

Healthcare Information Systems: A Look at the Past, Present, and Future

By Larry Grandia

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As healthcare information systems become increasingly crucial to quality improvement in healthcare, CIOs are under significant pressure to prioritize their resources appropriately. When approaching these initiatives, many CIOs have asked me:

- Why do I need to focus on [data warehousing](#) and [analytics](#) now?
- Should I prioritize a data warehouse above the implementation of needed transaction-based systems (such as EMRs and department-based systems)?
- Can't I just rely on the reporting capabilities of my transaction systems to get the data my organization needs?

Hospital Information Systems: from Accounting to Clinical Decision Support

First, I want to review the history of hospital information systems and how we evolved to the point today where analytics is so important. I've been in the industry long enough to see many of these changes develop, and I believe that a data warehouse, along with analytics tools, is a core component of any CIO's application portfolio.

To back up my argument for the utility of data and analytics, let's review the evolution of healthcare information systems, or health information technology (HIT). Below, I've created a decade-by-decade list of the main influence driving healthcare in each period, the respective driver for the IT, and, finally, the HIT innovation:

1960s:

The main healthcare drivers in this era were Medicare and Medicaid. The IT drivers were expensive mainframes and storage. Because

In 2000s decade the main healthcare drivers were more integration and the beginnings of outcomes-based reimbursement. We now had enough technology and bedside clinical applications to make a serious run at commercial, real-time EHR clinical decision support.

computers and storage were so large and expensive, hospitals typically shared a mainframe. The principal applications arising in this environment were shared hospital accounting systems.

1970s:

One of the main healthcare drivers in this era was the need to do a better job communicating between health system departments (ADT, order communications, and results review) and the need for discrete clinical departmental systems (such as clinical lab, pharmacy). Computers were now small enough to be installed in a single department without environmental controls. As a result, departmental systems proliferated. Unfortunately, these transactional systems, embedded in individual departments, were typically siloed, or islands unto themselves. In other words, they were inaccessible to other departments that might benefit (not interoperable).

1980s:

Healthcare drivers were heavily tied to DRGs and reimbursements. For the first time, hospitals needed to pull significant information from both clinical and financial systems in order to be reimbursed. At the same time, personal computers and widespread, non-traditional software applications had entered the market, as had emerging networking solutions. As a result, hospitals began to integrate applications so that financial and clinical systems could share information in a limited way.

1990s:

In this decade, competition and consolidation drove healthcare, along with the need to integrate hospitals, providers, and managed care. From an IT perspective, hospitals now had access to broad, distributed computing systems and robust networks. And so we created integrated delivery network (IDN)-like integration, and with it the impetus to integrate data and reporting.

2000s:

The main healthcare drivers were more integration and the beginnings of outcomes-based reimbursement. We now had enough technology and bedside clinical applications to make a serious run at commercial, real-time EHR clinical decision support.

Decade	Healthcare Drivers	IT Drivers	Resulting HIT
1960s	Medicare/Medicaid	<ul style="list-style-type: none"> ➤ Expensive mainframes ➤ Expensive storage 	Shared hospital accounting systems
1970s	<ul style="list-style-type: none"> ➤ Hospital-wide communications (ADT, OC, Bed Control) ➤ Broadened administrative systems ➤ Departmental systems processing 	<ul style="list-style-type: none"> ➤ Smaller computers ➤ Improved terminals and connectivity 	<ul style="list-style-type: none"> ➤ Expanded financial and administrative systems (PA, GA, HR, MM, OP/POB) ➤ Results review ➤ Selected clinical department automation (Lab, MR, RX)
1980s	DRGs	<ul style="list-style-type: none"> ➤ Networking ➤ Personal computers ➤ Cheaper storage ➤ Independent software applications 	<ul style="list-style-type: none"> ➤ Integrated financial and clinical (limited) systems ➤ Managed care financial and administrative systems ➤ Departmental imaging (limited systems)
1990s	<ul style="list-style-type: none"> ➤ Competition, consolidation ➤ Integrated hospital, provider, and managed care offering 	<ul style="list-style-type: none"> ➤ Broadened distributed computers ➤ Cheaper hardware and storage 	<ul style="list-style-type: none"> ➤ Expanded clinical departmental solutions ➤ Increased IDN-like integration ➤ Emergence of integrated EMR offerings
2000s	<ul style="list-style-type: none"> ➤ More integration ➤ Beginnings of outcomes-based reimbursement 	<ul style="list-style-type: none"> ➤ Mobility ➤ Emerging cloud computers and cloud based big data analytics 	<ul style="list-style-type: none"> ➤ Emerging, broad-based clinical decision support ➤ Broad operational departmental systems with EMR integration ➤ Emerging data warehousing and analytics solutions

Today's focus, out of absolute necessity, must be on quality performance improvement in healthcare, especially on the clinical side. Essential to this focus is the need for an analytics offering that can bridge and merge multiple applications—clinical systems, financial systems, patient satisfaction systems, and so forth.

A Fortuitous Byproduct of Healthcare IT Implementation

As the decades passed, the most commonly implemented healthcare information systems were those designed to automate transactions, either in a clinical or administrative context. The proliferation of transaction systems led to the dramatic increase in readily available digitized data. I like to think of this data as pure exhaust from a transactional data warehouse—we certainly didn't install the systems for the data, but data emerged as a critically useful byproduct. Suddenly, we found ourselves with enormous amounts of data siloed in multiple, discrete applications. Pioneers, such as [Dr. Brent James](#) at [Intermountain Healthcare](#), began to articulate to the industry that improving operational performance (interoperability) would require health systems to merge and then analyze this data.

Another focus of hospital information system implementation over the years has been [dashboard reporting](#). Reporting systems typically exist as components of transactions systems. Historically, this reporting has provided snapshots of information about the hospital to management, the board, or other data groups.

As valuable as these reporting systems have been, they have not been able to meet the analytics requirements of today's industry. Today's focus, out of absolute necessity, must be on quality performance improvement in healthcare, especially on the clinical side. Essential to this focus is the need for an analytics offering that can bridge and merge multiple applications—clinical systems, financial systems, patient satisfaction systems, and so forth.

Reporting systems confined to a transaction system clearly cannot do that. Furthermore, analytics requires more than mere reporting; health systems must support the ability to drill down into this comprehensive, merged data to achieve real insight into operational performance. Finally, complex analytics queries against millions of rows of data cannot be performed [on transaction system databases](#) without adversely affecting performance. Clearly, a separate data warehouse is required.

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The 2010s: What CIOs Need Today

Today’s healthcare drivers are [accountable care organizations](#) (ACOs) and other value-based healthcare, a need for cost and quality-control systems, and a broadening genomic influence on personal care. Our main IT driver is pervasive computing. We have microprocessors everywhere. We’ll be seeing more and more of them—along with an accompanying proliferation of data. IT in the industry has broadly implemented EMRs and operational data systems, and these EMRs will ultimately have pervasive clinical decision support. Knowledge gained from analyzing an organization’s data in search of performance improvement insights will complete the operational systems cycle by refining the rules essential for successful clinical decision support. These efforts are highly complementary.

To handle all of this data and achieve cost and quality benchmarks, CIOs must implement enterprise data solutions. In fact, I firmly believe that the primary expectations of a hospital organizational structure from IT will be:

1. Supporting and enhancing reliable operational systems
2. Offering systemwide access to needed information via an agile data warehousing and analytics offering

While transaction information systems must be implemented and run reliably, over time this will become more of a maintenance function than a strategic imperative. Information now drives strategic innovation in the health system, and actionable information comes from an effective data warehousing and analytics solution.

Today’s CIOs are working hard to fulfill their marching orders of installing or replacing enterprise EMRs and other important transaction systems. In spite of this, they must turn their attention to data warehousing as soon as possible. I can confidently predict that if analytics isn’t on your CEO’s mind now, it will be very soon. Organizational leadership and governance in healthcare can’t ignore the many successes in performance improvement resulting from effective analytics applications.

In summary, for CIOs to retain their strategic value as chief information officers, they must be actively engaged in a strategy that results in the capture and analysis of comprehensive data. This enables the health system to constantly improve quality in healthcare.

About the Author



Larry Grandia served on Catalyst's board of directors since fall 2011. He is an accomplished CIO veteran of the healthcare IT industry with more than 40 years of business and technology leadership experience. Until his retirement in 2007, Mr. Grandia was executive vice president and chief technology officer of Premier, Inc. Before joining Premier in 2000, Mr. Grandia was president and chief executive officer of DAOU Systems, Inc. Prior to DAOU, Mr. Grandia led IT functions for Intermountain Healthcare, Inc. for more than two decades. In addition to his executive positions, Larry Grandia has served on the boards of PatientSafe Solutions, DAOU Systems, Inc., IDX Corporation and on advisory boards for 3M Healthcare Information Systems and the Center for Clinical Integration. He served as a founding board member of the following organizations: Microsoft Healthcare User Group (MSHUG), the National Alliance for Healthcare Information Technology (NAHIT), and the College of Healthcare Information Management Executives (CHIME), of which he is a fellow. Grandia is also a fellow, life member, and past board member of the Healthcare Information & Management Systems Society (HIMSS), past president of Electronic Computing Health Oriented (ECHO), which served as IBM's healthcare users group, and a past member of the Healthcare Information Systems Executive Association (HISEA).