Viewpoint Paper

Accelerating U.S. EHR Adoption: How to Get There From Here. Recommendations Based on the 2004 ACMI Retreat

BLACKFORD MIDDLETON, MD, MPH, MSc, W. ED HAMMOND, PhD, PATRICIA F. BRENNA...
a business case focused on reduced costs associated with in-
formation management, potential quality of care impact, and, to a lesser degree, care process efficiency. For health
care providers who heretofore have borne little risk for the
quality of care provided, and who from their perspective
are managing clinical practice well with a paper-based med-
ical record, such arguments have largely fallen on deaf ears,
perhaps appropriately so.

We believe that the research agenda should focus on the value
proposition of EHR across the health care delivery spectrum.
Solid evidence of economic impact of EHR will help make the
business case for EHR and drive adoption.

Misaligned Incentives
In addition to the absence of solid evidence on the economic
impact of EHR, certain analyses suggest that the HIT market
is failing due to a fundamental misalignment of incentives be-
tween providers purchasing HIT and those who fund health
care, such as public and private payers and employers. The
economic analysis suggests that the benefits of HIT do not ac-
crue to those who must invest in these technologies. For ex-
ample, many of the patient safety and quality effects of
EHRs accrue benefit to the payer or employer–purchaser of
health care services who is at greater risk for a patient’s total
health care costs given decreasing rates of provider reim-
bursement under capitation. Under fee-for-service reimburse-
ment models, providers have little incentive to use EHRs
unless they can contribute enough to practice efficiency or
revenue cycle management to improve net revenue per time
unit. Under mixed reimbursement models such as variable
withholds, and newer pay-for-performance programs, EHRs
may contribute to achieving performance or quality bench-
marks that warrant increased reimbursement or increased
return of withhold payments. We identify recommendations
that may stimulate EHR adoption through reimbursement
reform and improved capital availability for the provider
sector.

Standards Adoption
Another component of the market failure we identify is de-
layed standards adoption. In the absence of a clear business
case or value proposition, it is not surprising that voluntary
U.S. standards-setting efforts have made slow progress in
stimulating adoption of standards addressing HIT functional-
ity, interoperability, content representation, and messaging.
With the exception of recent U.S. federal efforts at standards
acceleration and identification and endorsement of a select set
of standards for use in federal programs,9 progress has been
slow in the private sector among HIT vendor companies,
with the notable exception of the recent effort of the Markle
Foundation and the Connecting for Health Program10 and the
Integrating the Healthcare Enterprise (IHE) efforts.11
The absence of a solid business case for interoperability al-
lows vendors to take a myopic view of the use of standards
in their products and in installations of their technology in
customer environments. Few HIT customers currently pro-
pose information exchange with clinical business partners
as a requirement for their clinical systems. Commonly today,
only messaging standards are applied to ensure information
exchange between disparate systems within the context of
a single health care entity, whether group practice, hospital,
or multi-facility integrated delivery network (IDN).

Recent research suggests there is a considerable societal bene-
fit—a U.S. savings potential of $78 billion annually—that
could be achieved with seamless, fully interoperable health
care information exchange among key stakeholders in the
health care delivery system.2 At the local level, however, cur-
cently there is no financial reward for improved clinical infor-
mation exchange among health care entities that regularly
act as business partners providing care to a common set of
patients—providers are not reimbursed for electronic informa-
tion exchange. In one case of federally mandated interop-
erability standards, the Health Insurance Portability and
Accountability Act (HIPAA) engendered cooperation among
a set of diverse and potentially competing entities to improve
reimbursement transactions and administrative information
exchange12 through collaboration to identify and implement
a shared methodology for administrative transaction manage
ment. This idiosyncratic approach, however, is unlikely to lead
to a coordinated set of standards adopted across the country.

In the current marketplace, in the absence of a similar shared
and realizable gain for clinical information exchange, or other
recognition of the value of collaboration, there is no incentive
from the individual provider’s perspective for the adoption
and use of a common set of interoperability standards. Viewed
from another perspective, by distributing the costs of poor
information exchange and interoperability far and wide
across all participants in the health care delivery system,
each individual entity may be acting rationally from a local
perspective, but no entity perceives the magnitude of the
lost value in the aggregate (A. Milstein, personal communi-
cation, July 2004). This behavior precludes spending by indi-
vidual providers or purchasers of HIT for a potential public
good dependent upon the cooperation of other independent
entities. When the vendors of HIT do not perceive their cus-
tomers stating interoperability as a requirement of their sys-
tems, they act rationally and do not include these features
in their products. Thus, there is an opportunity for a third
party, such as the federal government and private payers,
to introduce reimbursement or regulatory policy changes
that would drive standards adoption.

Viable Companies and Products
The difficulties we have described prevent the development
of a robust marketplace for HIT. While the academic literature
has produced solid evidence on the impact of HIT on patient
safety,13 the quality of care,14,15 care process efficiencies,16 and
even revenue cycle management,17 the absence of a clear busi-
ness case and fundamental misalignment of incentives has
protracted the emergence of this market. To its credit, the ven-
ture capital community recognizes the potential value of HIT
and has made considerable investments over the last decade;
however, the market remains characterized by a few large
vendors (typically with diversified product portfolios, not
solely dependent upon their HIT product lines) selling to pro-
viders with sufficient operating margins and capital reserves
to make considerable investments and stay the course, and
a large number of small, highly unstable smaller EHR ven-
dors with a relatively short mean lifespan. These same pro-
viders are typically at risk themselves, through self-insured
or publicly funded health plans, for a percentage or all of their
health care expenditures and thus experience the rewards of
HIT investments themselves through internally aligned in-
centives (for example, Kaiser Permanente, Veteran’s Health
Administration). The majority of physicians’ office environments and small and midsize community hospital settings have yet to make significant HIT investments and in many cases do not believe they are in a financial position to do so.

In the absence of a viable marketplace, and with little barrier to entry in the absence of a standards conformance requirement, the HIT industry is replete with hundreds of EHR vendors attempting to provide products to fulfill niche requirements from just a few customers, paying little attention to functional, data representation, or interoperability standards for EHR. While the EHR may be conceived as a “system of systems” the lack of clarity around basic product definition, relevant standards, and market segments, stifles demand from a wary customer.

Recommendations
We now discuss four areas in which we suggest action is warranted to help stimulate the adoption of EHRs in this country: market incentives; EHR and informatics standards; enabling policy; and educational, marketing, and supporting activities. We prioritize these in a manner that we believe will lead to the quickest response, and in several areas efforts are underway. However, some require additional effort, and we suggest these initiatives may proceed concurrently. This report represents the authors’ opinions on these issues informed by the ACMI meeting held in February 2004, evidence in the literature, and experiences in both academic and commercial settings developing health care information technology.

Market Incentives
Given the heterogeneity of the U.S. delivery system and reimbursement mechanisms, we recommend the use of market mechanisms to stimulate HIT adoption. Such mechanisms take essentially one of two forms and can be expected to produce increased EHR adoption. We also suggest that an EHR certification process is called for to identify use of HIT that warrants one or both of these mechanisms. Finally, we suggest that open source technologies may have a role in lowering the price of HIT applications or components (particularly knowledge components), or pieces of the technology infrastructure for interoperability. We discuss these recommendations in turn.

Reimbursement Reform
The most direct way to stimulate any market is to increase demand. Such an increase would occur if users of HIT were directly or indirectly rewarded for using HIT. A direct reward could arise if, for example, payers required not only submission of administrative claims data electronically, but also submission of any attendant clinical information or other claims attachments in electronic form, and a differential payment was made to the provider supplying these data. This requirement would stimulate the adoption of HIT so that providers could supply both clinical and administrative data electronically. Secondary uses of these data for both individual provider performance assessment and secondary population health surveillance and public health management would produce secondary gains.

A more indirect mechanism would be to reward providers for attaining desired performance benchmarks across a variety of acute and chronic care conditions in both in-patient and out-patient care settings. While not a direct reward for the use of HIT, this would have the likely effect of causing providers to adopt HIT to capture relevant performance measures and produce timely reports, warrant the bonus payment, or return withheld reimbursement from payers. The costs of producing such benchmark reports and gathering the requisite data without HIT would be greater than doing so with HIT. Such an approach imposes fewer constraints on the providers in terms of what constitutes acceptable HIT, and thus many secondary benefits may not as readily accrue—either to the providers or to society. Nevertheless, this may be the least invasive mechanism that could leverage much of the existing HIT and produce dramatic results. The Bridges to Excellence program and the Leapfrog Group standards are notable examples of such efforts for out-patient and in-patient care settings, respectively, and several similar programs are in development or pilot stages around the country. Nevertheless, there is a paucity of evidence on what the effect of specific financial incentive mechanisms on EHR adoption is—this should be a research priority and tops our list of recommendations (Table 1).

Table 1 ■ Recommendations to Stimulate U.S. EHR Adoption

Expand the HIT Research Agenda
1. Increase funding to evaluate the impact of HIT in practice, with a focus on economic outcomes, costs and benefits.
2. Evaluate the utility of “open source” or public domain software for EHR and implementation and maintenance methods for such systems.

Financial Incentives to Stimulate EHR Marketplace
2. Capital availability: Establish low-interest loans or a grant program to facilitate hardware and software adoption in health care settings.
3. EHR Certification and Accreditation: Establish a process to certify EHR products as having requisite functionality in accordance with accepted standards and an accreditation process for level of use of EHR in practice.

HIT Standard Setting
1. Coordinate existing efforts to specify essential standards for basic EHR functionality, data representation, and messaging.
2. Specify a minimal clinical data set covering a patient’s demographics, medications, medical conditions, allergies, advance directives, and selected data pertinent to patient safety and health care quality.
3. Specify minimal functional standards for HIT systems in acute care and inpatient care settings, personal health records, and key functional components such as CPOE.

Enabling Policy
1. Promulgate Medicare Modernization Act relaxations to Social Security Act, Sec. 1877 (Stark).
2. Establish federal policy on clinical data ownership and stewardship.
3. Establish policy framework for Regional Health Care Information Authorities.
4. Establish U.S. national licensure in the health professions.

Educational, Marketing, and Supporting Activities
1. Establish educational and marketing campaign for the public—“Got EHR?”.
2. Establish educational campaign for health professionals.
3. Establish educational campaign for health care management.
4. Create a National Health Care Information Technology Resource Center.
**Capital Availability**

We believe that reimbursement reform is only one part of what will necessarily be a two-part approach to market incentives. While reimbursement reform may cause an increase in operating revenue for providers adopting HIT, it does not address the fundamental capital barrier that providers face in making the initial investment and capital outlay in expensive HIT software, hardware, support services, and the lost revenue typically associated with HIT adoption in the early phase of implementation. Many experts have described and proposed a variety of mechanisms to increase capital availability to small office environments, community hospitals, and other care settings, that lack sufficient capital reserves or credit to access capital markets. We suggest that what has occurred in many other countries should occur in the United States: low interest loans or even one-time grants to providers adopting HIT are in the nation’s and the payers’ interest to catalyze HIT adoption. Whatever the approach to providing initial hardware and software it must include a workable plan to both sustain and update those systems. We need to recognize that commitment to HIT is not a one-time expense.

**EHR Certification Process**

We believe that an EHR certification process is called for to attest to the appropriate functionality of EHRs, and an accreditation program is called for to attest to the level of use of an EHR in practice. HIT purchasers need assurance that their technology purchases will warrant incremental payments from payers. Payers need to be assured that their incentives are going to physicians who are using more than a spreadsheet as their EHR—it must meet minimal functional standards. In addition, they need to have assurance that the system is being used appropriately to achieve patient safety and quality goals; for example, that each clinician is using an electronic prescribing module for every prescription. While this may be viewed by some as something that raises the bar for entry into the HIT marketplace, this concern pales in comparison to fears HIT purchasers have that their investments will be for naught or concerns of the payer community, who fears being asked to comply with one or more of the reimbursement mechanisms we have described with no means to ensure compliance with HIT adoption or adequacy of the HIT itself.

**Open Source EHR and Related Technologies**

Finally, another market mechanism to stimulate market demand for a desired product is to lower the price. Many pundits have written about so-called “open source” software systems in health care, and many providers describe their willingness to pay for HIT at a price-point that is far below current prices for EHR. While it may be debated whether the open source model may ever truly apply to HIT technologies given their complexity, rich knowledge content for decision support, and mission-critical nature, what is clear is that for many providers, one of the main barriers to adoption is the cost of current technology. However, it is important to note what has been successful using the open source process. Most successes have been with tools and technology components rather than large applications.

The question of open-source software and component technologies warrants critical analysis and may be addressed at many levels: perhaps it is not the EHR application before the end user that should be open source, but rather the enabling technology and knowledge infrastructure underlying and supporting the end-user application. Much like the U.S. interstate highway system was viewed as a critical infrastructure for any form of transportation, public or private, we suggest that there are analogous critical information infrastructure components undergirding local HIT applications used in offices and hospitals that will enable the National Healthcare Information Infrastructure (NHII). These may include regional transaction hubs or information exchanges, secure networks and patient-matching infrastructure, public-interest organizational structures to manage regional information exchanges and broker communitywide investment and serve as a local certification authority, and so on. In addition, currently, each provider organization wrestles with the task of implementing and maintaining knowledge-based rules and alerts in its HIT applications. This time-consuming and difficult task could be ameliorated if there were an accessible library of such knowledge in the public domain. If such component tools and technologies were open source and readily available in the public domain, it could have a profound impact on vendors building HIT technologies as it would reduce their internal development costs and mitigate risks of adopting standards.

**EHR and Informatics Standards**

A great deal of activity in recent years brought considerable attention to the issue of standards development and acceleration of this process. Yet, from either a public or private perspective, adoption of even a minimal set of standards remains rare with a few notable exceptions. The standards development organizations have focused primarily on specific standards such as messaging and have assumed that other groups would develop the additional necessary standards for complete interoperability including terminology standards and a reference information model. More recently, HL-7, for example, has begun to develop standards for broader areas, addressing the complete set of standards that is necessary for interoperable data exchange. Lack of awareness regarding existing standards, confusion about which standard is the right standard, and lack of proof of the value of standards has severely limited the adoption and implementation of standards.

We believe that specification of a minimal set of essential standards that have the property of supporting interoperability (the ability to exchange clinical information reliably) is critical to rapid adoption of HIT—and a key component in deriving value from HIT. It is beyond the scope of this report to recommend specific standards, but we suggest that efforts underway in the Consolidated Healthcare Informatics initiative, the newly created Commission on Systemic Interoperability, and private sector efforts at HL-7 and ASTMM, be coordinated to ensure successful definition of essential standards for clinical information content representation and messaging.

Beyond the specification of standards for clinical information content and messaging, additional work is needed in specifying a variety of uniform clinical information data sets to facilitate interoperability between EHR implementations. The Continuity of Care Record effort is a notable example in which a set of information is defined to facilitate transfer of patients between health care entities for care and is a useful
intermediate step toward seamless health care information exchange and interoperability. We believe such instruments should be based upon a minimal set of patient care information that includes patient demographics, insurance coverage, allergies, medications, current medical problems and conditions, and the patient’s advance directives. Such a core data set serves as a means by which clinicians may quickly become familiar with a patient and serves as a foundation for clinical decision support in electronic health records. Availability of a common core set of laboratory data, and such ancillary information as prior electrocardiogram, would also be useful to promote patient safety and health care quality, and reduce redundant utilization.

Another area requiring definition and clarity is in the area of functionality of clinical information systems. Not only is this useful from the business perspectives described above, it also is critical for enabling the interoperability of an essential minimal core data set and is essential for certification purposes that will warrant additional payments or other incentives to providers from payers when the use of an EHR can be documented and attested to. The HL-7 functional model of the EHR is an excellent start, and the draft standard is now available for trial use.\(^{27}\) It is clear, however, that much more work needs to be done on functional standards for personal health records that interact with EHR systems, inpatient clinical information systems, and additional detail and specification regarding critical functional modules such as provider order entry and clinical decision support.

Enabling Policy

We identify four areas in which national policy could have a profound impact on the adoption of HIT: modification of Stark antitrust regulations, policies to guide clinical data ownership and stewardship, mechanisms to support creation of regional health care information authorities, and lastly, and with a longer view of clinical practice in this country, establishing means for national professional licensure in the health care professions. We discuss these in turn.

The Medicare Modernization Act\(^{22}\) (MMA) supports vendor adoption of electronic prescribing technology and provides for some relaxation of the Stark regulations in the Social Security Act (Section 1877). It is critical that these regulations be supported in practice from two perspectives. First, physicians in distinct organizational entities (different businesses) must be allowed to form purchasing cooperatives to allow economies of scale to accrue in HIT purchasing decisions. This would allow providers to experience considerable savings when participating in volume purchase agreements with vendors. Secondly, larger hospitals and integrated delivery networks must be allowed to improve the ability of physicians using their office technology to interact with that hospital or IDN clinical information systems for review of patient care data. In addition, health care data from the provider offices should be made available to the hospital systems. In situations in which community providers have affiliations with multiple inpatient care facilities, this ability is particularly important for patient safety and quality of care—they must have a complete view of their patients’ health care data from wherever care is provided. The MMA requirement that the hospital or IDN data be made available to any provider in the community may only be made possible through a community health information exchange.

Before discussing regional information exchange, however, it is useful to address clinical information ownership and stewardship. Many physicians express concern about adopting HIT when they cannot be assured that the information will be made available to them should they elect to switch EHR vendors. In addition, de-identified, aggregated clinical data may be viewed as a critical public good in light of bioterrorism and protecting the public health—biobehavioral and epidemiology research would be well served through access to anonymous clinical data arising from EHRs. The regulations implementing the HIPAA provide guidance for managing information security and privacy. These guidelines have been used effectively to facilitate the most notable demonstration of clinical information exchange to date—the Indiana Network for Patient Care (INPC). In this case, clinical information is shared broadly across the greater Indianapolis metropolitan area. Stewardship for the data is provided by the Regenstrief Institute, which is well versed in clinical information management and has the leadership, technical capacity, and political capital to help establish policies and procedures for the INPC. The lessons learned from this demonstration and others\(^{5,28}\) should be collected and elevated to the national policy level so that other communities wishing to create similar regional health care information exchanges could readily adopt policies and procedures that work.

While the HIPAA legislation, including the Privacy Rule, established protections for the security and confidentiality of personally identifiable health care information, it does not address fundamental issues of data ownership. Clarification of the rights of both the providers who gather and collect patient data, and the patient as source of the data, would be useful to help establish the value of these data and appropriate uses of the data in exchange for compensation in research and marketing purposes. Clarification of these rights and privileges will help define the methods to obtain patient consent and grant access to or exchange of personally identifiable health care information by authorized individuals. Such policy could allow explicit recognition of the multiple uses of medical record data within health care institutions and providers’ offices for billing, documentation, decision support, and quality analysis, as well as the patient’s rights with respect to secondary uses of the data beyond health care operations.

To derive value from HIT in clinical settings, two things must happen simultaneously: functionally rich EHRs supporting comprehensive patient data management, decision support, and health care workflow must be adopted in acute and chronic care settings,\(^{3}\) and these systems must share data with one another. That is, clinical information systems in disparate health care business entities must exchange clinical information on common patients for treatment purposes.\(^{2}\) Given the rational but myopic business perspective of most health care providers, we believe that to achieve regional health care information exchange, an appropriate regional authority must be established to guide development and implementation of data sharing policies and procedures among providers and patients, legal frameworks, enabling technologies (e.g., patient matching algorithms), and management of shared expenses and financial benefits in a coherent and sustainable business model. Such regional health care information exchanges are under development in several areas.\(^{10,21,28}\)
and several legislative efforts support this notion, but it would be useful to have in place federal guidelines, and seed money, that could be applied locally and regionally to ensure their success.

Finally, with the advent of "wired" clinical care environments and their emerging interconnectivity, and an increasingly mobile patient, we suggest that soon it will be advantageous for providers and their patients to have licensure in the health professions be provided at the federal level. Providers should be able to act on behalf of their patients even remotely; for example, when a patient is in another state, experiences a medical problem, and communicates electronically with his or her provider at home (who has access to both the local and remote health care data). Short of national licensure per se, relaxation of state regulations to facilitate reciprocity of professional licensure between state agencies is a worthy first step. Broadening the geographic scope of licensure in the health professions will allow the development of regional health care information exchanges that truly reflect "medical marketplaces" that may span across state boundaries. With national licensure or improved reciprocity between states, providers would be able to physically practice more readily in more than one state. More importantly, however, as health care becomes more "wired," providers will be able to seamlessly collaborate across state lines, rendering opinions remotely from the patient care site or remotely performing critical interpretive duties such as reading radiology, nuclear, electrocardiographic, sonographic, and other image modalities and interpreting biomedical signals, which do not require physical proximity to the patient.

**Educational, Marketing, and Supporting Activities**

Achieving President Bush's vision—that most Americans would have an electronic health record within ten years—will require an extraordinary effort. In addition to the recommendations above, we feel there is need for an educational and marketing campaign not dissimilar to the public announcements and efforts surrounding smoking cessation, drug abuse, obesity, accident prevention, and other campaigns in the interest of the public's health. At the 2004 ACMI Retreat, Kevin Johnson of Vanderbilt University suggested a campaign: "Got EHR?"

We suggest a three-pronged marketing and educational campaign directed at consumers, health care professionals, and the executive suites of our provider organizations across the country. The public has heard the news from the IOM reports that made the front pages of local newspapers, describing medical error, poor quality of care, and the role of HIT, but they do not yet generally perceive the risks of receiving care from providers and hospitals that do not have HIT with clinical decision support in place. It is often mistakenly believed that HIT is already in use. Just as a consumer buying a car today would never think of selecting one without seatbelts, airbags, or other safety features, American consumers should ask whether their personal physician and their hospital have CPOE and EHR systems in place and in use. Secondly, health care professionals may be increasingly aware of the potential benefits of HIT, but they have not yet adopted these technologies to any significant degree. In conjunction with alignment of incentives and reimbursement reforms we have described, an education campaign needs to be directed toward health care professionals to help them understand the potential of HIT, its use, and its limitations. This may begin by expanding the curriculum devoted to clinical informatics in the health professions schools. Finally, an educational campaign should also be directed at the executive suites of our health care enterprises, both large and small, where the strategic and investment decisions are made about the business of health care. Without leadership and commitment, whether it is the small office environment or the largest IDN, adoption of HIT will not proceed.

Even if every physician, nurse, and hospital were committed to adopting HIT; however, to facilitate rapid adoption, it is critical that we engineer adoption strategies that scale. That is, every clinic and hospital environment must not be forced to rediscover best practices for implementing HIT; there should be a National Resource Center for HIT that can be a repository of best practices and expertise for HIT implementation to accelerate the process. The recently announced requests for proposals from the AHRQ appear to be well targeted to meet this need. In addition, we believe there should be a national repository that would make available clinical knowledge required for HIT adoption, be readable, and be encoded in a standardized manner, including items such as appropriate controlled terminology, standard code sets, care rules, alerts and reminders, order sets, documentation templates, and forms, so that each clinic and hospital does not have to rediscover the best clinical knowledge for implementation within their chosen clinical systems. We believe the absence of such a resource protracts the implementation of HIT, and in some settings, the absence of the appropriate resources will make sophisticated decision support in clinical systems an unattainable goal. These resources should be public–private collaboratives that serve the interests of the HIT marketplace as well as the public and private purchasers of health care.

**Conclusion**

There is growing support for the widespread adoption of EHR as a fundamental strategy to improve U.S. health care delivery, efficiency, quality, and safety. Despite considerable evidence to support adoption of EHR, progress has been slow to date. We suggest that the current HIT marketplace has failed because of several factors, including misalignment of financial incentives, absence of a clear business case for EHR adoption and for interoperability between EHR implementations, and incomplete specification and adoption of relevant standards. To accelerate HIT adoption we believe a variety of stimuli are needed to align incentives, provide new incentives for adoption of interoperable EHRs, coordinate and promote relevant standards, and educate the health care community and consumers. This report describes our recommendations (summarized in Table 1) in all of these areas.

**References**

Boston, MA: Center for Information Technology Leadership; 2003.


