CHAPTER 1.7

Better Measurements for Realizing the Full Potential of Health Information Technologies

ELETTRA RONCHI, Organisation for Economic Co-operation and Development
JULIA ADLER-MILSTEIN, University of Michigan
GENNA R. COHEN, University of Michigan
LAURA P. WINN, Harvard School of Public Health
ASHISH K. JHA, Harvard School of Public Health

Understanding the challenges to the adoption and effective use of information and communication technologies (ICTs) in health systems, along with their broader economic impacts, is critical to achieving their widespread penetration and to realizing the potential benefits to be had from their application. Today, ICT sophistication and the range of possible uses in the health sector are enormous. There is strong evidence that ICT implementation, when done effectively, can result in healthcare that is higher quality, safer, and more responsive to patients' needs as well as more efficient (appropriate, available, and less wasteful). Advocates point to the potential reduction in medication errors in particular as a critical advantage. There is also growing evidence that health ICTs are essential to support the development of new, innovative models of care delivery.[1]

In addition to these health-related objectives, most governments in the Organisation for Ecoomic Co-operation and Development (OECD) countries recognize that health ICTs represent new and significant opportunities for economic growth. The global market for health ICT products and services is estimated at US$96 billion and growing.[2] In Europe, this sector includes a number of large European-based companies as well as an estimated 5,000 small- and medium-sized enterprises (SMEs) operating in various subsectors of e-health. E-health is considered one of the six most promising lead markets of the European Union.[3] Greater adoption of health ICTs is, therefore, projected to increase the demand for developers and skilled workers to implement, support, and use these technologies.

Despite their tremendous promise, incorporating ICTs into daily use in healthcare has proven difficult. More than two decades of effort across OECD countries provides a picture of significant public investments, notable successes, and also highly publicized delays and failures.[4] This outcome highlights the large gap between what is possible and where we are now, with little known about how to fully leverage ICTs to improve the health and wellness of the population. Data on successful adoption and use across countries are therefore an essential learning tool for policy development in this area.[5]

This chapter briefly reviews OECD countries' efforts to implement ICTs in healthcare systems and includes current perspectives on the state of implementation and benefits that can be realized. It then highlights areas where countries are finding it useful to share information and develop actionable indicators to monitor

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progress through international comparisons. The chapter concludes with a discussion on the process the OECD is now following to develop new measures to facilitate international comparisons in the context of their markedly different healthcare systems.

A GROWING IMPERATIVE: DOING MORE WITH LESS

Policymakers in OECD countries are faced with ever-increasing demands to make health systems more responsive to the patients they serve, to improve the quality of care, and to address disparities in health and in access to care. There is broad consensus that today's healthcare systems are not able to deliver the high-quality care that patients and providers want at a cost that countries can afford. Therefore, there is an urgent need to improve care and increase efficiency simultaneously.

Health is one of the largest areas of public expenditure in OECD countries, and forecasts show health spending continuing to climb for the foreseeable future.[6] From 1990 through 2010, an increasing share of the gross domestic product (GDP) of OECD countries has been devoted to the provision of healthcare. On average, total healthcare spending represented about 9.5 percent of GDP by 2010 (Figure 1)—up from just over 5 percent in 1970 and around 7 percent in 1990. In Japan, the share of spending allocated to health has increased substantially in recent years, to 9.5 percent (up from 7.6 percent in 2000), and is now equal to the OECD average. While the rate of increase in health spending has slowed in the period 2003–08, health expenditure growth has still exceeded economic growth in almost all OECD countries in the past 15 years.

Factors exerting upward pressure on health spending—such as demographic change, chronic diseases, and new technological advancements—will continue to drive health spending higher. According to OECD projections, public health spending could increase by between 50 percent and 90 percent by 2050. The message is simple yet urgent: the sustainability and affordability of health systems is a challenge that must be addressed.

Governments have a wide range of policy tools available to control the escalation of costs. "Command-and-control" policies can hold expenditures down in the short term, but they often have unintended consequences in the long term. In addition, such policies do little or nothing to moderate the underlying pressures that will continue to push health spending up.[7]

There are other promising avenues for controlling health spending in the longer term. For example, improving the quality of healthcare, increasing patient safety, and coordinating care across healthcare settings can all assist in controlling costs. Shifting care out of expensive, acute care settings and into the community and the home has also gained greater prominence as the prevalence of chronic diseases (and often multiple chronic diseases) increases with aging populations. Recent evidence suggests that ICTs can play a critical role in achieving this set of goals. To reap the potential gains of ICTs, however, requires careful planning, significant upfront investments, and collaboration across a wide range of stakeholders. Thus many countries face a dilemma: short-term and long-term policy priorities may point in different directions. Without solid evidence on which to base decisions, spending on ICTs for health has become a matter of opinion and often a political gamble. Policymakers therefore seek a clearer view of the "theory of the case"—that is, better evidence on why they should support widespread use of ICTs in healthcare and how best to do this.

WHAT ICTs CAN (AND CANNOT) DO FOR HEALTHCARE SYSTEMS

A more comprehensive use of ICTs can benefit healthcare systems in numerous ways. This section examines how expanded and better use of ICTs can contribute to job creation; help reduce healthcare spending; improve the safety of healthcare; and make shared, intelligible data a foundation for healthcare delivery innovation.

Promote new sources of growth and job creation

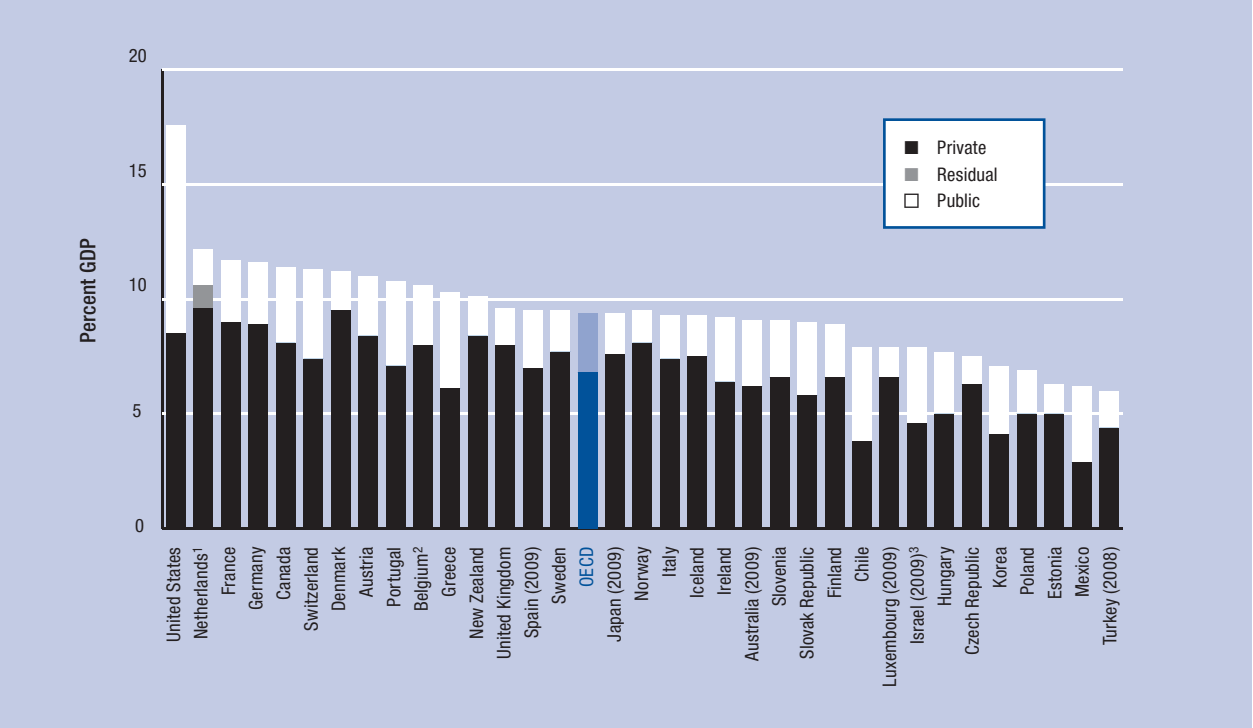
The health and social sectors employ a large and growing number of people in OECD countries and are projected to be one of the largest sources of job growth in the coming years. Employment in these sectors grew by 2.8 percent per year in nearly all OECD countries between 1995 and 2009—twice as fast as the total civilian employment growth rate of 1.3 percent (Figure 2).

Across OECD countries, the recent economic crisis has impacted the health and social sectors much less than other parts of the economy. Employment in these sectors continued to increase in 2008 and 2009, at a time when total civilian employment remained flat or even declined as economies entered into recession. In Ireland, for instance, employment in the health and social sectors grew by 3 percent from 2008 to 2009, while total employment fell by 8 percent.[8]

This trend is expected to continue and will probably accelerate in the next few years. The increased demand for workers in this area will stem largely from an aging population that requires care at home, at nursing care facilities, and in inpatient and outpatient settings.

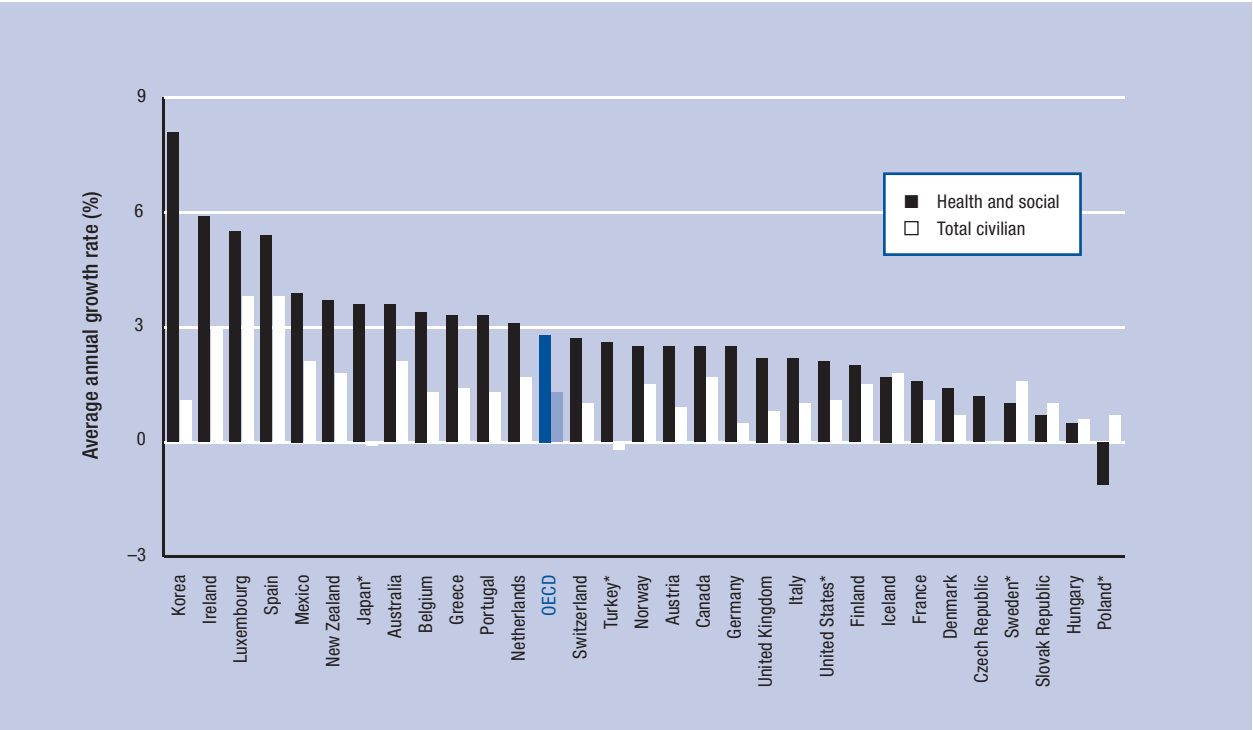
The field of health information technology (IT) is set to contribute to this growth in several ways. First, greater adoption will stimulate demand for jobs that directly support the development of the new platforms and applications, their implementation, and their upkeep. It will also change the way physicians and nurses work, potentially creating new jobs for healthcare

Figure 1: Health expenditure as a share of GDP, OECD countries (2010)



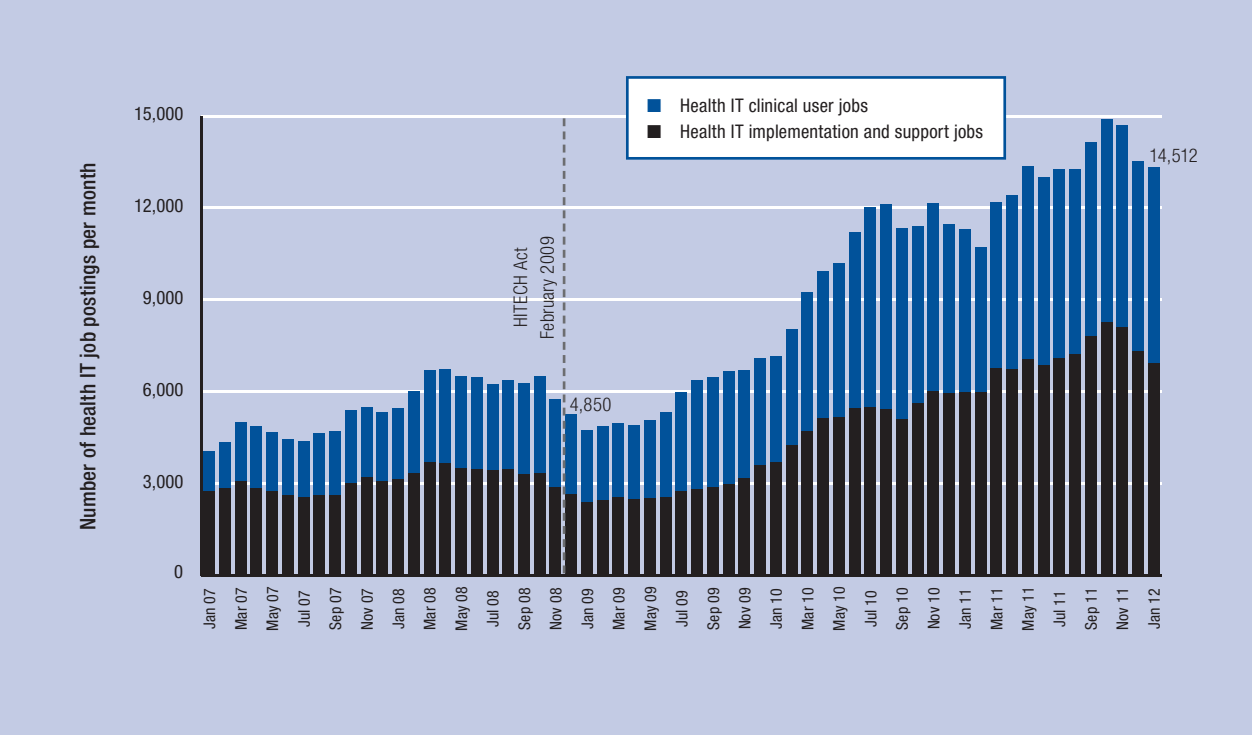
Source: OECD, 2012.
Notes: Data are for 2010 for all countries except Spain, Japan, Australia, Luxembourg, and Israel, which are for 2009.
1. In the Netherlands, it is not possible to distinguish clearly the public and private share for the part of health expenditures related to investments.
2. Total expenditure excluding investments.
3. Information on data for Israel is available at http://dx.doi.org/10.1787/888932315602/.

Figure 2. Employment growth rate in the health and social sectors compared with all sectors in the economy, 1995–2009 or nearest year



Source: OECD *Health at a Glance,* 2011.
* Data are the average of 1995–2009 or nearest year, with the following exceptions: Japan (2003–09), Turkey (2000–09), the United States (2003–08), Sweden (2003–08), and Poland (2000–07).

Figure 3: Online health IT job postings per month in the United States, 2007–12



Source: Furukawa et al., 2012.
Note: Data are based on the three-month moving average.

personnel who can use newly available data to identify opportunities to improve performance. The movement toward accountable care and larger, integrated delivery systems—a movement facilitated by a greater use of ICTs—is spurring investment in data, analytics, and care management platforms in many OECD countries.

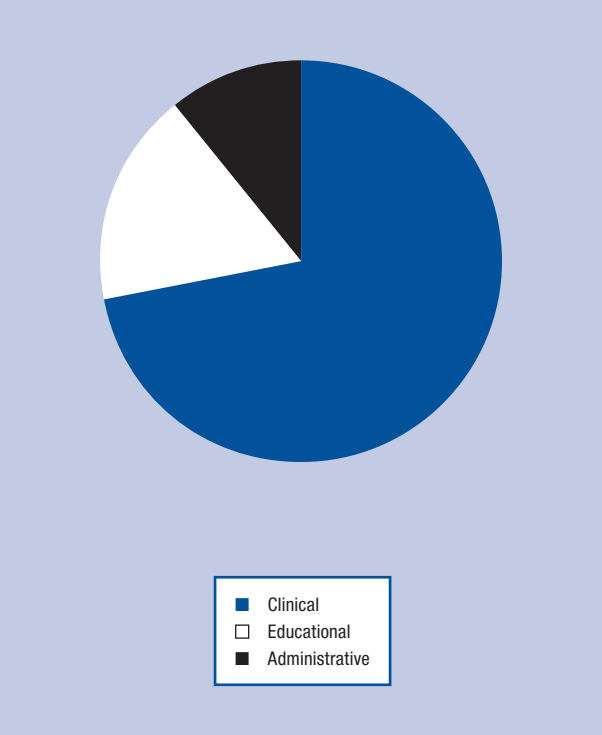
In the United States, the Healthcare Information Technology for Economic and Clinical Health Act (HITECH) provisions of the 2009 American Recovery and Reinvestment Act (ARRA)—which promoted "meaningful use" criteria and increased investments in health ICTs—have set the conditions for employment growth in this sector.[9] The number of online health IT job postings per month in the United States has increased by 199 percent since the passage of HITECH, growing from 4,850 in February 2009 to 14,512 health IT jobs in February 2012 (Figure 3). A study of actual employment found that more than 50,000 health IT jobs have been created between 2007 and 2011.[10] According to the US Bureau of Labor Statistics, employment of medical records and health information technicians is expected to increase by 21 percent from 2010 to 2020, faster than the average for all other occupations.[11]

Efficiency gains and cost reduction

In addition to its impact on economic growth, the introduction of ICTs could improve the value created in the health sector.[12] Specifically, ICT use is expected to lead to efficiency gains and cost reduction. The most frequently cited positive effects are generally attributed to a reduced utilization of unnecessary healthcare services. More effective information sharing, such as the rapid electronic delivery of hospital discharge reports to general practitioners and the use of computerized provider order entry (CPOE) systems, can reduce the use of redundant laboratory and radiology tests—sometimes by as much as 24 percent.[13] Clinical decision support features can influence prescribing behavior and can save money by informing physicians of the comparative effectiveness of alternative medical treatments. The use of picture archiving and communications systems (PACS) to acquire, store, retrieve, present, and distribute digital medical images can lead to a lower total number of x-rays, improved turnaround time, and some cost savings. In British Columbia, where PACS have been widely adopted, 87 percent of radiologists reported improvements in their reporting and consultation efficiency, and 93.6 percent indicated it had reduced the time spent locating radiological examinations for reviews.[14]

Other positive effects are expected to derive from greater efficiency in administrative processes, such as billing. A 2010 OECD report highlights the substantial administrative cost savings that can be found by introducing electronic claims processing through the New England Healthcare Electronic Data Interchange Network (NEHEN). Claims that cost US$5.00 to submit in labor costs per paper transaction were processed electronically at 15 cents per transaction after the introduction of NEHEN. In the Republic of Korea, all

Figure 4: Telehealth sessions in Canada, 2010



Source: Based on Canada Health Infoway et al., 2011.

hospital bill requests are completed through an electronic data interchange system implemented in 2003.[15] Each year, the Health Insurance Review and Assessment Service (HIRA) manages a flow of nearly 1.2 billion cases of hospital bill requests. In 2010, the number of claims was 1.3 billion. All the data are transferred and stored in HIRA's medical information system, which boasts the world's largest capacity and can store up to 210 terabytes of information. With 1,751 staff assigned to the review process, HIRA is able to process over 40 percent of these bills electronically. HIRA is planning to increase electronic review in the next four years to 65 percent in order to maximize efficiency and simplify the process.

The 2007 Commonwealth Fund report, *Bending the Curve,*[16] put the potential of aggregate system-wide savings of promoting health IT in the United States at US$88 billion over 10 years. The authors estimated that the cost reductions would result from a lower rate of medical errors, more efficient use of diagnostic testing, more effective drug utilization, and decreased provider costs, among other improvements. Additional savings would likely flow from better care coordination among multiple providers—and improved chronic care management—that would lead to both a decrease in provider time utilization and better health outcomes.

Improved healthcare delivery

Electronic health records (EHRs) can improve the quality and responsiveness of care by enabling timely access and better transmission of patient medical information across the healthcare continuum. The effective use of EHRs can also facilitate the evaluation of healthcare interventions and their quality at the practice level, clinical research and effective public health planning, and can be used to provide the information needed for incentive programs, such as pay-for-performance programs.

The potential of ICT applications to improve healthcare delivery extends, however, well beyond EHRs. Telehealth, for example, is increasingly viewed as an important tool for optimizing continuity in care and improving access to health services, particularly in rural and remote areas where healthcare resources and expertise are often scarce or even nonexistent. The introduction of telehealth in Canada has enabled assessments of patients in rural areas closer to home.

A recent study commissioned by Canada Health Infoway showed that, as of the end of the 2009–10 fiscal year, Canada had 5,710 telehealth systems in place in at least 1,175 communities.[17] Many of these systems serviced the 21 percent of the Canadian population who live in rural or remote areas. There were nearly 260,000 instances of telehealth use in Canada in 2010, of which over 70 percent were for clinical consultations (Figure 4).

Mobile health applications increasingly provide unique and unprecedented opportunities for empowering patients and for meeting the growing needs of aging populations. Advocates of patient-centered healthcare have long argued that individuals should be able to take responsibility for their own health. The argument today applies widely to the management of chronic diseases such as diabetes and obesity, where health systems increasingly see their roles mainly as agents of support. To the extent that individuals are the best judges of their own welfare, the chances of the success of any care or prevention program will depend on patient engagement and meaningful co-ownership and co-production of healthy behaviors. Health ICTs to support self-management (such as personally controlled health records, mobile health applications, and social networks) have an important (and growing) role to play in addressing the "information asymmetry" between healthcare providers and consumers/patients, thus allowing individuals to participate more actively in making better-informed decisions about their own healthcare.

Reduced medical errors and improved patient safety

Under the right conditions, health ICTs can reduce medical errors.[18] Medication errors, in particular, account for a significant number of additional hospital admissions and consultations in primary care. Three types of medical errors are common: errors caused by forgetfulness or inattention on the part of both doctor

Box 1: Impact of Computerized Physician Order Entry (CPOE) on medication error prevention

The Brigham and Women's Hospital, an academic tertiary-care hospital with approximately 700 beds in Boston, conducted a study in 1999 of the impact of CPOE on medication errors. All patients admitted to three medical units were studied for seven- to ten-week periods in four different years. The baseline period of the first year was before implementation of CPOE, and the remaining three periods occurred after the implementation of increasingly sophisticated CPOE. The study found that:

- Non-missed-dose medication error rate fell 81 percent, from 142 per 1,000 patient days in the baseline period to 26.6 per 1,000 patient days in the final period.
- Non-intercepted serious medication errors (those with the potential to cause injury) fell 86 percent from the baseline to period 3, the final period.
- Large differences were seen for all main types of medication errors: dose errors, frequency errors, route errors, substitution errors, and allergies.

Source: 1 Bates et al. 1999.

Box 2: Chronic disease management toolkit in British Columbia, Canada

In 2002, the Health Department of British Columbia identified problems with the management of chronic diseases. A study of 20,000 patients with diabetes between 1996 and 2001 showed that no more than 50 percent of diabetes patients received all of the series of services and tests recommended in clinical practice guidelines (for example, having their blood sugar monitored through HbA1c), no matter how many times they saw their doctor.

British Columbia developed a chronic disease management (CDM) toolkit, a web-based information system for diabetes and congestive heart failure. CDM incorporates clinical practice guidelines into flow sheets and includes other features that allow health professionals to monitor care for chronic disease. Between 2002 and 2005—that is, within the first three years of implementation of the CDM toolkit—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.

Sources: Krueger 2006; OECD 2010a.

and patient, errors of judgment or planning (rule-based errors), and errors resulting from a lack of knowledge. These errors can lead to adverse drug reactions, which is one of the leading causes of death in the United States (it is estimated to be between the 4th and the 6th highest cause).[19] ICTs can prevent medication errors by making it easier for healthcare professionals to acquire and share information. With electronic drug prescriptions (e-prescribing), an expert system can be integrated to check for adverse drug reactions (ADRs). Such a system flags possible ADRs for patients taking multiple drugs. It also generally contains patient-specific information on the history of reactions—such as allergies to penicillin or sulfa drugs—and provides a warning if these drugs are being prescribed. Studies have shown that ICT systems (including e-prescribing) reduce medication errors and decrease adverse drug reactions.[20] The Cochrane Review has shown that electronic prescribing improves quality (Box 1), but is equivocal on its cost-effectiveness.[21]

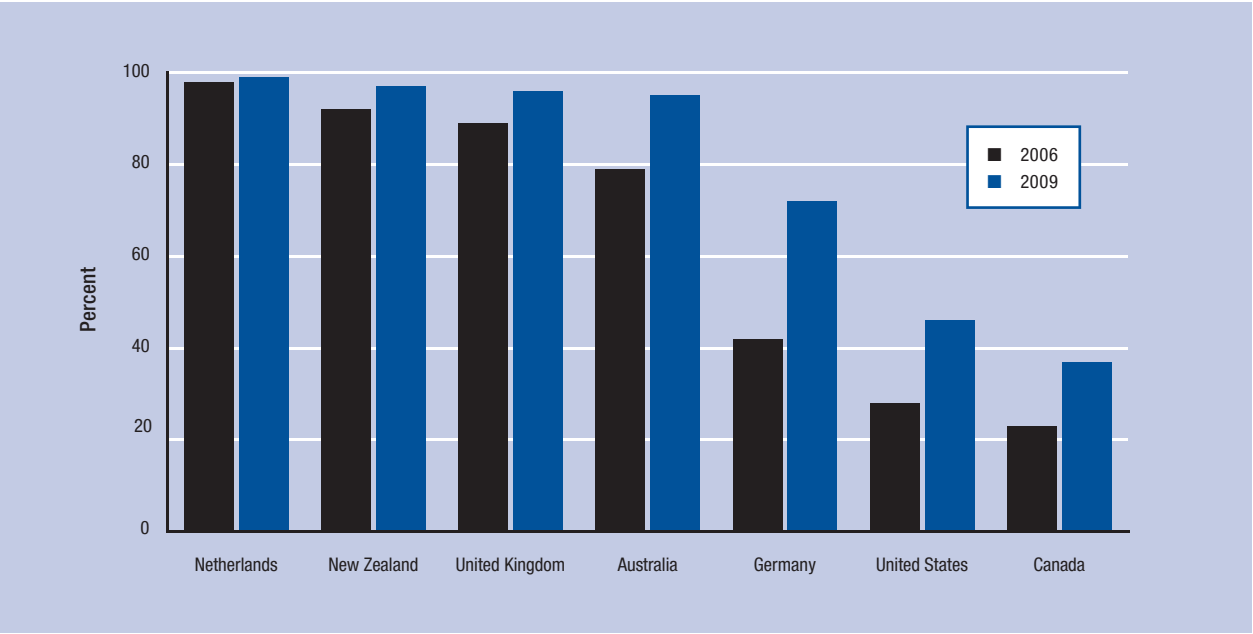
Improved management of chronic diseases

The use of ICTs to improve the management of chronic diseases has also gained significant attention. First, ICTs can improve care coordination.[22] The treatment of complex chronic diseases requires input across many different healthcare professions and multiple healthcare settings, thereby creating a complex set of data that the various people in the care process need to understand and use. Sharing patient information across providers is essential to improve clinical outcomes and also to prevent unnecessary duplications. EHRs can greatly facilitate this task.

ICTs can also play an important role in increasing compliance with clinical care guidelines or protocol-based care, which is particularly valuable in the management of chronic diseases such as asthma, diabetes, and heart failure. These are conditions with a broad evidence base for how best to manage patients; ICTs can help ensure that providers adhere to this evidence. A study conducted by the Rand Corporation in 1998–2000 in the United States showed that patients received only 54.9 percent of recommended care out of a set of 439 quality indicators defined for 30 acute and chronic conditions. Quality-care indicators were based on recommendations pertaining to screening, diagnosis, treatment, and follow-up for each condition. Although more than 75 percent of the recommended care was provided for senile cataracts or breast cancer, recommendations for care did not exceed 50 percent for 10 conditions. Only 22.8 percent of recommended care was provided for hip fractures and only 10.5 percent for alcohol dependency. In many but not all cases, nonadherence with recommended care corresponded to an underuse of healthcare services.[23]

Other studies have produced similar evidence of nonadherence to recommended care in medical practice. ICT systems are important for increasing the uptake of preventive services such as screening tests for diabetes and cancer (Box 2).

Figure 5: Use of electronic medical records by physicians in seven OECD countries, 2006 and 2009



Source: Schoen et al., 2009.
Notes: Survey question for 2006: "Do you currently use electronic patient medical records in your practice?" Survey question for 2009: "Do you use electronic patient medical records in your practice (not including billing systems)?"

UNEVEN ICT ADOPTION ACROSS OECD COUNTRIES

Making sure that ICTs are in place is only the first step on a long and challenging journey toward taking full advantage of these technologies. Indeed, it is fair to say that, although the potential gains from greater ICT use have been apparent for years, most countries still face major implementation challenges and adoption has remained remarkably uneven.

In 2009, the Commonwealth Fund reported that only 46 percent of US doctors used electronic medical records, compared with over 90 percent of doctors in Australia and the United Kingdom (Figure 5).[24] According to a recent survey of European Union countries,[25] on average, only 6 percent of general practitioners reported using e-prescribing, the exceptions being Denmark (97 percent), Sweden (81 percent), and the Netherlands (71 percent).

ACCELERATING ADOPTION AND THE DEVELOPMENT OF BENEFITS FROM ICTs: OVERCOMING THE CHALLENGES

Effective system-wide adoption of ICTs and the exchange of medical information continues to be logistically difficult for a variety of reasons. First, the way healthcare is financed and organized can create disincentives for providers (physicians, hospitals, others) to pursue ICTs.[26] In particular, fee-for-service payment schemes do not create incentives to improve quality and reduce redundant utilization—two of the primary benefits of health ICTs. Providers therefore have little motivation to go through a costly and disruptive implementation, particularly when they can benefit more directly from investing in biomedical technologies that will increase their own revenue.

This challenge can be addressed by designing payment systems that encourage the uptake of ICTs. This has been a central aspect of many recent programs to encourage the use of ICTs—examples include the Practice Incentive Programme (PIP) in Australia and the Quality Outcomes Framework (QOF) for primary care in the United Kingdom. It is important to note that the investments in ICTs are often part of a wider strategy to improve primary care and hospital performance and are linked with broader incentive regimes that pay for better performance, as well as reforms—such as disease management programs to improve chronic care. Often pay-for-performance schemes begin with paying for reporting that, in turn, provides financial incentives for ICT adoption and providing data on the quality of care in regular electronic form. Pay-for-reporting programs are often a necessary prelude to a more full-scale pay-for-performance scheme.[27]

A second barrier to ICT adoption and effective use is the broader issue of governance or stewardship. Too often, projects start without the systems that are needed to make progress—for instance, objectives need to be set in terms of the health gains expected, and appropriate workflow redesign, change management, education, and training need to be introduced.[28] This lack of governance is also reflected in the absence of commonly defined and consistently implemented interoperability standards. Although healthcare organizations have access to an ever-increasing number

Table 1: 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
Standalone surveys of healthcare providers (businesses or personnel)	High	Medium	High	Low

Source: OECD, 2010a.

of ICT products, their systems often cannot speak to each other, thus preventing the potential gains from sharing information. Linkages and health information exchange remain a serious problem. This market failure is widely recognized and governments are taking varying approaches to address it.

A third challenge relates to decisions on how healthcare organizations handle their digital information environment. This process profoundly affects the uptake of health ICTs and the transition to an e-health environment. The main challenge is integrating privacy policy, security, and technological requirements for access and the exchange of healthcare information. This is an area where public perception issues must be addressed. Keeping control over personal electronic medical information and privacy assurance remain the two top concerns for consumers. In particular, there is concern that information could have detrimental effects on employment, be used by health insurance companies to deny coverage or increase premiums, and harm social integration in the community.

Appropriate privacy protection should be incorporated into the design of new ICT systems and policies from the outset. However, such protection must be balanced with the value from broad information sharing.

BETTER MEASUREMENTS TO REALIZE THE FULL POTENTIAL OF HEALTH ICTs

The challenges to achieving widespread ICT adoption and meaningfully leveraging these tools to improve care are complex. Many countries are looking to learn from others' successes and failures to inform their own policy development. This, however, requires a shared understanding of ICT definitions as well as approach to measuring adoption and impact.

In 2008, the OECD undertook a study of how member countries were monitoring progress in ICT implementation under their respective national e-health strategies. The study showed a rising interest in monitoring ICT adoption that had led to a proliferation of surveys of varying quality and utility. These surveys were sometimes conducted by official government statistical agencies, and more often by academic entities and private-sector collection agencies funded by government health departments.[29] Most surveys were conducted as standalone surveys, on an ad hoc basis. In most cases, they focused on ICT adoption in the primary care sector.

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

Table 1 presents a simplified comparative analysis of the different data sources in terms of (1) relevance—that is, how well the data reflected the information priorities of policymakers; (2) feasibility—that is, how easily data can be gathered (cost and time to collect the data); (3) prevalence—that is, whether the type of data collection is frequently used or not; and (4) the extent of data comparability

The OECD study also reviewed how countries define ICTs in their surveys. With the exception of the terms *electronic health record (EHR)* and *electronic medical record,* there was very little or no overlap in the lists provided by countries. Notably, none included any general definition for either ICTs or healthcare. Even for the term *EHR,* the definitions used in questionnaires varied widely across countries (and often across surveys within the same country).

The variety in the way countries defined and measured ICTs inevitably made it difficult to compare data within and across countries, or to link survey data to other data sources. It was similarly challenging for countries to compare practices and policies from which they could learn.

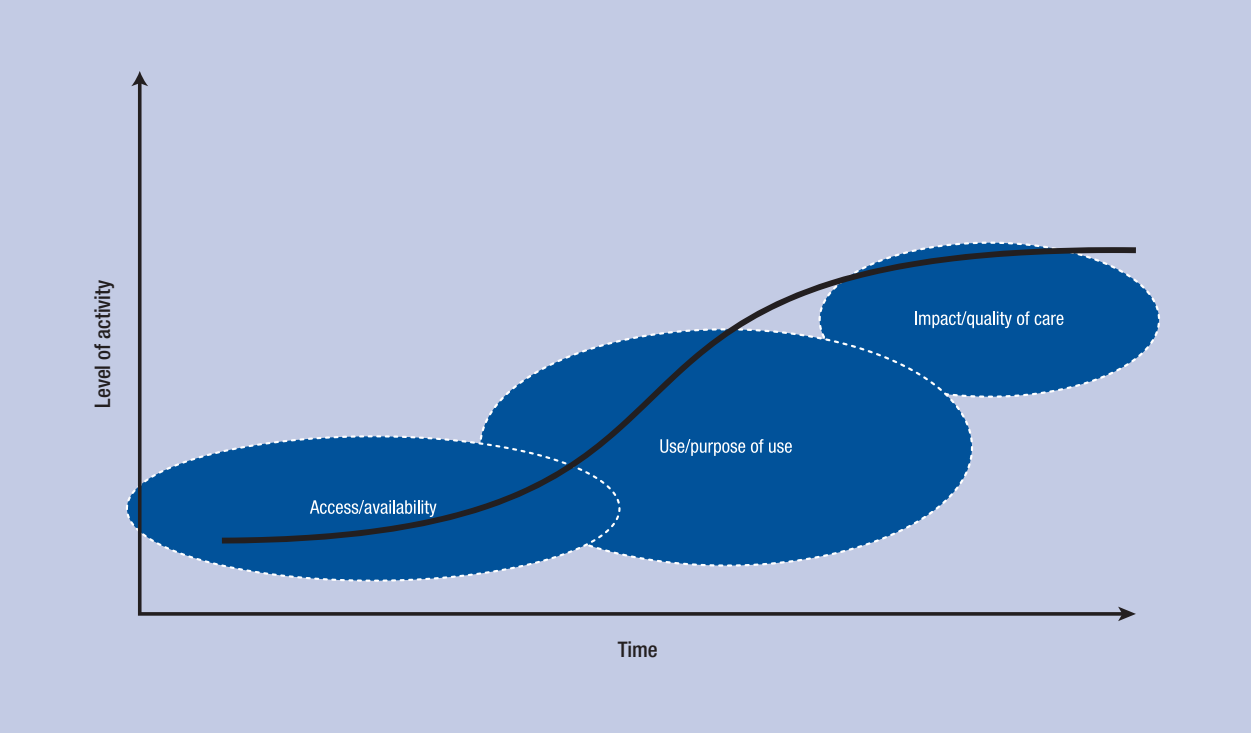
Prompted by the 2008 study, OECD countries agreed to undertake the following actions:

- establish a measurement framework for ICTs in health systems,
- establish internationally agreed definitions of ICTs, and
- develop a model survey for the measurement of the availability and use of ICTs in the health sector.

The establishment of an international measurement framework

Metrics and indicators have to be relevant to policymakers. In the early 1990s, the OECD developed a conceptual framework for the diffusion of ICTs. This framework recognizes that measuring ICTs is a moving

Figure 6: The diffusion curve of ICTs



Source: Adapted from Figure 1.2 in OECD, 2011b.

target. Countries follow an S-shaped curve that begins with increasing interest in availability and access (Figure 6). Once ICTs reach a critical stage of diffusion, policy interest shifts to the purpose and level of ICT use (intensity) and to its impact (and less on its access).[30] There is likely to be some demand for all three types of indicator, but priorities will differ over time for different countries.

Measures need, therefore, to reflect this continuum, starting from ICT availability and adoption, moving next toward effective use and the extent of health information exchange, and ending with measuring outcomes and impact on health and the performance of the health system.

The establishment of internationally agreed definitions of ICTs

To avoid confusion over concepts and definitions, the OECD began by proposing to define ICTs with reference to the functions they offer. This approach was first tested in the United States in a 2008 national survey of physicians.[31] An expert panel defined the key functions that constitute a "basic" and "fully functional" EHR, and then applied these definitions to the survey data to develop nationally comparable estimates.

Development of a model survey

One of the key challenges in developing international measures is finding an approach that can be applied to all countries while taking into account the difference in their pace of ICT deployment. Previous work to improve international comparability of surveys that measure the use of ICTs in households, businesses, and government indicated that developing and implementing a model survey composed of separate, self-contained modules can ensure flexibility and adaptability to a rapidly changing environment.[32]

The use of core modules (either as an add-on to existing country surveys or as a standalone survey) allows measurement on an internationally comparable basis. Additional modules and new indicators can be added to respond to evolving or country-specific policy needs in this area.

The framework underlying the elaboration of the model survey includes three main features that are of general applicability. These features are reviewed below.

1. **Linking indicators to user needs:** The model survey reflects common elements of national ICT use that, in turn, are guided by national policy priorities.

2. **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. Although 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.

3. **Minimized burden:** The model survey is designed to reduce respondent burden and enhance international comparability by being short, by making use of filter questions, and using a very limited number of quantitative questions.

MOVING FORWARD: THE OECD BENCHMARKING INITIATIVE

Given the rapid pace of developments, a narrow window of opportunity currently exists for countries to achieve international agreement on indicators and terminology. Recent work undertaken by the OECD in collaboration with Harvard School of Public Health, the World Health Organization, and the European Commission indicates that a nucleus of a few indicators may represent a reasonable starting point for the development of a common understanding about what should be included in the core module of a model survey on the adoption and use of ICTs in the health sector. These indicators are being organized into four broadly defined domains in which the measurement of availability and use represent today's policy priorities for OECD countries:

1. **Provider-centric electronic records systems:** These systems are used by healthcare professionals to store and manage patient health information and data, and include functionalities that support the care delivery process. Examples include electronic medical records, EHRs, and electronic patient records.
2. **Patient-centric electronic records systems:** These systems are typically used by patients and their families to access and manage their health information and organize their healthcare. Examples are personal health records, patient portals, and other patient-centric electronic records.
3. **Health information exchange:** This area entails the process of electronically transferring (or aggregating and enabling access to) patient health information and data across provider organizations. Examples include the e-transfer of patient data between ambulatory care providers or the transmission of prescriptions from the provider to a pharmacy.
4. **Telehealth:** This program encompasses the broad set of technologies that support care between patients and providers, or among providers, who are not co-located. Examples include video-mediated consultations between physicians and patients, remote home monitoring of patients, and teleradiology.

CONCLUSIONS

This review has summarized evidence suggesting that the widespread adoption and use of health ICTs can enable an array of benefits. Among these are reducing medical errors, improving clinical care through adherence to evidence-based guidelines, and preventing duplication and inefficiency for complex care pathways. These technologies hold substantial value for the management of chronic diseases by enabling better coordination of care as well as greater patient involvement in their care.

Smooth, evidence-based implementation of health ICTs is, however, still a distant prospect. There is much work still to be done to gather relevant information for improving the quality of existing measurements as well as improving the linkages between policy and measurement.

Understanding the barriers and incentives to ICT use is critical to achieving more widespread penetration and realizing the far-reaching economic and social benefits to be reaped from their application. OECD countries have much to gain by joining their efforts and sharing the burden of developing measurements and testing indicators in this sector. Risk, delay, and cost can be minimized by learning from good international practices, but this will be possible only if we have a common set of indicators that are collected on a comparable basis. The OECD work to develop internationally comparable measures about ICT use in healthcare and the wide-based support it has received is a reflection of the critical need for such data today in both OECD and non-OECD countries.

NOTES

1 OECD 2010a, 2010b.

2 Boston Consulting Group 2008.

3 *Lead markets* are defined by the European Commission as markets with high growth potential in which EU industry can develop a global competitive advantage if it gets support from the public sector; http://www.euractiv.com/innovation-enterprise/lead-markets-gateway-growth-linksdossier-188437. See Commission of the European Communities 2007.

4 OECD 2010a.

5 OECD 2010a.

6 OECD 2012.

7 OECD 2010a.

8 OECD 2011a.

9 Executive Office of the President, Council of Economic Advisers 2009.

10 Furukawa 2012.

11 US Bureau of Labor Statistics 2012.

12 OECD 2010b.

13 Chaudry et al. 2006.

14 OECD 2010.

15 HIRA 2010.

16 Schoen et al. 2007.

17 Praxia/Gartner 2001.

18 Scott et al. 2005; Chaudry et al. 2006; Shekelle and Goldzweig 2009; OECD 2010a.

19 Committee on Quality of Health Care in America: Institute of Medicine 2000; Lazarou, Pomeranz, and Corey 1998.

20 Chaudry et al. 2006.

21 Durieux et al. 2008.

22 OECD 2010b.

23 McGlynn et al. 2003.

24 Schoen et al. 2009.

25 EC 2008.

26 Ash and Bates 2005.

27 OECD 2010b.

28 OECD 2010a.

29 OECD 2010a.

30 OECD 2005.

31 DesRoches et al. 2008.

32 OECD 2011b.

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