In addressing the challenges posed, the Physician Connect effort has created a value proposition for all key stakeholders. These include:

- For patients
  - Enhanced health outcomes and quality of life through early and accurate delivery of appropriate medical services.
- For family physician practices
  - ICT enables a comprehensive chronic disease management approach
  - Automated tools to support changes in care delivery, improve health care delivery
- For regional health authorities
  - Assist clinicians in delivery of chronic disease patient care
  - Metrics to support appropriate allocation of funding and resources.

Policy context and sustainability

The overall approach to chronic disease in British Columbia includes two inter-related and complementary strategies, *1)* the Framework for a Provincial Chronic Disease Prevention initiative and the *2)* Chronic Disease Management Strategy. Diabetes is the first of nine diseases to be tackled under this strategy.

The implementation plan for both strategies is based on the Expanded Chronic Care Model which was itself developed as a strategy for implementing comprehensive health system change.

These efforts, including those aimed at addressing care gaps and the rapidly increasing chronic disease trends, were sustained by the Canadian Government through the Primary Health Care Transition Fund (PHCTF).

Although British Columbia based its reform efforts on well aligned and coherent actions such as new privacy legislation, physician incentive schemes, clinical guidelines, and others, some challenges to sustainability remain. The need to accelerate HIE across the health system and integration of data within and across health authorities while maintaining their autonomy is an ongoing concern – along with a need to deal more comprehensively with patient confidentiality. A view held by many physicians was that sharing identifiable patient data among different providers raised the questions of who should be allowed access to the file.

Governance

Successful implementation was based on the development of largely positive working relationships and partnerships between NHA staff and physicians. This is evident at the local level through physician and NHA staff engagement in quality improvement initiatives and also at the Health Service Delivery Area (HSDA) and regional levels through relatively synergistic relationships between NHA administration, provincial government, and the Medical Advisory Committees.

The Massachusetts e-Health Collaborative in the United States

Key achievement

The Massachusetts e-Health Collaborative (MAeHC) successfully supported the implementation of electronic health records (EHRs) and clinical data exchange capabilities in three Massachusetts communities. The three communities have today unmatched capabilities to aggregate and analyse in real time, information on patients and provider performance. This provides the foundation for improved co-ordination and continuity of care and quality feedback loops that can more effectively guide physicians' practice and increase alignment between incentives programmes.

Determinants of success

Breaking down the financial barrier

MAeHC, funded by a non-profit payer community, Blue Cross Blue Shield of Massachusetts, provided cost-free implementation of EHRs in physicians' offices and HIEs in three pilot communities.

A close community relationship

The health ICT effort was based on extensive stakeholder consultations and took account of the varying needs and objectives of the three communities. The process emphasized local physician and community leadership to ensure participation and a co-ordinated effort.

Support was provided at all phases, from planning the implementation and redesigning the workflow, through installation and use.

MAeHC operated a full service practice support operation and assisted physicians in overcoming implementation issues, including technical and organisational problems as well as assisting in identifying a practical number of qualified vendors from the more than 200 available. The Collaborative also performed negotiations with the selected vendors for all participating communities, enabling the latter to simply choose the vendor(s) that best meet their specific needs and not have to spend time and effort in contracting, which can be problematic for most practices. Collaborative spent approximately 5% (USD 2 million) on contracting and associated legal services. Budgeting for such support was generous – typically about one-third of total expenses.

Physician leadership

The project originated with a medical professional organisation interested in promoting the quality and safety of medical care. The Collaborative called upon recognised physician leaders and experts in quality and safety to help set the agenda and facilitate the process.

Addressing privacy and security concerns

A dedicated privacy and security committee worked in conjunction with communities and consumer councils to make final determinations for privacy and security policies. A global opt-in approach was used in which patients are specifically asked to agree to as-needed electronic exchange of their clinical data between clinical sites (however, no permission is sought to have data stored in the practice's EHR); and the benefits of HIE participation were touted to encourage patient participation rather than making security a major concern.

Background and benefits

The Massachusetts e-Health Collaborative (MAeHC) was formed in 2004 as an initiative of the physician community to bring together the state‘s major health care stakeholders for the purpose of establishing an EHR system through community-based implementation that would enhance patient safety and quality of care in Massachusetts. Funded through a USD 50 million grant from Blue Cross Blue Shield of Massachusetts (BCBSMA), MAeHC launched pilot projects in three Massachusetts communities in May 2005 to demonstrate the costs and benefits of EHRs and health information exchanges (HIE).

To date, the MAeHC has successfully implemented EHRs and HIEs in the three pilot communities consisting of almost 600 physicians and over 500 000 patients. The MAeHC has:

- Provided complete no-cost EHR systems to physician practices coupled with practice management software to link all clinical and administrative practice functions in one seamless health ICT solution.
- Provided start-to-finish implementation of health ICT systems in conjunction with system vendors, as well as practice support to ensure smooth transition to the digital environment.
- Developed community-level HIEs custom built and organised around each community’s priorities, addressing the major issues surrounding patient privacy and data sharing agreements.
- Built a novel health care quality data infrastructure to collect, organise, and analyse, health care system performance.

Results to date have shown over 95% physician adoption rate of EHRs in the three pilot communities as well as patient HIE “opt-in” averaging about 90% in all three pilot communities.

Business case

In Massachusetts, a baseline survey done in the spring of 2005 found that while nearly half of the physicians were using an EHR, a figure much higher than the national average, a vast majority of small office practices still did not have EHRs, due in part to the fact that small practices are much less likely to adopt as in other parts of the country. In addition, a health reform law passed in 2006, though it had increased coverage of the uninsured, was costing more than expected creating long-term funding sustainability concerns. Legislation and state efforts highlighted health ICT as a fundamental component to not only sustainable health reform but also key to increasing quality and access to health care.

Policy context and sustainability

Coupled with over USD 30 billion injection of funding through ARRA, national health ICT efforts led by the Office of the National Coordinator for Health Information Technology within the US Department of Health and Human Services (US DHHS) is providing leadership for the development and nationwide implementation of an interoperable health information technology infrastructure to improve the quality and efficiency of health care. The funding designated for health ICT will come in two main forms. The largest portion resides in the over USD 30 billion for that the Medicaid and Medicare incentives for eligible professionals and hospital incentives are estimated to pay out over their duration. The second, smaller but significant portion will come from programmes funded out of the USD 2 billion specifically appropriated to support implementation of the health ICT initiatives other than the incentives themselves, including programmes of grants to states to support sub-national or state-wide health information exchange efforts. Governors may designate an entity within their state to receive this funding. This provides a unique opportunity to invest in maturing HIE initiatives and making them sustainable.

Recent state legislation is also supporting the advancement of health ICT in the state. Notably, Massachusetts is only one of two states (the other being Minnesota) that has a legislative mandate for the use of health ICT tools specifically, tying implementation of CPOE and EHRs to facility licensure standards for hospitals and community health centres. The Department of Public Health has been charged with adopting regulations to require implementation of CPOE by 1 October 2012 and of electronic health records by 1 October 2015. A newly created public/private institute has also been made responsible for allocating, up to USD 15 million annually for state-wide implementation of EHRs to meet the 2015 deadline.

The MAeHC's original BCBSMA funding is nearly exhausted as the community pilots draw to a close. As such the new national and state legislation supporting health ICTs has left the MAeHC ideally positioned to be eligible for funding by providing a range of health ICT implementation services. It can provide the services at two levels. Either through incentive payments to physicians for EHR implementation or through state grants as supporting a state designated HIE or other entity. To this effect, MAeHC has successfully launched a for-profit subsidiary to provide consulting services related to EHR deployment, HIE, and quality data warehousing. As with the MAeHC, the service will include start to finish implementation including strategic planning, project management, and project execution services.

Governance

The MAeHC is a public/private collaborative of providers, payers, associations, and government with physicians providing key leadership. It is further strengthened by overlapping leadership from the four major cross-institutional community collaborations in Massachusetts. The MAeHC forms a critical piece and provides the "last mile" connectivity to the physician's office. In addition, efforts by local, state, and federal officials helped bring parties together, encouraged community participation, and allayed public privacy and confidentiality concerns; as well as sponsoring legislation to promote standards and adoption of EHRs in clinical practice.

Telestroke in the Baleares (Spain)

Key achievement

The Balearic health authority (Ib-Salut) has implemented a telestroke programme which has made emergency stroke care available to the far corners of the Balearic Islands. Providing access to life saving care which was previously unavailable [tissue plasminogen activator (tPA)] within the first three hours after onset of symptoms can effectively reduce the risk of death and severe disability).

Determinants of success

Government leadership and strong political commitment to wide-spread implementation

Critical to the effective delivery of this form of acute stroke care has been Ib-Salut's overarching health information technology modernisation effort guided by the Plan Estratégic de Sistemes d'Informació (PESI) which included the development of a health system-wide EHR, radiology information system (RIS)/picture archiving and communication system (PACS), pharmacy information system, and others. The guiding vision of the plan to deliver equal access to health services regardless of patient location and providing continuity and co-ordination of care have created the foundation for telehealth as a necessity in the region given the geographic and resource divide between the islands.

Garnering stakeholder buy-in

Although the technology to build and operate a telehealth programme for stroke patients was available, stakeholders from the various hospitals and health authorities had to be convinced of the potential benefits of the programme. Evidence from the clinical research, proving the value of telestroke programmes helped build a strong health case for establishing the programme. Furthermore, the Helsingborg 2006 Declaration with Spain as a signatory has several goals for improving stroke outcomes for patients in Europe by 2015 that are relevant for what the Balearic telestroke programme hoped to accomplish.

Background and benefits

Established in 2006, the Balearic telestroke programme is addressing one of the biggest health challenges in the region. Emergency access to life saving stroke care due to the geographic divide between islands, combined with the shortage of available skilled neurologists, has not been an option for all but the patients in the Palma area.

Subsequently, the telestroke programme has bridged the geographic and skills gaps and brought stoke care to patients who would not have had the option otherwise. Currently, three hospitals outside of Palma are connected

via telestroke system and are receiving emergency stroke expertise from the lone stroke unit hospital in the region, Son Dureta in Palma. The telestroke programme has:

- Made electronic records available for all patients at the point of care as well instant access and sharing with the stroke unit experts at Son Dureta.
- Integrated picture archiving and communications system (PACS) for the management of radiological images from community hospitals.
- Provided real time remote patient assessment via the private Balearic network with merged audio, video, and data for neurologists at Son Dureta to "virtually" examine stroke patients.

Results on outcomes show that efficacy and safety of telestroke is comparable with face-to-face care. The primary outcomes were examined using a standardised approach based on a scale that grades the disability in a stroke patient. A local study shows that recovery rates three months post-stroke were virtually identical: 59% of patients treated in a face-to-face setting reached full recovery against 55% with telestroke. The use of telestroke services also seems to reduce inappropriate variations in practice.

Business case

Stroke is the leading cause of death for women and the third leading cause of death for men in the Balearic Islands. There are approximately 2 000 strokes cases annually in the Balearic Islands. Combined with an average annual cost per patient upwards of EUR 30 000 and a population of just over 1 million in the Balearic region the cost of stroke could take a heavy toll on the local economy.

Fortunately, of the stroke cases, approximately 86% are ischemic strokes and readily amenable to clot busting drugs like tPA. However, for tPA to be effective it must be administered within three hours, effectively eliminating it as an option for stroke patients outside of Palma. As such, the telestroke programme now not only offers increased access to life saving stroke care but also the potential to reduce the socioeconomic costs from lack of treatment.

Policy context and sustainability

Stroke is one of the leading causes of death and disability in Europe. As the population in Europe ages, the burden of the disease on society will increase. In a united front with other European nations, Spain adopted the Helsingborg Declaration on European Stroke Strategies in 2006, which is a

statement of the overall aims and goals of stroke management agreed upon by the WHO to be achieved by 2015. Of the several goals, goal two, management of acute stroke, is especially relevant to the telestroke programme and targets:

- More than 85% of stroke patients survive the first month after stroke.
- More than 70% of survivors are independent in their activities of daily living by three months after the onset of stroke.
- All patients with acute stroke who are potentially eligible for acute specific treatment are transferred to hospitals where there is the technical capacity and expertise to administer such treatment.

Further, in line with the Helsingborg Declaration, Spain in 2008 also developed its own strategy, the Stroke Strategy of the National Health System. It has outlined a series of objectives and recommendations aimed at improving stroke prevention and treatment along with rehabilitation, enhanced training for physicians, and the expansion of stroke research efforts. Subsequently, the Helsingborg Declaration and the national stroke strategy, form the strategic basis for development of the Balearic telestroke programme. The central aim of which, is to use telemedicine to establish a network that makes it possible to bring timely stroke expertise to underserved areas to:

- Assist community hospitals.
- Avoid unnecessary transfers.
- Extend tPA administration.
- Provide equal access to care.
- Provide home care based stroke rehabilitation.

Given the stated policy goals, it is clear that the telestroke programme is fulfilling major objectives, all with nominal costs for the programme of less than EUR 100 000. Combined with the much improved patient access, prospects of major socioeconomic cost savings, and increased equity of care have cleared a path for long term sustainability of the programme.

Governance

The telestroke programme is under the purview of Ib-Salut and is fully funded and supported as part of the broader health care mission of the authority. Ib-Salut has further played a key role in designing, developing, and operating the underlying infrastructure that has enabled the programme to work. Central to the programme, Ib-Salut's Hospital Son Dureta in Palma,

with the region's only specialised stroke unit, serves today as the "hub" with connections to the smaller hospitals in the other islands. Combined with stroke care training for clinicians, adherence to stroke treatment protocols, and a multidisciplinary approach, the community hospitals on the other islands have effectively become primary stroke units forming the "spokes" to the Ib-Salut stroke care network.

E-prescription in Sweden

Key achievement

A national e-prescription system has been deployed connecting all of the pharmacies in the country to a majority of primary care physicians. Convenience, enhanced security in the dispensing process, and time-savings are the features most appreciated by users today.

Determinants of success

Apoteket's monopoly position and state-ownership

Apoteket has occupied until 2009 a monopoly position as Sweden's only retailer of prescription and over-the-counter (OTC) medicinal products. This state-owned, not-for-profit organisation offered medication to all Swedish citizens through its network of about 900 outlets nationwide, including both full-scale pharmacies and local village shops in more remote areas. State-ownership, combined with the monopoly status significantly facilitated the decision and implementation processes.

Early adopters within an innovation-friendly environment

Swedish pharmacists had been experimenting with e-prescription since 1981, based on the hypothesis that e-prescription could be the first step in automating the physician's office; the collaboration resulted in the first ever electronic transfer of a prescription (ETP). This occurred in 1983 between a doctor's office at a medical clinic and a nearby outpatient pharmacy. Apart from achieving the world's first ETP, the researchers had anticipated a shift in technology that was occurring at the time: a move away from mainframe computing to desktop PCs. Combined with continued research and live implementations throughout the 1980s and 1990s, Sweden has accumulated almost 30 years of e-prescription experience and developed a wealth of knowledge and a solid information base. Swedish authorities have successfully leveraged this to quickly ramp up efforts in expanding and rolling out their current e-prescription system nationally.

A secure national network

The Swedish Health Care Network (Sjunet) operating since 1998 connects virtually all Swedish hospitals and primary care centers as well as some national authorities and vendors who are connected to Sjunet and use it both for telemedicine and administrative communication. The network infrastructure allows secure communication and distribution of patient data, pictures, medical applications and services for which the Internet is not acceptable. Subsequently, in 2001 when the first large scale e-prescription implementation effort began in Stockholm county, the vital communication link between physicians and pharmacies was already in place. As a result, technical implementation of e-prescription was focused largely on designing, developing, and deploying the e-prescription applications on either end of the Sjunet, at the providers and pharmacies. In part, helping to speed the deployment, as the secure interconnecting infrastructure was already in place.

Close co-operation between all stakeholders

Apoteket's implementation strategy emphasized the partnering with local health regions (County Councils), physicians, and other local stakeholders. To achieve this, Apoteket formed implementation teams in each county across the country. These teams led by dedicated local project managers at the health care providers and pharmacies provided the necessary relationship management, consensus building, technical support, and training. The start to finish local implementation approach created the necessary stakeholder relationships, bonds, and buy-in that are essential to any technology project. Furthermore, patient outreach and education organised entire communities around the value and convenience of e-prescriptions. In effect, creating and cultivating a consumer demand.

Background and benefits

The first Swedish efforts in e-prescription date back to 1981 with a national working party, in collaboration with the county hospital in Jönköping. At the time e-prescribing was envisioned as the start of a transformation with several lines of e-development for the physician's office: appointment planning, health care records, prescribing, information retrieval, and prescriptions with adverse drug event reporting. Several pilot projects later, e-prescribing has finally taken off. Today the majority of new prescriptions are now transferred electronically. The e-prescription programme has:

- Made e-prescription services available virtually throughout the country.
- Deployed a national e-prescription mailbox allowing patients to store all their prescription drug information.
- Enabled patients to pick up their medications from any one of the 900 Apoteket pharmacy locations in the country.
- Improved patient drug information for physicians.

By May 2008 over 75% of all e-prescription were sent electronically from the doctor's offices to pharmacies. More than 2 million electronic prescriptions were transmitted during the single month of January in 2009. Penetration across counties ranges from 51% to 92%. E-prescription has led to a reduction in phone calls and has contributed to a 30 minutes per day time savings for both physicians and pharmacists.

Business case

The key driver for the e-prescription effort was to increase the efficiency and convenience of the entire medication prescription and dispensation

process. The traditional paper prescriptions required over a dozen daily clarifications between individual pharmacists and physicians due to illegibility, unclear short hand, and potential drug interactions. Paper prescriptions also were an inconvenience to patients. Prescriptions and medication lists were often lost or not remembered in addition to often lengthy waits to first drop off prescriptions at a pharmacy then having to return or wait to pick up the medication.

Subsequently, the introduction of e-prescription has decreased the call backs and clarifications to the physician by pharmacists. Patients have shorter pharmacy wait times, as prescriptions are electronically submitted to pharmacies and can be picked up more quickly at a choice of pharmacy locations throughout the country without having to first drop off the prescription. In addition, patients have ready Web access to their entire medication lists as prescribed and can be easily printed in preparation for physician consultations.

Policy context and sustainability

Although various e-prescription pilots had been ongoing in Sweden since the 1980s, there was no large scale adoption across the country. It was not until the late 1990s that e-prescriptions really began to take hold and spread. This was due in large part to:

- New legislation allowing national databases, independent of reimbursement form, but with high degree of patient consent and transparency.
- The elevation of e-health as a political priority.
- Low degree of detailed regulations, giving high responsibility to stakeholders, beneficial for the entrepreneurial development of the new technology.

Furthermore, in support of better aligning laws and regulations to technology advances, as well as outlining the national vision for e-health, Swedish authorities released their first National e-Health Strategy targeting six action areas. Critical to these action areas, e-prescription has been highlighted as a key "strategic puzzle piece in the context of future handling of national medicinal data". The strategy specifically notes that this is mainly because the service clearly affords advantages and benefits for all parties concerned. An efficient e-prescription support system and effective procedures for prescribing, dispensing and distributing medicines offers direct, positive benefits for patients and care professionals alike.

To this effect the e-prescription programme has accomplished the major goals. However, there are some lingering challenges that must be addressed if the full benefits of e-prescription are to be realised. These include:

- Legal misalignment with technological capabilities. For example, physicians are not allowed to view the entire prescribed medication list-resulting in low physician use of the national database.
- Clinical decision support has not been developed and implemented yet, limiting patient safety gains.
- Many physicians' systems are not compliant with required privacy and security measures to allow access to certain national databases, *e.g.* National Pharmacy Register.
- Progress in hospital deployment has been limited due to competing interests of physicians and hospital administrators.

Governance

The government owned Swedish pharmacy monopoly, Apoteket AB, initiated and implemented the national e-prescription effort in conjunction with local authorities in each county. The effects of the Swedish Government's recent decision to deregulate the pharmaceutical market and the breakup of the Apoteket monopoly are anticipated to have an impact on retail drug distribution. However, ICT policies and e-prescription will continue largely intact with the formation of a new company, Apoteket Services which will continue to maintain and operate the national e-prescription programme and related infrastructure.

Implementation of a Patient Summary Record System in Twente (the Netherlands)

Key achievement

The pilot project established the foundations for the electronic transfer of patient health information between family doctors and "locum GP's" in out-of-hours health centres, therefore enhancing care co-ordination and patient safety.

Determinants of success

Driven by a robust business case and evaluation framework

To improve the likelihood of adoption by physician and set up an appropriate implementation strategy, the Dutch Ministry of Health, Welfare and Sport commissioned an evaluation prior to the implementation of the pilot. Three key questions drove the evaluation:

- What activities are necessary for the introduction of the electronic patient summary?
- What investments are necessary and what costs will be incurred by physicians?
- What are the expected benefits?

The results were used to decide between specific implementation approaches or strategies, as well as system components.

Support and training was provided at all stages of the pilot

Financial support, education and training were integral components of the implementation strategy. A handbook and other material was developed to aid physicians the "Handboek invoering EMD/WDH" (Handbook for the Introduction of the EMD/WDH) (EMD stands for Electronic Medication Record).

Robust privacy and security frameworks

In the Netherlands individuals are able to exercise, to a significant degree, control over their health information. They can totally opt out of participating in the electronic exchange of their health information (in which case it is not recorded in any registry and cannot be accessed in an emergency). They can also request the provider to conceal or mask discrete data items in their medical record by withholding authorisation or by requesting the masking or concealing of specific information at the local level.

The government has introduced a unique identifier for all healthcare practitioners: the UZI card, which is the Unique Healthcare Practitioner ID. The UZI card can be used to ascertain who has sent or called up information. In addition, a healthcare practitioner can use the card to encrypt information. With the UZI card the healthcare practitioner can add an electronic signature to a prescription, a letter of referral or a contract. The government has

also introduced a national unique patient identifier: the Citizen Service Number (known in Dutch as BSN). The identifier is identical to the "social security number". This number does not provide any information and vest any right. Since June 2009 healthcare practitioners are required to use UPIs when they exchange patient information related to clinical care and administrative processes.

Close co-operation with vendors

A great deal of effort and co-ordination went into the "front end" identification of technical requirements for interoperability and to assess ways for overcoming problems with pre-existing legacy systems.

In the Netherlands, the decision to launch the national EMD/WDH programme began with a proof of concept (POC) in which the various components of the planned national health care information system were tested.

ICT suppliers were invited to take part in the POC and were financially reimbursed for their participation. The POC process acted as a needs assessment process and helped identify "gaps", technical and information needs requiring additional effort and/or investment in research, development, testing, and evaluation.

Legislation

Recent legislation currently in the process of being enacted makes it mandatory for all health care providers to connect to the National Switch Point (LSP). Thus, ensuring that all care providers are electronically exchanging patient information.

Background and benefits

The focus of the case study is the 2008 pilot implementation in the Twente region of the electronic patient summary record to be shared between family doctors and GP's in after-hours walk-in-centres. This project represents a first step in the implementation of a virtual national electronic health records system (EHR). The programme is co-ordinated by the NICTIZ (the Dutch National IT Institute for Healthcare), an independent organisation composed of governmental and private organisations.

The government has opted to deploy the EHR gradually, starting with the launch of an electronic medication record (EMD) and a patient summary record (WDH) for the locum GPs who are in service after hours. Many other applications are in the pipeline. These applications are being tested in pilot sites since 2007. The WDH provides the out-of-hours GP and allied health professionals with a summary of the patient's history which can assist doctors in providing both effective patient triage and clinical care. The patient records are only temporarily accessible to the out-of-hours centre, which can, on the other hand, provide feedback to the regular GP in the form of an electronic report.

It appears that the availability of patient information, at least from the viewpoint of physicians in walk-in clinics is considered very useful. The quality of the information recorded depends partly on the records being kept in accordance with the ADEMD guidelines (Dutch College of General Practitioners guideline for the "Adequate Management of the Electronic Medication Record").

All healthcare providers – GPs and assistants at out-of-hours centres – have at some stage in the past taken one or more ADEMD courses. However, the degree to which medical records comply with the ADEMD guidelines still varies significantly since according to many physicians compliance with the guidelines is time-consuming.

Business case

Policy makers and patients worry increasingly about access to and the quality and safety of care provided after hours, especially in urgent situations. Although walk in centres are not designed to provide the high level of care provided by GPs for people with serious or complex health problems, they need to link closely with GPs to ensure continuity of patient care. The "Spoed moet Goed" report shows that each walk in centre spends EUR 160 000 on unnecessary tests and treatments because of the lack of adequate information on the patient. The patient summary is meant to address this problem, at least to some degree.

Until recently, most after-hours primary care in the Netherlands was delivered by collaborating practices via local call schedules. In a very short time (between 2000 and 2003), the landscape of after-hours care changed almost completely. Almost all GPs in the Netherlands now participate in large-scale, after-hours, primary care co-operatives. After-hours care in the Netherlands is defined as care delivered from 5 p.m. to 8 a.m. on weekdays and from 5 p.m. on Friday to 8 a.m. on Monday. There are about 120 of these co-operatives with generally 40-120 family physicians taking care of populations of 50 000-500 000. The work of locum GPs is demanding because of patients with a wide range of problems and needs and of the urgency of many problems. This can easily lead to physician stress and organisational problems, which the implementation of the patient summary record should help prevent or, at a minimum, reduce.

Policy context and sustainability

In the Netherlands, 97% of the GPs are computerised and use a patient management system. Almost all use their system to record clinical notes during their consultation with a patient. Twente had already successfully

implemented a regional service that allowed electronic communication between GPs and other local healthcare providers.

An important contributor to the introduction of EMRs in GP practices has been the agreement reached in the fall of 1991, between the National Association of General Practitioners and the government on an incentives package to promote the purchase of computers and the use of electronic medical records. This package included an extra per capita fee for each patient registered with the public fund and a moderate increase in the fee for service for each private patient if the GP used a computer. Together, these incentives represented an EUR 8.000 average increase in a physician's annual remuneration. To qualify, the general practitioner had to: *1)* use an information system tested and approved by professional associations; *2)* implement a patient management system within two years from the purchase of a computer; and, *3)* participate in data collection and reporting. In addition, until 2008, physicians could also receive an additional 25 cent quarterly/patient if participating in electronic claims processing. The incentives programme was terminated in 2006. Physicians can, however, still qualify for extra allowances for caring for elderly patients and those living in low-income districts, as well as for participating in health care innovation, such as programmatic care for patients with chronic illnesses.

Implementation and use of the patient summary record may not be cost-effective in every situation. An evaluation sponsored by the Dutch Ministry of Health, Welfare and Sport in 2007, described two major implementation models: traditional in-office installation of software/hardware and installation through an external application service provider (ASP). For practices that have a contract with an ASP the introduction of the WDH pays for itself within five years. General practices which operate their own system, run the risk of a loss. A migration to an ASP was, therefore, recommended.

Use of the WDH, however, requires the physician to spend time on fulfilling a number of privacy and security requirements and to keep records in accordance with the ADEMD guidelines. All these tasks are considered important by physicians, but they are also perceived as very time-consuming. In the absence of appropriate compensation for the time spent in these activities or additional incentives, this may affect the rate of participation and the sustainability of the programme.

Governance

Implementation of the national electronic health record is co-ordinated by the National IT Institute for Healthcare (NICTIZ). NICTIZ is a foundation that was set up by a range of associations representing all relevant health care and IT sector stakeholders and also serves as an

independent expert organisation providing guidance on infrastructure and standards related to the national EHR effort. It is funded by the Ministry of Health, Welfare and Sport.

The national information system is based on a central "locator service", the Landelijk SchakelPunt or National Switch Point (LSP), which went live in 2006. Under this system, clinical data will be maintained locally, *i.e.* in the databases of the health care provider or regional databases and will be accessed through the central search engine which can locate and extract the data from local databases. The LSP cannot store patient histories, and doctors' systems will not be able to store records retrieved by LSP. To retrieve data, LSP keeps an index of specific patient information kept by each healthcare practitioner. It also maintains a log of who accesses what information, and when. Doctors can only see information pertinent to their patient population and for which they have permission of access. In this way, the LSP enables a level of accessibility usually found in centralised systems, yet achieves greater security and cost savings through decentralisation.

Annex B. Project background and methodology

This report builds on activities carried out under two distinct but overlapping work streams. Activity on work stream 1 has focused on collecting information on how OECD countries are monitoring health ICTs, specifically on surveys or data collections that are considered useful from a policy perspective and the most common indicators used today.

On work stream 2, the project has proceeded in several phases. First, a scoping paper was commissioned to review the strength of the available evidence on the impacts of ICTs on productivity and efficiency in the health sector. In addition, an expert workshop was organised in April 2007 to take stock of progress in health ICT applications, discuss factors that promote or impede implementation and adoption, and consider how the work could best be carried out. Given the dearth of data, the workshop concluded that implementation of case studies would be the most promising approach.

A group of OECD experts in health information technology was established to help guide the work, the development of a framework for the selection and analysis of case studies and interpretation of results. The group included expert delegations from 18 OECD member countries, the Business Industry Advisory Committee to the OECD, the European Commission and the World Health Organisation. The group met three times during the project.

Methodology used

Case studies were implemented through semi-structured expert interviews at country level. The number of interviews conducted was determined together with experts of the host country and by an assessment of the characteristics of the proposed case studies, including the variables under investigation, and the need to ensure the validity and reliability of findings.

The following individuals were interviewed for each case study:

- Person(s) responsible for the development, implementation and evaluation of the programme/project which the case study addresses. These included contacts for the policy/programme aspect, as well as at the project level.
- Person(s) who had privileged access to information about the case study, the people involved in the decision process.
- Person(s) who had been/are the target of the programme/project and had views to share on implementation, adoption and use. These are "users" *e.g.* physicians, and other health professionals.

The case studies were analysed and reviewed against the distinctive features of the participating countries' health care systems and other relevant contextual information. This information was necessary to understand the similarities and differences of ICT approaches, along with the potential benefits and drawbacks of policies and frameworks affecting the structure, design, implementation and outcomes of the different programmes and projects.

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OECD Health Policy Studies

Improving Health Sector Efficiency

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Despite the promise they hold out, implementing information and communication technologies (ICTs) in clinical care has proven to be a very difficult undertaking. More than a decade of efforts provide a picture of significant public investments, resulting in both notable successes and some highly publicised costly delays and failures. This has been accompanied by a failure to achieve widespread understanding among the general public and the medical profession of the benefits of electronic record keeping and information exchange.

With consistent cross-country information on these issues largely absent, the OECD has used lessons learned from case studies in Australia, Canada, the Netherlands, Spain, Sweden and the United States to identify the opportunities offered by ICTs and to analyse under what conditions these technologies are most likely to result in efficiency and quality-of-care improvements. The findings highlight a number of practices or approaches that could usefully be employed in efforts to improve and accelerate the adoption and use of these technologies.

Further reading

Health at a Glance 2009: OECD Indicators
Pharmaceutical Pricing Policies in a Global Market
Achieving Better Value for Money in Health Care

The full text of this book is available on line via these links:
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