# Electronic Health Records: An International Perspective on "Meaningful Use"

Bradford H. Gray, Thomas Bowden, Ib Johansen, and Sabine Koch

**ABSTRACT:** Research has shown that the United States lags many other countries in the adoption of electronic health records (EHRs). The U.S. has now embarked on a major effort to achieve "meaningful use" of health information technology by clinicians and hospitals. This issue brief describes the extent of meaningful use in three countries with very high levels of health information technology adoption—Denmark, New Zealand, and Sweden. While all three have achieved high levels of meaningful use, none has reached 100 percent in all categories. The brief find high levels of meaningful use for EHR items and substantial information-sharing with other organizations or health authorities, although less information is shared with patients. Insights that may prove useful to the United States include providing economic incentives to encourage adoption and designating an organization to take responsibility for standardization and interoperability.

★   ★   ★   ★   ★

## OVERVIEW

Although health information technology (HIT) is widely seen as an essential component of the health care system of the future, the United States has lagged many other countries in the use of electronic health records (EHRs) in patient care (Exhibit 1).[1] That is now changing, with the implementation of the Health Information Technology for Economic and Clinical Health Act (HITECH) of 2009, which provides $27 billion over 10 years for federal incentive payments to hospitals and clinicians for adopting EHRs. Substantial sums are at stake—$44,000 from Medicare and $63,750 from Medicaid for individual clinicians and millions for individual hospitals. To obtain incentive payments, providers must not only adopt EHR systems but they must also make "meaningful use" of them to improve patient care. This means not simply translating paper records into electronic form, but creating an

electronic infrastructure that would improve the health care system and the health of Americans.

The Office of the National Coordinator in the Department of Health and Human Services reached a major milestone when it published regulations in July 2010 that set forth standards to define the "meaningful use" of EHRs.[2] The standards were stated in terms of objectives (e.g., maintaining an active medication list for patients) and measures for qualifying for incentive payments (e.g., recording at least one entry as structured data for at least 80% of patients).
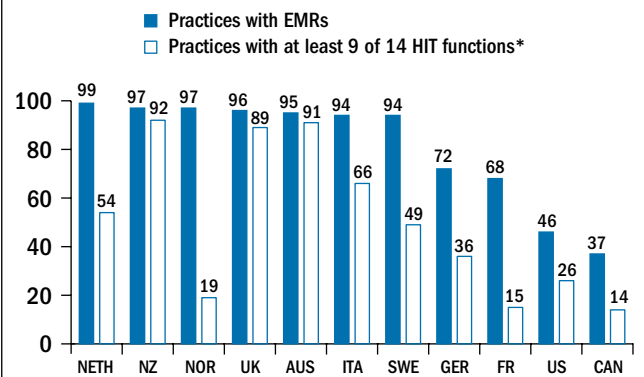
This issue brief describes meaningful use in three countries—Denmark, New Zealand, and Sweden— that have extensive experience with EHRs but that did not start out with a concept of meaningful use. These countries were selected because they are known to have achieved high levels of EHR use. All Danish primary care physicians use electronic medical records.[3] In addition, data from the Commonwealth Fund's 2009 International Health Policy Survey of Primary Care Physicians show that almost all primary care doctors in Sweden and New Zealand reported using electronic patient records in their practices, compared with fewer than half of American primary care doctors (Exhibit 1).[4]

## E-HEALTH IN DENMARK, NEW ZEALAND, AND SWEDEN

### Denmark: National Interoperability Standards and Financial Incentives Drive IT Adoption

Nearly all primary care physicians in Denmark have electronic health records with full clinical functionality.[5] These systems are connected to a national network that is operated by a private nonprofit organization called MedCom, which enables general practitioners (GPs) to exchange clinical data with specialists, hospitals, pharmacies, laboratories, and other health providers. Most communication among these service providers takes place electronically. The Danish National Health Portal, which was introduced in 2005, gives patients electronic access to their EHRs and facilitates electronic communication between patients and their regional health service.



Exhibit 1. Practices with Electronic Medical Records vs. Advanced Electronic Health Information Capacity

■ Practices with EMRs
□ Practices with at least 9 of 14 HIT functions*

| | NETH | NZ | NOR | UK | AUS | ITA | SWE | GER | FR | US | CAN |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EMRs | 99 | 97 | 97 | 96 | 95 | 94 | 94 | 72 | 68 | 46 | 37 |
| 9 of 14 HIT | 54 | 92 | 19 | 89 | 91 | 66 | 49 | 36 | 15 | 26 | 14 |

* Count of 14 functions includes: electronic medical record; electronic prescribing and ordering of tests; electronic access test results, Rx alerts, clinical notes; computerized system for tracking lab tests, guidelines, alerts to provide patients with test results, preventive/follow-up care reminders; and computerized list of patients by diagnosis, medications, due for tests or preventive care.
Source: 2009 Commonwealth Fund International Health Policy Survey of Primary Care Physicians.

Several factors have enabled Denmark to reach its high level of IT use. Supportive policies going back to the early 1990s include national standards to facilitate interoperability of data systems, quicker payment for physicians who use EHRs, and financial incentives to primary care practices for phone and e-mail consultations. Peer pressure and lesson-sharing by early adopters played a role, as did the public perception that physicians who did not use EHRs were second-rate. Physicians report that IT has increased efficiency and improved coordination of care. A national integrator (MedCom) developed the national infrastructures, set standards, and provided technical assistance.

All these factors facilitated the widespread adoption of EHRs before a mandate for GPs to use HIT was passed in 2004. The mandate includes receiving lab and x-ray results and electronic discharge records from hospitals, as well as sending electronic prescriptions and renewals, referrals, lab test orders, and reimbursement requests. GPs also do consultations by e-mail.

The EHRs used by Danish physicians make only limited use of structured and coded clinical data; fewer than 50 percent of Danish primary care physicians code each patient visit. This limits functionality that depends upon aggregation of data across patients or over time.

Hospitals and hospital-based specialists use EHRs less often than do GPs. Only about half of hospital beds are covered by full electronic patient records, though full

coverage is anticipated by the end of 2012. All hospitals use electronic systems for administering and documenting medication use during hospitalizations, and discharge or outpatient summaries are transmitted electronically to patients' GPs after hospital stays. Discharge abstracts for hospital inpatient and outpatient visits are captured in the electronic Patient Administrative System that is used for reporting in the National Diagnoses Register.

Patients' electronic records are separate for hospitals and physicians in Denmark, and hospitals do not have access to GPs' systems. However, GPs have access to look up hospital EHR data. Although GPs own their patients' records, when a patient changes GPs, the EHR is transferred electronically to the new GP. Legislation allows physicians access to the medication profiles of patients, but all other health professionals must obtain patients' consent before looking at their health information. Every Danish citizen has a unique national personal identification number that is used when health care is obtained. The privacy laws do not restrict the use of data for quality improvement and public reporting, and there is a trend toward patients' accessing their own data.

## Methods

We created a reporting template of meaningful use criteria by combining the objectives and measures from the meaningful use regulations from the U.S. For example, the meaningful use objective "maintain an active medication list" was combined with the measure for that objective (i.e., over 80% of patients have at least one entry recorded as structured data) to form the criterion "maintain patient's active medication list with >80% of patients with at least one entry recorded as structured data." All the Department of Health and Human Services' meaningful use objectives and measures were combined in this way on our reporting template, which is the basis for Exhibits 2 and 3 in this report. Many standards are the same for both primary care physicians and hospitals, but a few are applicable only to one or the other. We included 15 core items and 12 optional ones. There are 21 standards for physicians and 20 for hospitals.

Collaborators from Denmark, New Zealand, and Sweden pulled together available information from their countries regarding the meaningful use criteria. It was not always possible to apply the criteria precisely, and the physician and hospital groupings did not necessarily include all hospitals (e.g., the Swedish data pertained only to publicly owned hospitals, which comprise most of the total) or all physicians (e.g., some data were limited to primary care physicians). However, the effort yielded a general picture of the extent of meaningful use by hospitals and doctors in the three countries.

### A Note on Terminology and Comparability

Although efforts have been made in the field to make and use clear distinctions among such terms as electronic health records (EHRs) and electronic medical records (EMRs), actual use is not consistent. Throughout this issue brief, we use the term EHR.

Physicians and hospitals in the U.S. generally have their own patient record systems so requiring and reporting separate meaningful use standards for physicians and hospitals seems natural here. For comparability, we report meaningful use separately for physicians and hospitals for the other countries, but in many cases they use common EHR systems. The physician data from the three comparison countries pertain to primary care physicians since some specialists are based in hospitals and use a common EHR system. (In Denmark, however, specialists are private and use EHRs similar to the GPs; about half the specialists in New Zealand are in private practice.)

Also regarding comparability, there are major differences between the U.S. and these comparison countries in both scale and the ways that health care is organized. Even so, there are common tasks and challenges in achieving the meaningful use of EHRs.

## New Zealand: Electronic Information Exchange with Specialists, Immunization Databases, and Public–Private Sector IT Collaboration

New Zealand, which has a well-developed system of primary care, has had primary care IT systems in place for 20 years and has steadily expanded and refined them.[6] In some cases, this means through four or five generations of software. Most general and specialist practices in New Zealand are private, as are some hospitals. All are expected to fund HIT investments out of operating budgets while conforming to centrally directed guidelines and national standards. Substantial investments to make needed upgrades of HIT capacity are common. Nearly all New Zealand health care organizations make extensive use of electronic messaging services to exchange clinical information, with effort being made to create a fully interoperable environment.

IT development took place separately in hospitals and doctors' offices. Regional hospitals began buying electronic administrative systems in the early 1980s. Specialized applications were added over time, including clinical intranets that linked organizational components together to create a single patient view. A few enthusiastic GPs also began investing relatively large amounts of money in the mid-1980s in Unix-based practice management systems. Wider adoption of physician EHRs took place as easier-to-use Windows and Macintosh systems became available and when the delivery of clinical messages (e.g., lab reports, discharge summaries, communications with specialists) became electronic. Electronic communications across providers' systems commenced in 1994.

Today, all of New Zealand's 1,100 general practices use a practice-based EHR that supports a broad range of functions, including primary care records, problem lists, clinical progress notes, ordering of tests and medications, managing medication lists and test results, issuing preventive reminders, and providing access to external decision-support systems. Most of the early use of IT was within and between health care organizations, but electronic communication with patients is beginning to occur via use of EHR systems with patient portals that enable patients to access limited subsets of their records from home.

A health system integrator called HealthLink facilitates communications between physicians' offices and other elements of the health sector (e.g., laboratories and hospitals). The integrator also provides expertise to solve technical issues. Almost all New Zealanders (95%) are enrolled in a primary health organization (PHO)—62 PHOs operate in the country—that provide various services to GP practices and to the 20 district health boards (DHBs) that operate hospitals and public health services. Practices are transitioning from office-based EHR systems to remotely hosted systems.

General practices communicate with an average of 58 other organizations in a given month. The electronic exchange of information includes clinical and administrative information, radiology and diagnostic test results, hospital discharge summaries, emergency department visit reports, specialist reports, communication with immunization databases and other national registries, and reporting on quality indicators.

Electronic communication of prescriptions has lagged other forms of health sector communication, but electronic prescribing trials involving hospitals, general practices, and pharmacies are now under way.

The New Zealand government has played a role in developing and fostering health IT by implementing a unique national patient identifier system in 1992, developing a health information privacy code and security framework, creating standards and adopting the HL7 electronic messaging standard, and requiring that claims for payment be made electronically. Governmental policy also created an investment climate that attracted the private organizations that provide most HIT services. Most of the core investment in HIT was provided by the central government, including small grants to GPs to purchase computers, grants to the district health boards, and some targeted payments to primary care organizations.

Like Denmark, New Zealand rejected the idea of multiple organizations sharing a single medical record in favor of an approach that facilitates the sharing of information across organizations when needed. However, data repositories for secondary care (e.g., test results, discharge

summaries, specialist letters) are being developed at the regional level and significant investments are being made in sophisticated systems for making online referrals. Also similar to Denmark, New Zealand is using a private organization (HealthLink) to provide services like electronic messaging, online services, and technical support.

## Sweden: Moving Toward a Single EHR for Primary Care and Hospital Use

In Sweden, responsibility for providing hospital and primary health care is decentralized to 21 county councils or regions, as is decision-making regarding the introduction of EHRs.[7] Even so, EHRs are used for documentation by all physicians and most hospitals (and most ambulances). Hospital use has lagged use in primary care, but EHRs are now used in 97 percent of hospitals and 100 percent of primary care clinics. Most Swedish EHRs contain functions for clinical documentation, electronic prescribing (80% of prescriptions are written electronically), and computerized provider order entry. All laboratories are fully computerized, and computerized order entry for various laboratory, radiology, and pathology services is growing, but varies (20% to 75%) among the county council regions. Most county councils have systems for electronic exchange of hospital discharge summaries and most have systems for electronic scheduling of visits and renewal of prescriptions.

Coordination is mainly achieved at a regional level. Electronic referrals and exchange of clinical data across county councils are problematic because national standards for interoperability are lacking. Development of EHRs was led by local clinical champions and strong administrators in the early 1990s, and approximately 27 different systems came into use. Today, however, four different EHR providers cover most of the Swedish market. About half of the county councils have adopted a single EHR system for both hospitals and primary care, and most of the others are moving in that direction. The creation of a single record allows hospital physicians (with patients' consent) to have access to patients' primary care records and for hospitals to have reciprocal access.

Sweden has an extensive system of more than 60 national quality registries that are organized by condition and contain individual-level data on problems or diagnoses, treatments, and outcomes. The success of these systems is attributed to their being developed by the clinical caregivers who use the data. However, they are built upon different information structures and technical platforms and are not integrated with EHRs in standardized ways.

Sweden adopted a National eHealth Strategy in 2006 for the purpose of improving the safety, accessibility, and quality of care; facilitating patient mobility; meeting growing demands from patients and health professionals; and providing a platform for improving health services. The National Board of Health and Welfare is responsible for defining a national information structure and working on the international terminology standards such as SNOMED CT. In 2009, the Center for eHealth in Sweden, governed by the Swedish Association of Local Authorities and Regions, municipalities, and private care providers, was formed to develop and introduce nationwide use of IT. The work includes new services for citizens, additional support for health and social care provision, a national technical and information infrastructure, and common regulatory frameworks and standards.

A new Patient Data Act, passed in 2008, allows health care providers, with patients' consent, to have electronic access to information held by other health care providers. Citizens have the right to electronic access to their own health care information but systems for gaining such access are not yet available nationally.

Each resident has a unique identification number that is used for all public services. The vision in Sweden is to have an infrastructure that makes necessary information available at the point of need, independent of where the information was produced. This will include both health care and social care.

## MEANINGFUL USE BY PHYSICIANS AND HOSPITALS

Exhibit 2 illustrates meaningful use categories for primary care physicians in the three comparison countries. Comparable information is not available for the U.S. Specialists in these countries are generally covered under hospital IT systems; 75 percent of private specialists in New Zealand use an EHR.

The meaningful use categories for physicians can be grouped into four broad categories—contents of the EHR (Exhibit 2, items 1–6); the exchange of information with other providers or authorities (Exhibit 2, items 7–13); sharing information or communicating with patients (Exhibit 2, items 14–17); and decision-support and patient protection (Exhibit 2, items 18–21).

Several patterns can be gleaned from Exhibit 2. First, none of the countries has reached 100 percent on all the meaningful use categories for physicians' practices. New Zealand is the closest, with 100 percent meaningful use on 13 of 21 categories.

Second, the highest levels of meaningful use in these countries involve items in EHRs. This is not surprising, because it is the only category that is both internal to practices and requires no data manipulation, which is necessary, for example, for generating a list of patients by condition (Exhibit 2, item 18). The only one of the six EHR content items on which the three countries have not achieved 100 percent is maintaining a problem list within the record.

Third, in all three countries, there is a substantial amount of information-sharing with other organizations or with health authorities (Exhibit 2, items 7–13), including information about referrals. However, in all three countries there are limits on the sharing of information beyond the physician's practice.

Fourth, the least-developed type of meaningful use pertains to sharing of information with patients (Exhibit 2, items 14–17). In two countries, paper is used to share information such as test results. But there are efforts now in all three countries to make electronic health information available to patients.

Fifth, the four items pertaining to decision-support and patient protection are only standard in New Zealand. Finally, because physicians in all three countries share certain information outside their practices (Exhibit 2, items 7–13), it is noteworthy that all practices in all three countries have implemented systems to protect patient privacy and the security of patient data in EHRs.

In Exhibit 3, meaningful use information about hospitals is shown. The items are grouped into categories similar to Exhibit 1.

As with meaningful use in physicians' practices, none of the countries approaches 100 percent meaningful use on all categories for hospitals. The highest level is in Denmark, with 100 percent meaningful use reported for 13 of the 20 items. As with physicians, meaningful use is most common regarding the contents of the EHR. The least commonly included item is advance directives—a category not found on the physician list.

In contrast to meaningful use in physicians' practices, at least one country has reached or is approaching 100 percent meaningful use on two of the other groupings—the exchange of information with other providers or with authorities (Denmark) and decision-support and patient protection (New Zealand). As with the physician meaningful use measures, the lowest level of development among hospitals pertains to the sharing of information with patients.

## EXAMPLES OF THE USE OF ELECTRONIC HEALTH RECORDS

Meaningful use is broadly described and summarized in Exhibits 2 and 3. More specifically, EHRs are used in the three countries in the following ways:

- General practices in New Zealand use cardiovascular disease and diabetes assessment and management systems in which data fields are automatically pre-populated from the patient's EHR and are risk-assessed, and management options are saved back into the EHR to deliver patient-specific, evidence-based advice at the point of care.

- In New Zealand, certain preventive care data entered into a patient's EHR are automatically transferred into national registers. For example, scheduled childhood immunizations are recorded in the National Immunization Register, as are cervical Pap smears in the National Cervical Screening Programme Register. These systems can be accessed by general practices to determine the immunization or screening status of their patients. The systems also send reminders to patients who are late for their immunizations or screenings.

- In New Zealand, in electronic referrals to hospitals, the hospital can define the information it wants about the patient and the GP's EHR automatically extracts and sends relevant information, including appended reports. This system is transforming the GP–hospital interface. About 80 percent of the content of electronic referrals is common across all referral types, but the other 20 percent varies according to specialty type. For example, a dermatology referral may request digital photos of an affected area over the past three months or an obstetrics referral may require ultrasound results within the term of the pregnancy.

- In Denmark, when patients are referred by GP to a hospital, the hospital staff and GP have electronic access to notes and examinations from all other hospitals the patient has visited.

- Home care in Denmark is automatically notified when a patient is admitted to a hospital and discharged. Information about the patient's status at discharge in included.

- Medication information from GP EMRs in Denmark is stored in a national database and can be accessed by all hospitals.

- When patients in Denmark are transferred from one hospital to another, the EHR information can be accessed by both hospitals.

- In Sweden, patient information is automatically transferred from EHRs in ambulances to acute care settings in hospitals.

- Shared EHRs in Sweden facilitate care planning among primary, secondary, and long-term care settings.

## Facilitators and Challenges in Achieving Meaningful Use

In assessing meaningful use in these three countries, the authors have applied a new set of standards that were developed in the United States. This makes their rates of meaningful use—particularly in categories where they have achieved 100 percent—particularly noteworthy. At the same time, although these countries are far ahead of the United States in HIT adoption,[8] they nevertheless fall short of 100 percent meaningful use on many items.

Legal and regulatory provisions have a substantial impact on some types of meaningful use. National unique patient identifiers are particularly important for facilitating cross-organizational sharing of information. Data protection laws can facilitate or inhibit some meaningful use (e.g., the creation of drug profiles). All three comparison countries have strong legal protection for the privacy of medical records. Financial incentives from government facilitated the adoption of HIT in each country.

Each of the three countries has the capacity to create EHRs that meet the meaningful use criteria, to exchange information with other providers or with health authorities, and to share information with patients. Reasons vary for not achieving meaningful use in these areas. Some pertain to the way medical care is organized. Physicians do not submit reportable lab results to public health authorities in Denmark and Sweden because that reporting is done directly by the labs. Overall, the Swedish results reflect the way care is organized. Local county councils are responsible for services, which results in variation around the country and interoperability problems across county councils.

Political factors also play a role, as in New Zealand where prescription information is entered into patients' records but not transmitted in electronic form because of existing pharmacies' fears that prescription orders might go to mail-order pharmacies.

In some instances, normative or cultural factors play a role in limiting use of electronic communication with patients. Other factors that limit meaningful use are differences in payment systems for hospitals and doctors in Denmark, differences in the importance accorded to some prevention activities (e.g., smoking is not included in Danish EHRs, except for pregnant women), and weak economic incentives for some meaningful use categories.

Public and professional expectations play an important role in the development and use of HIT. The national adoption of health information systems can reach a point at which health professionals and patients

expect capacities that are possible only if electronic health record systems exist. Sweden's low ranking on e-services for patients is partly due to the fact that there were no relevant incentives prior to legislation in 2008 that gave patients the right to digital access to their own records.

Other challenges that have arisen include: overcoming interoperability problems stemming from differences among organizations that would ideally be able to share information electronically in their EHR systems or in the coding and structuring of information; getting patient information coded at the time of entry; and dealing with legal and practical concerns regarding privacy and confidentiality of patient information.

## CONCLUSIONS

Meaningful use can help a country's health care system if emphasis is placed on making the technology functional and valuable and if expectations regarding functionality are raised gradually in relatively small steps.

Economic incentives have been important for encouraging adoption of EHR systems and can also be used in conjunction with regulation to facilitate interoperability. However, once installed, IT systems may get updated because of the benefits they provide to the user organizations, not because of external incentives.

Both government and private organizations have played important roles in the development of meaningful use, such as the nonprofit MedCom in Denmark and the for-profit HealthLink in New Zealand. Both organizations have helped to develop the standardization and interoperability that facilitates meaningful use. In Sweden, in 2009, the Swedish Association of Local Authorities and Regions, municipalities, and private care providers together formed the nonprofit Center for eHealth to provide a common infrastructure. This suggests that it is important for an organization—whether governmental, private, or nonprofit—to take responsibility for standardization and interoperability.

Other important factors include:

- Ensuring that the government's health reform strategy and associated policies are clearly understood and viewed as achievable by the parties

(governmental or nongovernmental) that are expected to invest in e-health systems and services.

- Helping health-sector provider organizations see value in exchanging information and taking care to ensure that any modest operational benefits or efficiency gains are not eclipsed by strategic, financial, or competitive drawbacks.

- Ensuring that any initial efforts and investments by provider organizations result in the creation of tangible value that will reinforce the benefit of their making further IT investments.

- Making it easy for practices to make the decision to automate, for example by allowing them to use their own choice of system supplier rather than require a switch to an approved supplier that is unfamiliar, inconvenient, or costly.

- Designing and operating health information exchange systems to give the public confidence that the privacy of their personal information is preserved.

- Creating a sector-wide expectation that systems will be interoperable and use agreed-upon standards.

Although Denmark, New Zealand, and Sweden are far ahead of the United States in many ways in the use of health information technology, these countries' performance is uneven on the dimensions that have been defined as constituting "meaningful use" in the United States. On some dimensions, few or no hospitals or physicians have achieved meaningful use. This finding points to the value of the meaningful use concept in shaping a country's HIT capacities and reinforces the idea that even countries that are well advanced in adoption of HIT can learn from other countries' efforts. It also raises the possibility that the United States' late start may accord some long-term advantages because of the meaningful use concept. This, of course, depends upon the extent to which clinicians and hospitals in the United States are able to achieve meaningful use.

Notes

1    C. Schoen, R. Osborn, M. M. Doty, D. Squires, J.
     Peugh, and S. Applebaum, "A Survey of Primary Care
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     on Care, Costs, and Experiences," *Health Affairs* Web
     Exclusive, Nov. 5, 2009, w1171–w1183; D. Protti,
     "Comparison of Information Technology in General
     Practice in 10 Countries," *Healthcare Quarterly,* 2007
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2    D. Blumenthal and M. Tavenner, "The 'Meaningful
     Use' Regulation for Electronic Health Records,"
     *New England Journal of Medicine,* Aug. 5, 2010
     363(6):501–4.

3    D. Protti and I. Johansen, *Widespread Adoption of
     Information of Technology in Primary Care Physician
     Offices in Denmark: A Case Study* (New York: The
     Commonwealth Fund, March 2010).

4    The Commonwealth Fund survey was conducted
     more than a year before the meaningful use standards
     were announced, and, although it included more
     than a dozen items about the use of electronic patient
     records, the survey items differ in many ways from the
     meaningful use standards.

5    This section is based on Protti and Johansen,
     *Widespread Adoption of Information of Technology,*
     2010.

6    This section is based on T. Bowden, *Electronic Health
     Records Within the New Zealand Health Care System,*
     prepared for the Commonwealth Fund's 2009
     International Symposium on Health Care Policy (New
     York: The Commonwealth Fund, unpublished).

7    This section is based on S. Koch, *Nationwide
     Implementation of EHealth: The Swedish Perspective*,
     prepared for the Commonwealth Fund's 2009
     International Symposium on Health Care Policy (New
     York: The Commonwealth Fund, unpublished).

8    A. K. Jha, C. M. DesRoches, P. D. Kralovec et al., "A
     Progress Report on Electronic Health Records in U.S.
     Hospitals," *Health Affairs,* Oct. 2010 29(10):1951–57.

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**Exhibit 2. Meaningful Use of Electronic Health Records by Physicians
in Denmark, New Zealand, and Sweden**

| Types and functions of EHR capacities | Percent of primary care physicians with EHR capacity | | |
|---|---|---|---|
| | **Denmark** | **New Zealand** | **Sweden** |
| 1   Record **demographics** (sex, race, etc.) on >50% of patients as structured data. | 100%<br>All demographics are also registered in the national citizen repository.<br>All GPs have an EHR. | 100%<br>All demographics are also registered on the National Health Index. All GPs have an EHR. | 100% |
| 2   Record **vital signs** (height, weight, blood pressure) >50% of patients as structured data. | 100% | 100% | 100% |
| 3   Record **smoking status** for patients 13 or older, with more than 50% having smoking status record as structured data. | 100%<br>(15% as structured data, including all pregnant women) | 100%<br>All GPs with EHRs record smoking status as structured data. | 100% |
| 4   Incorporate >40% of **clinical laboratory test** results into EHRs as structured data. | 100% | 100% | 100% |
| 5   Maintain up-to-date **problem list** of patients' diagnoses, with >80% of patients with at least one entry record as structured data. | 65%<br>Coded as ICPC/ICPC2. Is mandatory for all chronic diseases as of April 2011. | 100%<br>Most New Zealand practices have been doing this for nearly 10 years. | ~60-70%coded as KSH-97P, a primary care version of ICD-10 with modification. |
| 6   Maintain patient's active **medication list**, with >80% of patients with at least one entry record as structured data. | 100% | 100%<br>At present, general practices have very good records of what they have prescribed. However, they are unable to ascertain what has been prescribed by other doctors. Plans are being made to create a national view of a patient's medicines. | 100% of physicians have a medication list in their EHR and have access to the pharmacies' medication list where all prescribed medications for the patient are registered. 50% to 60% of county councils have an integrated medication list per patient (compiled from different physicians' EHRs) implemented. National coordination ongoing. |
| 7   Generate and transmit electronically >40% of **prescriptions.** | 100% created electronically and 90% transmitted electronically. Most prescription drug information is stored in a national database to which patients and physicians have access. A new complete database has been launched and will be at full scale in two years. | 100% of prescriptions are created and stored electronically however they are not yet transmitted electronically | 100%<br>According to the pharmacies, in 2009, 80% of all prescriptions were e-prescriptions, created and transmitted electronically. |
| 8   Have **electronically exchange key clinical information** among providers or patient-authorized entities. | 100% | 100% | Ongoing project on National Summary Care Record, implemented in three county councils so far. At a regional level, key information is exchanged. |

| Types and functions of EHR capacities | | Percent of primary care physicians with EHR capacity | | |
|---|---|---|---|---|
| | | Denmark | New Zealand | Sweden |
| 9 | Perform **medication reconciliation** for >50% of patients transitioned between care settings. | 50% Not fully implemented. New national medication record can handle this. Running live now and will be fully implemented in 2013. | None. A medicine reconciliation process is currently being developed but is not as yet in use. | 80% in regions where all physicians document in the same EHR system. National coordination ongoing. |
| 10 | Provide **summary of care record** for >50% of patients referred or transitioned to another provider or setting. | 100% | 100% | Ongoing project on National Summary Care Record, only implemented in one test site/ region so far. 100% at a regional level where most referrals occur. |
| 11 | Ability to **report clinical quality measures** to external organizations. | 100% report to more than 75 national quality databases. There is automatic online capture of data from GPs about chronic disease care, with feedback to GPs about the obtained quality assurance results for each individual patient | 100%. There are extensive performance management initiatives in place. | 100% have the possibility to report to one of more than 60 disease-based National Quality Registries. Specific National Quality Register for Primary Care is under development. |
| 12 | Submit **electronic syndromic surveillance data** at least once to a public health agency. | 100% | None. | Surveillance data for 64 notifiable diseases are collected and analyzed using an electronic service, SmiNet. Reporting is done by both clinicians and laboratories. They report in parallel to the Swedish Institute for Disease Control and to the County Medical Officers. |
| 13 | **Submit reportable laboratory results** at least once to a public health agency. | N/A Reported from labs. | 100%. Information is sent from all general practices and hospitals to a national cancer registry. | Not applicable in Swedish context. |
| 14 | Provided **clinical summaries** to >50% of patients within three business days of visits. | 85% (from GP to patients) 100% from hospitals to GP | Clinical summaries are not written for patients, but 85% of GPs routinely send patient information to other providers. | 100% provided from hospitals to primary care physicians. Information not available on provision of information to patients. |
| 15 | On request, provided **electronic health information** (test results, problem lists etc.) within three business days to >50% of patients requesting it. | All lab results, examinations etc. are mailed to patients or send by paper if agreed between patient and GP. | A number of New Zealand GPs are beginning to implement patient portals, allowing patients to view their own medical records from home. | 100% provided as paper printouts. Can be ordered electronically via a patient portal. Although not widely available yet, currently used by 5% of the population. |

| Types and functions of EHR capacities | Percent of primary care physicians with EHR capacity | | |
|---|---|---|---|
| | **Denmark** | **New Zealand** | **Sweden** |
| 16 | Provide >10% of **patients with electronic access to** their health information within four days of its updating in EHR. | 90% for hospital records now and will be 100% for GP records by end of 2011. | New Zealand practices are beginning to offer their patients online access to their own medical records within 24 hours of being updated in the EHR. | Only in some test installations. One County Council strives for implementation in 2011. |
| 17 | **Send reminders** to >20% of patients age 65 or older or age 5 or younger for preventive and follow-up care. | Possible, but not widely used. Is used for smear screening, mammography screening, and children until age 7. | 95% | 100% for regular screening programs (e.g., mammograms and child care). Other information not available. |
| 18 | Generated at least one **list of patients** by specific conditions to use for quality improvement, reduction of disparities, research, or outreach. | 60%, using ICPC coding. Mandatory for all chronic diseases as of April 2011. | 100% of New Zealand practices use a limited form of coding for this. | Depends on the EHR system used. Can be generated out of disease registries but those are not automatically fed by EHR. Percentage information not available. |
| 19 | Use EHR technology to identify **patient-specific education resources** and provide >10% of appropriate patients. | 35% | 85% | Not available. |
| 20 | Implemented at least one **clinical decision-support** rule and have ability to track compliance. | 60% | 100%<br>Clinical decision-support systems are in widespread use. | Simple decision-support, e.g. warnings, implemented depending on EHR system used, but percent information is not available. |
| 21 | Implemented systems to **protect privacy** and security of patient data in the EHR. | 100%<br>Denmark has a strong data protection law. All exchange of data must be accepted verbally by patient. | 100%<br>NZ has a health information privacy code that is well understood and widely applied. | For security, 70% use the national infrastructure called SITHS. It is based on hard certificates and used for authentication, single-sign-on, electronic signatures, etc. |

Notes: EHR = electronic health record; GP = general practictitioner; ICD = international classification of disease; ICPC/ICPC2 = International Classification of Primary Care, 2nd Edition
Sources: For Sweden, percentages in table reflect public health care. If exact figures were not available, estimates were provided by L. Jervall at the Center for eHealth in Sweden. For New Zealand and Denmark, figures come from multiple surveys reviewed by the coauthors in those countries.

## Exhibit 3. Meaningful Use of Electronic Health Records by Hospitals in the United States, Denmark, New Zealand, and Sweden

| | Types and functions of EHR capacities | Percent of U.S. hospitals meeting EHR criteria | Percent of hospitals with EHR capacity | | |
|---|---|---|---|---|---|
| | | | **Denmark** | **New Zealand** | **Sweden** |
| 1 | Record **demographics** (sex, race, etc.) on >50% of patients as structured data. | 86% | 100% | 100% | 100% |
| 2 | Hospitals' record **mortality info** (date and preliminary cause) on >50% of patients as structured data. | N/A | 100% All cases are registered in a national "cause of death" repository. Based on national citizen identifier | 100% Mortality information is created as part of discharge information. | 100% Mortality info is recorded in the National Cause of Death Register, which is used as a basis for official cause of death statistics and contains data on cause-specific mortality for descriptions of the population's health. |
| 3 | Record **vital signs** (height, weight, blood pressure) >50% of patients as structured data. | N/A | 100% | 100% | 100% |
| 4 | Incorporated >40% of **clinical laboratory test** results into EHRs as structured data. | 84% | 100% | 100% | 100% |
| 5 | Maintain patient's active **medication list**, with >80% of patients with at least one entry record as structured data. | 66% | 100% | 65% | 100% of hospitals have a medication list in their EMR and have access to the pharmacies' medication list where all prescribed medications for the patient are registered. 50% to 60% of county councils have an integrated medication list per patient (from different physicians' EMRs) implemented. National coordination ongoing. |
| 6 | Maintain active **medication allergy list**, with >80% of patients with at least one entry record as structured data. | N/A | 100% | 65% | 100% |
| 7 | **Record advance directives** >50% of patients 65 years of age or older. | 49% | 80% | All New Zealand EHR systems are capable, but no information available about how many hospitals do it. | Information not available. |

| Types and functions of EHR capacities | | Percent of U.S. hospitals meeting EHR criteria | Percent of hospitals with EHR capacity | | |
|---|---|---|---|---|---|
| | | | Denmark | New Zealand | Sweden |
| 8 | **Computer provider order entry** (CPOE) >30% of patients with medication orders. | 30% | 100% | 100% | 100% |
| 9 | Can **electronically exchange key clinical information** among providers or patient-authorized entities. | 11% | 100% (discharge diagnosis, ICD-10) Treatment codes: operations, x-ray, histopathology/ cytology. | 95% electronically exchange of key clinical information. | Discharge planning information exchanged electronically in 100% with the municipalities. Ongoing project on National Summary Care Record, only implemented in one test region so far. |
| 10 | Provide **summary of care record** for >50% of patients referred or transitioned to another provider or setting. | N/A | 100% | 95% | Ongoing project on National Summary Care Record, only implemented in one test site/region so far. |
| 11 | Submit **electronic syndromic surveillance data** at least once to a public health agency. | N/A | 100% | None | Surveillance data for 64 notifiable diseases are collected and analyzed using an electronic service, SmiNet. Reporting is done according to the Communicable Disease Act by both clinicians and laboratories. They report in parallel to the Swedish Institute for Disease Control and to the County Medical Officers. |
| 12 | Submit **electronic immunization data** to immunization registries or immunization information systems. | N/A | None. An obligatory national vaccination database is being implemented. | 100% | 50% National Vaccination Register |
| 13 | Provided electronic **discharge instructions** to more than 50% of patients requesting it after discharged from hospital or emergency department. | 62% | 100% | 95% | Discharge planning information exchanged electronically in 100% with municipalities and the responsible GP |

| Types and functions of EHR capacities | | Percent of U.S. hospitals meeting EHR criteria | Percent of hospitals with EHR capacity | | |
|---|---|---|---|---|---|
| | | | Denmark | New Zealand | Sweden |
| 14 | On request, provided **electronic health information** (test results, problem lists etc.) within three business days to >50% of patients requesting it. | N/A | 100% in paper form 30% electronically on the Health Portal (delay of newest information for14 days, due to professional interpretation, if needed). | 100% of hospitals provide discharge information to GPs electronically | 100% provided as paper print-out. Can be ordered electronically via a patient portal. Although not widely available yet, currently used by 5% of the population. |
| 15 | Use EHR technology to identify **patient-specific education resources** and provide >10% of appropriate patients. | N/A | 10%, may be more. High for chronic disease patients, low for simple surgery. Used 100% for rehabilitation program. | 100% | Information not available. |
| 17 | Generated at least one **list of patients** by specific conditions to use for quality improvement, reduction of disparities, research, or outreach. | N/A | 100% | 100% All New Zealand hospitals have highly functional clinical intranets that can analyze patients by condition. | Percentage unknown. Depends on the EHR system used. Can be generated out of disease registries but those are not automatically fed by EHR. |
| 18 | Implemented at least one **clinical decision-support rule** and have ability to track compliance. | 61% | Unknown | 100% | Simple decision-support, e.g., warning implemented depending on EHR system used. |
| 19 | Implemented systems to **protect privacy** and security of patient data in the EHR. | N/A | 100% Denmark has a strong data protection law. All exchange of data must be accepted verbally by patient. | 100% NZ has a health information privacy code that is well understood and widely applied. | 70% use the national infrastructure to handle security. It is based on hard certificates and used for authentication, single-sign-on, electronic signatures etc. |
| 20 | Implemented **drug formulary checks.** | N/A | 100%, same as primary care physicians. | 100% of hospitals have automated drug formulary checks. | Depends on the EHR used. 12 of 21 county councils are connected to the National Drug Registry which can be used for formulary checks. |

Notes: EHR = electronic health record; GP = general practictitioner; ICD = international classification of disease; ICPC/ICPC2 = International Classification of Primary Care, 2nd Edition.
Sources: A. K. Jha, C. M. DesRoches, P. D. Kralovec et al., "A Progress Report on Electronic Health Records In U.S. Hospitals," *Health Affairs,* Oct. 2010 29(10): 1951–57; For Sweden, percentages in table reflect public health care. If exact figures were not available, estimates were provided by L. Jervall at the Center for eHealth in Sweden. For New Zealand and Denmark, figures come from multiple surveys reviewed by the coauthors in those countries.

ABOUT THE AUTHORS

Bradford H. Gray, Ph.D., is a senior fellow at the Urban Institute in Washington, D.C., and editor of *The Milbank Quarterly*, an interdisciplinary journal of health policy and population health. He is also senior advisor to the Commonwealth Fund's Harkness Fellows program and co-editor (with Robin Osborn) of the Fund's Issues in International Health Policy. He previously established and directed the Division of Health and Science Policy at the New York Academy of Medicine. Previously, while on the faculty of the Department of Epidemiology and Public Health at Yale University, he directed Yale's Institution for Social and Policy Studies and its Program on Nonprofit Organizations. Earlier in his career, he spent a decade as a study director at the Institute of Medicine and served in a staff capacity for the National Commission for the Protection of Human Subjects and the President's Commission for the Study of Ethical Problems in Medicine and Research. He has written extensively about for-profit and nonprofit health care, and has also done research on Medicaid, managed care, ethical issues in research, and the politics of health services research. He holds a Ph.D. in sociology from Yale University. He is a member of the Institute of Medicine.

Thomas Bowden is chief executive officer of HealthLink Ltd, a New Zealand-based health-system integration company that he cofounded in 1993 under an agreement with the New Zealand Government. HealthLink provides electronic communications and data security services to more than 9,000 individual health care organizations across New Zealand, Australia, and the Pacific. HealthLink is currently leading an Australasian-wide initiative to implement electronic referrals between primary care providers and hospitals. Mr Bowden has been involved in a series of international health system comparisons and he has performed consulting assignments for government health care agencies in Australia, Canada, and Denmark.

Ib Johansen is the deputy manager and consultant at the Danish Centre for Health Telematics, a position he has held since 1994. He is responsible for developing, testing, and implementing technology standards in the Danish health care system, for the national MedCom dissemination and quality assurance project, and for testing health information technology systems.

Sabine Koch, Ph.D., is the first professor of health informatics at Karolinska Institutet in Stockholm and director of its Health Informatics Centre. She was previously associate professor and director of the Centre for eHealth at Uppsala University. Her fields of interest include models for cooperative care, human factors and usability, and evaluation of health information systems. She is the current president of the Swedish Federation for Medical Informatics and the incoming treasurer of the International Medical Informatics Association. She is a member of the editorial boards of several international medical informatics journals. In recent years, she acted as scientific expert to the Swedish National Board of Health and Welfare with regard to the national information infrastructure for health and social care and was involved in the development of a model for estimating the benefits of national eHealth investments on behalf of the Ministry of Health and Social Affairs. She holds an M.Sc. and a Ph.D. in medical informatics from Ruprecht–Karls University Heidelberg.