



**ELECTRONIC MEDICAL RECORDS—  
GETTING IT RIGHT AND GOING TO SCALE**

W. Edward Hammond, III, Ph.D.  
Duke University Medical Center

January 2004

This is a background paper prepared for The Commonwealth Fund/Nuffield Trust Conference, “Improving Quality of Health Care in the United States and the United Kingdom: Strategies for Change and Action,” Pennyhill Park, Bagshot, England, July 11–13, 2003.

Support for this research was provided by The Commonwealth Fund. The views presented here are those of the author and should not be attributed to The Commonwealth Fund or its directors, officers, or staff.

Additional copies of this (#695) and other Commonwealth Fund publications are available online at [www.cmwf.org](http://www.cmwf.org). To learn about new Fund publications when they appear, visit the Fund’s Web site and [register to receive e-mail alerts](#).



## CONTENTS

About the Author .....	<a href="#">iv</a>
Introduction .....	<a href="#">1</a>
The Current State of Electronic Medical Records.....	<a href="#">4</a>
Policy Issues Around Implementation of Electronic Medical Records .....	<a href="#">11</a>
Issues for Discussion.....	<a href="#">13</a>

## LIST OF TABLES

Table 1	List of Vendors Providing EHR and Related IT Products.....	<a href="#">5</a>
Table 2	Partial List of Institutions Well-known for Information Systems.....	<a href="#">6</a>

## ABOUT THE AUTHOR

**W. Edward Hammond, III, Ph.D.**, is professor emeritus, community and family medicine, and professor emeritus, biomedical engineering, at Duke University, and an adjunct professor in the health sectors management division of the Fuqua School of Business. He has had extensive experience in the design and implementation of electronic patient records. He is a codeveloper of The Medical Record (TMR), which functions in both inpatient and outpatient settings and is a clinical as well as a billing record system. He is also involved in the development of data standards and controlled vocabularies.

Hammond is president of the American Medical Informatics Association (AMIA). He has served on the AMIA Board since its inception, and has served as treasurer twice, chair of Health Level 7 twice, and is currently cochair of the Vocabulary Technical Committee and vice chair of the HL7 Technical Steering Committee. Hammond is currently chair of the Data Standards Working Group of the Connecting for Health Public-Private Consortium, serves on the Board of the eHealth Initiative, and serves as a member of the Institute of Medicine Committee on Patient Safety Data Standards. He also served as president of the American College of Medical Informatics (ACMI), chair of the Computer-based Based Patient Record Institute, and chair of the Special Interest Group on Biomedical Computing for two terms. He is currently the convener of the International Standards Organization Technical Committee 215, Working Group 2. Hammond has served and is serving on a number of editorial boards and National Institutes for of Health review committees, and has published over 300 technical articles. He is a fellow of ACMI and of the American Institute of Medical and Biological Engineering.

## **ELECTRONIC MEDICAL RECORDS— GETTING IT RIGHT AND GOING TO SCALE**

### **INTRODUCTION**

Increasingly, it is becoming clear that all aspects of health care can only be significantly improved or even “fixed” by the acquisition, aggregation, and sharing of clinical and administrative data. Providers need information for informed decision-making in real time, at the point of service. The economics demand that data be collected once at the point of creation and, preferably, entered automatically or by the source of the data and reused throughout the system. Such an approach demands cooperation among a myriad of stakeholders never before achieved. The influencing factors include demand for high-quality care embedded in an evidence-based medicine approach, significant reduction in medical errors, reduction in cost of care, higher efficiencies, equity in access and level of treatment, timeliness, and better management of chronic disease. The requirements are further expanded, driven by current events, to include health surveillance (evidenced by the recent SARS experiences) and the threat of bioterrorist activities (anthrax, smallpox, plague, and others). The explosion of knowledge and the distribution of that knowledge through electronic as well as paper media have added a new requirement for much more focused and appropriately filtered presentation of data. Electronic availability of data and knowledge has significantly reduced the lag time from creation of data and knowledge to use for intervention and treatment with corresponding improvements in outcomes. Real-time data mining from electronic health records, and the immediate application of that derived knowledge to patient care, become achievable goals.

Recognition that the quality of data required for clinical use and research is similar, and that the costs of recruiting patients for clinical trials and acquiring the research data independent of the clinical process is prohibitive, has led to models that perform both services as well as reporting for various purposes and reimbursement. An increasing interest on the part of the consumer in participating in informed decisions relating to their health and health care has introduced a new component to the traditional hospital-based illness treatment model for health care. This new consumer interest has opened many new avenues for information management and information sharing, including the concept of the personal health record and access to health-related information on the Internet, with corresponding problems of quality control, authentication, appropriateness, and understanding. Medical advice and prescribing on the Internet has raised many new ethical and legal issues, including differing state laws regulating the use of these resources. Consumer interests have increased the visibility of models for community health care, including nursing homes, home health, skilled nursing, rehabilitation, retirement

communities, public kiosks for education, and “shopping mall health testing” (e.g., magnetic resonance images and other imaging, cardiovascular testing, and other diagnostic testing). Continued emphasis on preventive care and healthy lifestyles has changed the focus in the United States from an electronic medical record to an electronic health record (EHR).

All of these factors have resulted in new views of what is required for the use and management of clinical and administrative data in health. The model includes three views of the EHR: (1) an institutional/provider EHR that is similar to what most people recognize today as the medical record; (2) a population health record that is defined regionally and linked nationally; and (3) a personal health record.

For most U.S. institutions, institutional/provider data exist today primarily in paper form. Even if they exist in electronic form, they are not linkable and shareable with other systems. The relationship of the EHR to the ordering process (Computerized Provider Order Entry and ePrescribing systems), the Hospital Information System, ADT systems, departmental systems, etc., as well as different settings (e.g., inpatient care, outpatient care, nursing homes, intensive care, emergency departments) must be considered. This record also serves the purposes of credentialing, billing, reporting, and administrative management, including staffing.

The “population view” serves the need for public health in health surveillance and monitoring for bioterrorist events. This population health record, a summary record derived from the multiple points of care, also can serve research purposes for better understanding of prevalence of disease as a function of many environmental factors (e.g., geography, weather, and occupation) and understanding differences in treatment and outcomes. The population record also will serve—with a patient’s permission—as a tool of communication among all providers involved in that patient’s health. The consumer should be able to control and monitor access to this record.

The final view is the personal health record, which is growing in popularity in the United States. Throughout all of these views, the focus is patient-centric. Exactly what is meant by this term is still being discussed, but essentially it means the focus is on the patient, and that patient data are independent of the source and input, storage, and presentation. The data are accumulated and analyzed to provide a current view of a person’s health status as well as a predictor for future events. With this focus on the patient, however, it is important to note that there are many other uses of the EHR, including a provider-centric view.

Given this vision of the EHR, it is obvious that interoperability for the interchange and sharing of data and for the necessary underlying infrastructure is fundamental. It should also be obvious that the term EHR really implies an EHR system, rather than only a data repository, although that is an important component.

Most hospitals in the United States currently support some form of computerization of data. An estimated 13 to 15 percent of hospitals have some type of electronic prescribing. However, providers in these hospitals enter less than 25 percent of their orders electronically. Most systems serve administrative and financial requirements; in the clinical area, the functions are primarily service-related. Paper is still the primary form for storage of data for patient care. In outpatient settings, the use of computers is almost predominately for patient management (administrative and financial). Less than 8 percent of providers in the United States use an EHR.

Today's electronic record systems have been developed over many years. Technology has changed, and concepts have changed. Systems were not designed with data sharing, integration and aggregation, and interoperability in mind, particularly beyond the institution. Standards are necessary for data sharing. Some have been developed, others are being developed, and others are yet to be developed. Operationally ready are the Health Level 7 (HL7) Reference Information Model (RIM), the HL7 V2.n, and evolving V3 data interchange standards. The HL7 RIM provides a basic information model to which any subsequent developments may be mapped. The RIM provides a commonality among standards and system developers. Data types define a structure of data elements and are necessary to be specified for each data element to insure interoperability. Common data types include numeric, text string, integer, datetime, currency, and coded. More complex data types include names and addresses.

In development are the Clinical Data Architecture, Clinical Templates, Clinical Guidelines and Decision Support Algorithms, and a functional model for the EHR for various clinical settings. Other operable standards include Digital Imaging and Communications in Medicine for imaging, the Accredited Standards Committee X.12 transactions standards as required by the Health Insurance Portability and Accountability Act (HIPAA), the National Council for Prescription Drug Programs, Inc., SCRIPT for electronic drug reimbursement, and the Institute of Electrical and Electronic Engineers 1073 series of standards medical device communication. The lack of a single integrated terminology standard remains a major barrier for the aggregation of data across multiple sources. Major progress is being made in this area with the U.S. Department of Health and Human Services (HHS)/Systematized Nomenclature of Medicine (SNOMED) agreement

to include SNOMED Clinical Terms in the National Library of Medicine's Unified Medical Language System and make SNOMED CT available without cost in the United States. Other terminologies include Logical Observation Identifiers Names and Codes (LOINC), International Classification of Diseases (ICD) 9 and 10 with clinical modification, Current Procedural Terminology, nursing terminologies, and over 90 other terminologies. Efforts are now underway to map these various terminologies into a single, integrated terminology.

Other barriers include provider resistance, slower workflow resulting in lower productivity, affordability of systems, lack of knowledge about what to buy, lack of appreciation for value of information technology (IT), lack of defined migration pathway, questionable adequate functionality, stability of the market, and failure to provide an effective business case for core use of IT.

### **THE CURRENT STATE OF ELECTRONIC MEDICAL RECORDS**

The current state of electronic medical records is difficult to ascertain because of the many differences discussed above. Implementations include a combination of commercial products and systems developed in-house. There is a wide range of functionality that differs from site to site, even when using the same vendor product. Based on personal experience, it appears that only half of the software licenses purchased are actually ever implemented. There are an increasing number of articles published that give strong evidence of the value of IT systems in all of the various health care settings as well as an increase in satisfaction by both patients and providers. In spite of that evidence, growth in the marketplace is extremely slow.

One of the barriers to the purchase of EHR systems is the instability of the vendor community providing systems. The survival time of many small vendors is only a few years. In the past 10 years, Duke University purchased at least two IT systems and then had the vendor declare bankruptcy before the system was installed. The market is extremely volatile with only a few vendors surviving over the long term. Table 1 identifies vendors that market a range of products, including components of an inpatient Health Information System (HIS) and ambulatory care systems. All of these vendors include an EHR product, but functionality varies widely. Vendor attitude relating to interoperability within an institution and among multiple institutions ranges from "We can do that" to "Why would anyone want to do that?" Vendors are driven in their product development by what customers wish to buy.



Table 1. List of Vendors Providing EHR and Related IT Products\*

3M–Health Information System	IDX
Cerner	McKesson
Eclipsys	Meditech
Epic	Misys
Philips Medical Systems	Siemens
GE Medical Systems	

\* The list is not complete but represents a common set.

Most institutions today purchase products from multiple vendors and create a “best of breed” system. Such an approach accommodates differences of opinions, biases, and preferences about products and diminishes dependency on a single vendor. This heterogeneous approach requires the use of data standards to achieve some degree of interoperability. Most institutions today have a variety of products that are not interfaced, and data, while widely available, are not integrated. Many vendors today are marketing “integrated systems,” which provide a homogenous approach to systems integration. While that approach provides a higher degree of data sharing, commitment to a single vendor is strong.

When the “best” systems are identified today in the United States, most of them come from academic medical center settings and most include some degree of in-house development. A few of these systems have been the basis for a subsequent commercial product, but most have required a reworking of the product before it is implemented in a commercial setting. Table 2 identifies some well-known and highly publicized systems that have enjoyed some degree of success.

Table 2. Partial List of Institutions Well-known for Information Systems

---

Beth Israel CareGroup HealthCare System, Boston  
Columbia Presbyterian  
City of Hope, Los Angeles  
Intermountain Health, Utah  
Kaiser Permanente  
Mayo Clinic—Scottsdale, Rochester, Jacksonville  
Partners HealthCare System—Brigham and Womens,  
Massachusetts General Hospital  
PeaceHealth  
Regenstrief Institute, Indiana  
Santa Barbara County Care Data Exchange  
University of Illinois Chicago Medical Center  
University of Pittsburgh  
Vanderbilt University  
Veterans Health Association

---

The Regenstrief Medical Record System (RMRS) is perhaps one of the best examples of developing, implementing, and going to scale with an electronic medical record system. The system, which has undergone constant development since the late 1970s, has served as an example for evolution in the use of IT over several decades. The RMRS, developed by Dr. Clement McDonald and colleagues at the Regenstrief Institute, also has provided many examples of the value of the EHR in patient care. McDonald was one of the first to prove the value of reminders during the care process. He found that providers who were given reminder messages were twice as likely to provide preventive care as those who were not. Regenstrief has been a pioneer in the use of the HL7 data interchange standards and is the impetus for the development of LOINC, which is used primarily for naming and coding laboratory tests.

Since 1994, a community EHR based on the RMRS has operated in the Indianapolis, Indiana, area. This EHR system contains all inpatient and emergency department (ED) encounter diagnoses, procedures, and demographic data along with laboratory, radiology, pathology, inpatient medications, and all transcribed documents from 11 hospitals—accounting for more than 95 percent of the care in the region. In addition, it includes data from the public health department on immunizations. Some hospitals and one large physician group contribute vital signs, electrocardiograms, cardiac diagnostic testing images, radiology images, and more. In a pilot study, this network showed a \$26 per visit charge reduction for ED care. Much of the cost of the implementation of this project came from the National Library of Medicine.

The Intermountain Healthcare System was derived from the development of the HELP Hospital Information System at the Latter Day Saints (LDS) Hospital in Salt Lake City, Utah. Development on this system began in the intensive care setting under the leadership of Homer Warner, Reed Gardner, and Al Pryor, and many others have contributed to the system over the years of its development. An outpatient component was recently added to the functionality. The LDS HIS was transferred to a commercial vendor, 3M, and marketed as the HELP system. However, there is considerable difference in Intermountain Healthcare's computer system today and the 3M product. The Intermountain system now provides connectivity between hospitals and clinics in the Intermountain Health System, linking 23 hospitals, 70 clinics, and two clinical laboratories. These settings share common vocabularies, common applications, and a common database. The HL7 provides the linkages among the components of the system. Much of the research and development of this system was provided by federal funding.

The Vanderbilt system was developed in-house and centered on a Computerized Physician Order Entry (CPOE) System known as Wiz Order. This system has resulted in considerable cost savings, higher quality of care, and reduced medical errors. This system was migrated to the commercial market through McKesson as the Horizon CPOE System.

The Santa Barbara County Care Data Exchange was created to test the concept of community-wide shared information services. Participants come from a collection of medical groups, hospitals, clinics, laboratories, pharmacies, payers, and other health care organizations committed to exchanging clinical data at the point of care. The group identified a number of problems that resulted in lower quality and efficiencies in care:

- Physicians sharing the same patient ordered duplicate tests and therapies. The same drug and radiology exam were ordered 11 percent of the time. Half of the time, patients followed the duplicate instructions.
- Physicians did not know what other physicians were doing to their patients. Primary care physicians were not aware of one of four prescriptions taken by patients.
- Uncertainty and hassle reduction drove decisions. One of seven admissions resulted from missing information in EDs or primary care settings. One of five lab and X-ray tests were duplicates because of retrieval barriers.

The typical physician in the Santa Barbara network gets test results from five or more sources. By making information accessible all in one place, workflow is simplified

and staff members are able to focus on other things. Another benefit to physicians is that more patient data are made available. Preliminary results from this effort suggest major changes in the behavior of both providers and patients, with significant improvements and increased satisfaction in both providers and patients. Many of the physicians involved in the Santa Barbara project intuitively believe that quality of service will improve through data sharing. The project is commissioning a study to address the impacts on service quality. Key areas that will be tested include: reduction of duplicate and inappropriate utilization, reduction in hospitalizations and inpatient length of stay, improvement in preventive care by involving the patient, and reduction in the turnaround time of results that will accelerate the treatment process.

PeaceHealth is a not-for-profit network of community hospitals across three states in the Northwest. It consists of five regional medical centers, physician practices (275 employed physicians and 1,400 affiliated physicians), labs, pharmacies, and chronic care. PeaceHealth has implemented a single electronic medical record, lab system, financial system, practice management, and data warehouse across all of its facilities. The resulting network has resulted in greater cost-efficiencies and increased clinician satisfaction. The strategy has improved revenues for the organization, while reducing costs by 20 to 30 percent per unit of service. Nurse satisfaction has improved by 15 percent, and adverse drug events are down by 80 percent. PeaceHealth has included some automation in nursing homes as part of this network.

The Mayo Clinic, in Scottsdale, Arizona, began as a paperless hospital but delayed the implementation of the EHR in its ambulatory care setting until 2000. That project is now functioning, with major benefits in terms of improvements in quality of care, reduction of medical error, and improved care at reduced costs due to better-informed decisions. The Kaiser Foundation, after one abortive try, has budgeted \$2.5 billion for the development of an EHR, working with Epic. The Veterans Health Association has implemented an EHR system called VistA throughout its system. VistA serves more than 5 million veterans in 22 designated regions.

Most of the development costs of the systems mentioned here have been from federal grants.

The electronic health records, known by a variety of names over the years, have been a goal of informaticists for at least three decades. Some progress has been made, but no one system has clearly demonstrated that the problem has been solved and the market understands what is required and how to do it. A few systems, such as RMRS and

Intermountain Health, have continued to evolve and influence health care in their settings. Other systems have come and gone. Much has changed over the last three decades. Technology is clearly adequate for scalability in numbers and volume. Universal connectivity and network speeds are more than adequate and permit reasonable and affordable access to multimedia records. Although still not without problems, data entry and the human/computer interface have progressed. Response times, for the most part, are scalable and adequate. Failures or dissatisfaction with systems are still the norm. Despite some evidence to the contrary, many people are not convinced of the cost-effectiveness of the EHR. Many studies have demonstrated the benefits of specific aspects of an EHR, but none has provided the compelling evidence to make the EHR a national mandate.

Electronic medical records will help physicians find the information they need when they need it. At least 30 percent of the time, physicians cannot find patient information that had been previously recorded in a paper-based chart. Not knowing what has happened may lead physicians to recommend tests to confirm diagnoses that were already confirmed, duplicate lab tests and other medical services, delays in treatment, and increased risk of medication errors if physicians do not know what drugs patients are taking or what allergic reactions they have. Patient satisfaction would be immeasurably enhanced if they simply did not have to repeat demographic, financial, and even clinical data at every encounter.

Even as a stand-alone implementation, the EHR can have a significant impact on cost and quality. In one study, evidence suggests that primary care providers can save an estimated \$86,400 over five years, instead of using traditional paper-based methods. These benefits are expected to be realized through adverse error reduction, reduced spending on drugs, reductions in radiology, decreased billing errors, and improved charge capture for billing. At a macro level, CPOE systems have the potential to avoid 522,000 serious medication errors in the United States per year. A study of intensive care patients found that when physicians used a computerized system, the incidence of allergic drug reactions and excessive drug dosages dropped by more than 75 percent, and the average time patients spent in the unit dropped from 4.9 days to 2.7, slashing costs by 25 percent. Brigham and Women's Hospital found a 55 percent reduction in error rates from 10.7 to 4.9 errors per 1,000 patient days. Another example demonstrated an 84 percent reduction in potential adverse drug events. The LDS Hospital in Utah demonstrated a 70 percent reduction in adverse drug events.

In an early study at Duke, simply having medical information accessible via computer resulted in an estimated \$596 savings per year for geriatric patients. In other

studies in the outpatient setting, it was found that simply displaying test results or predicting test results can reduce test utilization. Even having access via wireless methods to only certain components of the medical record, such as laboratory results, can influence utilization and management.

Computerization of adverse drug event reporting is shown to be more effective than traditional chart reviews, and to cost 20 percent less. Beyond institution-specific savings, coordination of efforts around adverse drug event reporting at the federal level represents another significant opportunity to improve our system. Mark McClellan, commissioner of the Food and Drug Administration (FDA), stated: “In medical care, it is conceivable to develop an electronic network that would provide automatic updates on adverse events and the circumstances that may have contributed to their occurrence. Such an information network could also enable the FDA to disseminate automatically updated, relevant information on medical labels and warnings, and thereby help prevent the adverse events from happening again.”

Additional savings result from not having to file, store, and retrieve paper charts as well as not having to manage getting charts signed and locating missing charts. Costs for performing these tasks range from \$12 to \$28 per visit. Relatively expensive paper-based processes are replaced by electronic, labor-free, low-cost transmissions. The payback for data-handling costs alone is more than two to one. This gain does not factor in savings that would be realized through more appropriate utilization of services (e.g., lab tests, admissions, physician time, etc.). The primary beneficiaries of these cost savings are the net data suppliers: hospitals, labs, pharmacies, radiology sites, and other institutional providers. Physicians have not been included in this dollar impact, since their labor costs are typically low (usually one full-time equivalent).

Few systems implemented take advantage of all the functionality that could be available in today's EHR systems. Decision support and effective, integrated clinical guidelines are not widely implemented. No systems provide a person-centric EHR with data aggregated from all points of care. Most institutions, like Duke, have little interoperability among the 20 to 30 different systems implemented throughout the institution. Quality of care will be realized through improved clinical data collection driven by more consistent implementation of clinical guidelines. Quality will be improved through the use of disease registries that are updated automatically from EHRs and focus on performance indicators for quality care. Little of this occurs today.

## **POLICY ISSUES AROUND IMPLEMENTATION OF ELECTRONIC MEDICAL RECORDS**

If you look at the different implementations of the EHR across the United States, you will find that someone somewhere has implemented most of the desirable functions for the EHR, but no single implementation encompasses them all. Although there is proven value in the implementation of a stand-alone EHR, a major increase of value occurs when data and knowledge are shared across the total expanse of health care. Further, complete implementation of functionality, including the features of CPOE and ePrescribing, including decision support, aggressive use of standards, scheduling, reminders, clinical guidelines embracing evidence-based medicine, disease registries, and an aggregated, person-centric EHR available universally is an obtainable goal. The functionality should also include establishing eligibility status, billing and claims, and required reporting. The issues of privacy, security, and confidentiality can prevent widespread implementation and effective use of the EHR if they are either over- or underemphasized. The HIPAA privacy requirements have not solved the problem. The ambiguity of the rules permit both over- and under-interpretation. This issue needs to be addressed quickly. Control and ownership of data must be decided by balancing the perspectives of consumers and providers.

Perhaps the most important policy consideration is who sets policy. The balance among policies that are voluntary, market-driven, incentive-driven, or mandated is important. In some instances, one approach will work; in others, the approach must be different.

To create effective policies for interoperable IT health care systems, we must first create a shared, national vision that defines an operational framework for accomplishing the goals of a comprehensive, person-centric EHR. It is clear that this vision must include a national infrastructure that will support the linking and sharing of data. Interoperability requires the creation, adoption, and implementation of the necessary set of data standards. The *Connecting for Health Initiative* has recently completed a nine-month project focused on accelerating the rate of adoption of national clinical data standards throughout the nation's health care system to facilitate interoperability. That report identifies operable standards, presents the value proposition, and addresses a migration strategy.

U.S. Secretary of Health and Human Services Tommy G. Thompson stated on March 21, 2003: "It is important for the federal government to lead by example by selecting and adopting these clinical data standards. With appropriate privacy protections for personal health information, consumers and patients will benefit when their health

information is available to their doctors and other health care providers when it is needed, such as in the emergency room. But we cannot do it alone. The private sector will be crucial to the widespread diffusion of these standards.” He endorsed the work of the federal government’s Consolidated Health Initiative (CHI), a consortium of federal agencies with an interest in using IT in the health system to improve patient safety and reduce costs. Thompson recognized the need for a common coding system in order to ensure that health information is available to the patient’s physicians and other health care providers when it is needed. Thompson stated, “Health technology is going to be the key driver of change for the 21st century.”

Thomas Scully, Administrator of the Centers for Medicare and Medicaid Services (CMS), committed CMS to the adoption of clinical data standards and to the launching of demonstration projects to evaluate reimbursement alternatives for IT in health care. Scully also stated that CMS was committed to supporting the rapid acceleration of adoption of EHRs in the ambulatory environment. To that end, the CHI has enabled an accelerated effort by the Institute of Medicine and HL7 to create a technical specification defining the required functionalities of the EHR in various care settings.

The National Committee on Vital and Health Statistics, the President’s Information Technology Advisory Committee, and the Institute of Medicine have emphasized the importance of a national health information infrastructure (NHII), which is essential to improving patient safety and quality, rapidly detecting bioterrorism and other health threats, and enhancing the efficiency of the health care system. The recommendation stated: “Recent events underscore that an effective NHII is not a luxury but a necessity; it is not a threat to our privacy but a vital set of resources for preventing and addressing personal and collective health threats.” The recommendation also stresses that the initiative must be a public/private collaboration. The first recommendation, the establishment of a senior position and a lead office within the HHS with the authority and funding for building relationships in the public and private sectors, has been accomplished. Dr. William A. Yasnoff, M.D., Ph.D., has been appointed as the senior advisor in HHS for this project. Several meetings have occurred, and a major meeting involving all stakeholders was held June 30 to July 2, 2003. HHS Secretary Tommy Thompson, at this meeting, noted that grocery stores in the U.S. were more automated than most health care facilities. He endorsed the development of functional standards for the EHR by the Institute of Medicine and by HL7.

A number of policy-setting bills have been introduced in Congress, including bills for patient safety, improving quality, creating a national network, and adopting the EHR.



Several important issues remain to be addressed. It is critical that the federal government take the lead in establishing the infrastructure for the NHII. That infrastructure not only must include the leadership and vision for such an infrastructure but also the funding and momentum to create the vision, plans, and, ultimately, the physical connectivity to make this occur. The government should continue to support the adoption and implementation of existing standards and encourage through funding and other mechanisms other standards that must exist. The government should support certification of vendors to compliance of standards and create funding and processes to distribute and maintain standards and knowledge bases, including terminology, clinical guidelines, clinical documents, clinical templates, master data registries, disease registries, and other appropriate items. The government should support research in data mining, health surveillance, and analyses of data in these nationally linked databases to improve our understanding of the occurrence of diseases, the causes of diseases, differences in outcomes, treatment effectiveness, patient safety, clinical trials and other research, and new methods of surveillance. Much of the dollars in research today is spent on establishing the infrastructure to collect, mix, and create databases. With an effective and efficient population dimension, much of that work already will have been completed, and the funding can be used more effectively for research.

If data are to be aggregated across multiple sites of care for each individual, the most effective, error-free method of linking the data is a unique personal identifier. This is a sensitive issue, but the public must be educated to understand the inherent value of such an identifier. It is also important to establish levels of privacy, security, and control of data that reduce the risk of misuse of such an identifier.

National policies to address the barriers identified in Section I are needed. A primary concern is funding or providing incentives for creation of EHR systems in all health care settings, from large to small inpatient, outpatient, nursing home, home health, rehab, intensive care, pharmacy, dental, and skilled nursing settings. It also is important to link all these together and couple them with the consumer domain through the personal health record for an ideal health environment.

## **ISSUES FOR DISCUSSION**

It is important to establish a common understanding of the role of the EHR system in the new view of health and health care. What are the required differences in the different settings in which health care is delivered? Is there one EHR, or are there multiple, interoperable EHRs for the different settings? When does data flow from one setting to another? How do the three domains or views of the EHR relate? How is the content of

the EHR established? Does every institution have to collect the same data? Is data restored in the population record and in the personal health record as well as in the provider record? How much of the actual data architecture will we define and standardize? Where do the propriety boundaries stop and the national standards begin? What additional standards are necessary and who should create them? How important is the internationalization of standards and sharing of knowledge bases? Do we need an international terminology, data elements, and person identifiers? When and how do we introduce genetics into the EHR?

What kind of comparative studies could be done to look at the strengths and weaknesses of the two different health care systems? Which system provides the best care for the money and why? How does the role of IT vary from England to the United States? Does provider acceptance differ between the two countries? How do consumers perceive the value of IT in health care, and how do they relate to EHR in the two countries? Does the United Kingdom share the United States' interest in the three views of the EHR? What knowledge, tools, and resources might be more effectively shared across the countries? Is the occurrence of medical errors similar in both countries? How do outcomes differ, and what are the factors creating the differences? How do we share lessons learned? How are the countries dealing with the vulnerable population who may not have access to technology—the digital divide?

What is the time frame in which these goals may be accomplished? What will it cost? What is the most effective way of paying for IT in health? What are the savings in each country, and how can they be documented?