



Applying KISS to Healthcare Information Technology

Regina Herzlinger, *Harvard Business School*

Margo Seltzer, *Harvard University*

Mark Gaynor, *Saint Louis University*

Current public and private healthcare information technology initiatives have failed to achieve secure integration among providers. Applying the “keep it simple, stupid” principle offers the key guidance for solving this problem.

Early efforts to transform paper medical records to electronic health records (EHRs) resulted in worst-case scenarios for some institutions. California’s Cedars-Sinai Hospital, an industry leader, spent US\$34 million in 2002 to build a comprehensive EHR system that was shelved after three months when the staff that had to use it—but who were not included in its design—rebelled because the system was so slow, clunky, and out of step with the hospital’s workflow.¹

Nevertheless, hospitals, clinicians, and patients increasingly rely on information technology because multiple unrelated healthcare providers must frequently deliver services to the same patient. For those affected with chronic disease, who comprise 75 percent of healthcare expenditures and for whom integrated care leads to better and less expensive outcomes, fragmentation of care is more expensive and leads to increased morbidity. For example, patients with diabetes often suffer from multiple conditions and require care not just from their primary care physician or endocrinologist, but also from other specialists.

The lack of integration among healthcare providers lowers quality and efficiency, causing overutilization (duplicative testing and therapy) and underutilization (omitted critical steps in the care process). It also burdens healthcare providers, patients, and their loved ones as they strive to coordinate care.

Borrowing from the KISS principle in engineering and computer science—keep it simple, stupid—we explain why simplicity in healthcare information technology (HIT) is essential for providing effective, efficient, safe, and state-of-the-art medical treatment.

HEALTH INFORMATION TECHNOLOGY

Before we can look at how to make the pain go away as simply as possible, we need to look more closely at how information technology can improve healthcare management. HIT enables communication among many groups, including payers (such as health insurers, Medicare, and Medicaid), providers (physicians, hospitals, and specialists), consumers (patients), and the organizations that facilitate data exchange. Telemedicine provides scalable, cost-effective healthcare in both urban and rural areas. But two major challenges currently permeate HIT: data exchange and privacy.

Data exchange

Exchanging data among different organizations is a major challenge, thanks to numerous overlapping standards as well as structural and economic disincentives. HIT vendors create proprietary formats and extensions to emerging standards to protect their market share. One

Acronym Definitions

- **CCD:** Continuity of care document, a standard that defines the data within an EHR
- **EHR:** Electronic health record, the structured medical information about a patient kept in digital files
- **HIPAA:** Health Insurance Portability and Accountability Act, a US law defining privacy and security for healthcare information
- **HIE:** Health information exchange, the organization that helps with the exchange of health information
- **HIT:** Health information technology, the tools used for exchanging and processing health information
- **ONC:** Office of the National Coordinator, the US government office responsible for HIT

leading EHR vendor, for example, has created proprietary extensions to the continuity of care document (CCD) standard, which defines the content and encoding of information in EHRs, thus seriously hampering interoperability. This means that other vendors are disadvantaged because the data they exchange is not as content rich.

There are currently three approaches to developing standards that enable the semantically meaningful exchange of data, in other words, interoperability: government-led standards, private-sector-based standards, and healthcare information exchanges (HIEs). However, to date, none of these approaches has enjoyed sufficient success to become the de facto standard for EHRs. Rather, providers, insurers, and third-party vendors each select systems and information formats according to local traditions and needs.

In 2010, the US Office of the National Coordinator (ONC) for Health Information Technology launched the Direct project, which created a set of government standards specifying a simple, secure, scalable way to exchange data with a trusted recipient over the Internet. Direct is based on Internet protocols, such as the Simple Mail Transport Protocol and Secure/Multipurpose Internet Mail Extensions, as well as standards such as the CCD. The ONC is a powerful agency that requires organizations receiving government funding to adopt EHRs to demonstrate “meaningful use,” which is roughly defined as collecting and using the data contained in EHRs. It is defined in three stages, starting with data collection and ending with utilizing the data to produce better patient outcomes. Each stage includes interoperability mandates. Thus, the government requires interoperability but does not specify any particular standard or any process by which organizations must agree on a standard.

But an open question is whether the government’s intervention via these requirements promotes interoperability or suppresses innovation, as some critics suggest. Government-led data exchange standards might provide a long-term solution and could be cost-effective—but only if cooperative efforts among the myriad providers and insurers lead to freely available and extensible standards. There is a suggestive parallel between the current ONC effort and the government’s Open Systems Interconnection (OSI) networking standards from the 1980s. Although the government insisted that OSI networking was a requirement for the receipt of federal funding (as is the current case for ONC), the OSI networking model never achieved widespread adoption and was ultimately supplanted by the more grass roots efforts that produced TCP/IP.

If government-led standards risk stifling innovation, the private sector offers an alternative. The successful Payment Card Industry Data Security Standard, for example, gave organizations across many industries a standardized

way to protect credit card information. Similar private-sector success stories exist in healthcare as well: SureScripts is a nationwide network that enables electronic drug prescriptions and access to clinical information from member organizations such as medical providers and pharmacies. Similarly, the CommonWell Health Alliance, a coalition of private-sector EHR vendors, enables cross-entity identity management, data access management, patient record location and consent verification, and directed query services.

HIEs are hybrid government/private sector initiatives intended by the ONC to be public, private, or a combination of both. HIEs translate data between different medical standards, addressing the reluctance of healthcare providers and vendors to change systems and standards. They unburden organizations from converting legacy systems to new standards or replacing legacy systems with modern, standards-based systems. However, the biggest drawback for HIEs is that they expose sensitive medical information, which introduces significant privacy and security risks.

Privacy

The Health Insurance Portability and Accountability Act (HIPAA) is a US law mandating the privacy and security of healthcare information. However, when compared to the robust requirements for protecting credit card data, the HIPAA security rules are vague, specifying only the need to protect data, not guidelines for how to do so. As HIT advances, absent a specific set of security standards, the healthcare industry is susceptible to even more security breaches than the financial sector, such as hacks into Bank of America and Citibank, which led to millions of dollars in losses (www.wallstreetandtech.com/data-security/the-top-9-most-costly-financial-services/232800079?pgno=2).

Concerns about the ability of HIT to meet privacy and security needs are well founded because the interoperability solutions all open the door for major risks, whether the solution is government financing of EHR adoption

requiring interoperability, EHR vendor organizations such as CommonWell specifying common standards, or introducing third-party HIEs in every data exchange. The current situation is exacerbated by the growing use of analytics in HIT, which permits software vendors to take raw data from EHRs as the input for their analyses.

KEEPING IT SIMPLE

Effectively addressing these challenges requires taking a step back and creating a minimal infrastructure architecture and a set of standards for a hybrid option, which seems to make the most sense and cover the most ground. A simple, universal method for exchanging health information among different platforms and different organizations can promote both innovation and connectivity.

Simple architectures and standards have been wildly successful for the Internet's explosive growth. Indeed, the Internet's architecture is known as a "simple network," in contrast to the complex "smart" networks for traditional phone services. But what does "simple" mean in this context? We offer three principles that could well result in a more effective infrastructure—effective precisely because it is so basic.

Move from a document-based approach to metatags

Although the CCD is a step in the right direction, it seems more like an extensible wrapper holding a variety of structured documents based on vocabulary-controlled metadata. A less complex universal data exchange language that promotes information exchange at a more atomic and disaggregated level will be easier to adopt and promote greater innovation.²

When possible, triage data exchange


Although we believe in a simple data exchange strategy, we also believe that moving less data is more efficient and secure. The best way to do this is to take processing to the data instead of moving the data to a processing site. Organizations can respond to queries on their patients' behalf rather than exporting patient data to other organizations or providers, who then provide access to the queried data.

Simple IT creates safer healthcare

The first two principles promote simple and secure access to raw data and its conversion to processed information for evidenced-based medicine. The third principle posits that simple systems will promote greater use of healthcare information, which will improve health outcomes at both the individual and population level.

Data should be easy to enter and retrieve, and applications should have simple and intuitive displays.³ Systems with more components and more interfaces can have negative unintended consequences, because their complexity

creates opportunity for human error and paths for system breakdown that do not exist in simple systems. For example, complex HIT and poor data displays in emergency department EHRs lead to user fatigue and diminished alertness, and modern radiation machines cause errors such as over-radiation of patients, all because "complexity has created new avenues for error."⁴

T's maximum benefit to healthcare has yet to be achieved, in part due to the complexity of exchanging healthcare information and the complicated user interfaces for displaying patient information. Multiple parties involved must revisit how and when information is exchanged and how best to present it to patients, caregivers, and providers. 

References

1. C. Connolly, "Cedars-Sinai Doctors Cling to Pen and Paper," *The Washington Post*, 21 Mar. 2005; www.washingtonpost.com/wp-dyn/articles/A52384-2005Mar20.html.
2. "Realizing the Full Potential of Health Information Technology to Improve the Healthcare of Americans: The Path Forward," President's Council of Advisors on Science and Technology, 2010; www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-health-it-report.pdf.
3. Inst. of Medicine, "Health IT and Patient Safety: Building Safer Systems for Better Care," Nat'l Inst. Health, 2010; www.iom.edu/Reports/2011/Health-IT-and-Patient-Safety-Building-Safer-Systems-for-Better-Care.aspx.
4. W. Bogdanich, "Radiation Offers New Cures, and Ways to Do Harm," *The New York Times*, 23 Jan. 2010; www.nytimes.com/2010/01/24/health/24radiation.html?pagewanted=all&_r=0.

Regina Herzlinger is a Nancy R. McPherson Professor of Business Administration at Harvard Business School. Her research interests include managed care and the rise of consumer-driven healthcare. Herzlinger has a DBA from Harvard Business School. Contact her at rherzlinger@hbs.edu.

Margo Seltzer is a Herchel Smith Professor of Computer Science at Harvard University. Her research interests include provenance, file systems, transaction processing systems, and applying technology to problems in healthcare. Seltzer is president of the Usenix Association and a member of the Computing Research Association's board of directors. She has a PhD in computer science from the University of California, Berkeley. Contact her at margo@eecs.harvard.edu.

Mark Gaynor is an associate professor of health management and policy in the College for Public Health and Social Justice at Saint Louis University. His research interests include distributed sensor networks for medical applications and IT for healthcare. Gaynor has a PhD in computer science from Harvard. Contact him at mgaynor@slu.edu.



Selected CS articles and columns are available for free at <http://ComputingNow.computer.org>.