Enterprise Integration: Defining the Landscape

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Introduction

Hospitals and healthcare systems use healthcare information technology (HIT) to run their core operations. Simply stated, an HIT system is like other computer systems—it consists of a computer network, software and database (that stores information). Yet, despite these similarities, HIT is different in that it performs tasks that have life or death ramifications, is exceedingly complex, and must be transacted with blazing speed for patient safety purposes.

Generally speaking, most hospitals cannot jettison their entire IT systems in favor of new ones (due to cost and patient safety issues). Therefore, many HIT systems employed by hospitals comprise a patchwork of both old and new software from a variety of vendors. Much of this software does not communicate, slowing the transfer of information within the healthcare enterprise.

Enterprise Integration (EI) seeks to connect systems to achieve system inter-operability. In layperson's terms, EI seeks to enable software from different vendors to communicate, notwithstanding their differences. This speeds the transmission of information, and allows hospitals or healthcare systems to save time and expense, and to operate more efficiently. Generally EI is accomplished in one of two ways: (1) the purchase of a new integrated system from a single vendor; or (2) the creation of interfaces (bridges) between software applications to enable the transfer of information.

This paper will discuss the basics of EI, as well as its benefits, drawbacks and challenges. The intended audience includes HIT leaders, healthcare administrators, and healthcare board members and trustees who will benefit from a broad and high level overview of EI. Additional sources for information regarding EI are contained throughout this document.

Who Benefits from Enterprise Integration?

In this day and age, EI benefits a wide variety of persons and entities. To understand its benefits, it helps to identify its intended beneficiaries:

- The Healthcare Enterprise;
- Payors and employers; and
- Patients.

Healthcare Enterprise

Hospitals and healthcare systems derive considerable benefit from EI. These benefits include the following:

- Timeliness of care delivery;
- Legibility and accuracy of medical records and billing;
- Medical intelligence (evidence-based medicine); and

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- Cost savings (including, among others, labor cost savings and improved accuracy due to the reduction of manual reentry of data).

The faster a patient's vital statistics and condition are provided to the physician, the quicker a diagnosis may be made and treatment begun. In an integrated electronic system where technology interoperates seamlessly, a patient's test results can be made available to physicians and nurses within minutes. Furthermore, EI reduces the required interaction between disparate healthcare personnel, departments and facilities, saving time and expense.

Another important benefit of EI is evidence-based medicine (EBM). EBM is available in electronic clinical systems, and contains a system of synchronous and asynchronous alerts and warnings that enables providers to identify a patient's condition and recommend care paths. While there are no substitutes for "hands-on" care, EBM has been shown to reduce medical errors and provide timely and consistent treatment to patients with similar illnesses.

Moreover, EI produces greater productivity, enhanced revenue generation (through reduction of lost charges), greater billing accuracy, enhanced patient care and patient satisfaction.

Payors and Employers

Payors (such as insurance carriers or HMOs) and employers (companies that pay the healthcare costs of their employees) also benefit from EI. Among other things, EI provides cost reduction to payors by eliminating billing redundancies. Alternatively, employers benefit from EI by enabling them to more accurately monitor their worker's injuries and decreasing the cost of care and insurance premiums.

Since the enactment of the Healthcare Portability and Accountability Act of 1996 (HIPAA), payors and employers have been affected. HIPAA mandates the use of electronic data interchange, a process that allows organizations to share information (EDI). Under HIPAA, the EDI standard known as ANSI-X12 is mandated. Use of this standard by providers and payors allows users to communicate seamlessly. Yet, to benefit from EDI, participating enterprises must have financial and clinical systems that collect and integrate data documenting patient activity, which is then converted into ANSI-X12 transactions.

Patients

Patients benefit from EI through the receipt of expedient, efficient and cost-effective care. Patients may also benefit from reduced healthcare costs, based upon the increased cost and efficiency of care between hospitals and healthcare systems in the same or different cities, states and regions.

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As the U.S. population becomes more educated on healthcare-related issues, providers are witnessing younger generations expressing more interest in healthcare-related issues. Many private and public initiatives now target public wellness (e.g., anti-smoking campaigns, obesity clinics, blood pressure and cholesterol awareness), making large portions of the public more demanding consumers of health-related data.

In addition, EI allows patients with chronic conditions to transmit self-administered test results to physicians and nurses, allowing them to monitor a patient's condition remotely on a real-time basis. EI is the force that allows all of this to happen.

Public Sector versus Private Sector

EI is affected by both the private and public sectors. The private sector includes for-profit hospitals and healthcare systems, as well as private insurance companies. The public sector includes Medicare and Medicaid, not-for-profit institutions and government-owned or supported healthcare institutions.

A few years ago, the U.S. Military (USM) and the U.S. Veterans Administration (USVA) recognized the advantages of using a highly computerized healthcare system. Among other things, the USM and USVA mandated that their hospitals move towards utilization of a fully computerized patient record. Today, the USM and USVA have some of the most far-reaching and well-integrated computer systems in the U.S. Though the USM and USVA have experienced some obstacles to EI due to their sheer size, they have experienced significantly higher patient outcome scores than their counterparts in private enterprise.

In the private sector, patients generally obtain their health insurance through their employer. Public health *assurance*, on the other hand, is a benefit that is provided to the elderly, the poor, the military and a select group of persons. Because the price of healthcare coverage is growing significantly as the U.S. population grows and ages, the federal government has significant concerns about the future costs of healthcare.

Many public and quasi-public agencies study the availability of and need for EI. For example, in regard to EI on a national basis, the need can be readily understood by the following hypothetical situation. For example, suppose that a terrorist strike occurs in Washington, D.C., a place where there are tens of thousands of visitors at any one time. Suppose further that many visitors are injured by the strike and are hospitalized. Local Washington, D.C. hospitals need access to the medical records of the visitors in order to care for them. In this instance, the immediacy of data becomes paramount. Healthcare providers from around the country would need to communicate data on a massive level. How will this occur? The answer lies within EI!

Key Integration Issues

Hospitals and healthcare systems depend on system integration to run their businesses. However, in most instances, few hospitals have the ability to install completely new, fully

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integrated HIT systems. Conversely, at most hospitals the IT systems consist of an amalgamation of software and hardware from different vendors that was not designed to share information. Instead, the software and hardware were built to operate independently. A key challenge in any integration effort is how to bring these disparate systems onto a common platform. The key issues in achieving EI are discussed below.

Record Linkage and Identification

For most healthcare organizations, patient identification is important. In many instances, a hospital or healthcare system maintains separate medical records for the same patient under different names. For example, a married woman may have a medical record under her maiden, married or former spouse's names. However, the ability to identify all medical records pertaining to a patient is critical for patient safety and quality of care.

Data Quality

Most hospitals and healthcare systems employ many different software applications that offer different functionality. This presents data communication issues. If health data is collected, stored, analyzed and presented differently within an institution, the quality and reliability of such data becomes suspect. If data cannot be trusted, an institution risks patient safety issues, as well as business process problems.

Data Synchronization

Some software applications used by hospitals have different life cycles and maintenance schedules. For example, some software applications and/or databases update data daily, while others update weekly or monthly. Because hospital executives, physicians and nurses need timely information, this is an important issue for healthcare institutions. What's more, hospitals risk liability if they rely on outdated information, which EI can remedy.

Business Rules Management

The sharing of financial and business information is critical to hospitals. However, many enterprises cannot share information among departments or facilities because their software does not communicate well if at all. This creates redundancies and inefficiencies.

Collaboration

Physicians and nurses must collaborate on a real-time basis in order to treat patients. Yet, such collaboration cannot occur without EI. EI allows a multitude of physicians and nurses to access an institution's software systems at the same time and from different locations within or outside of a hospital.

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Security and Privacy

The Internet age presents new and more difficult security challenges for healthcare enterprises. The Internet opens a hospital's systems to data and communications from external sources. Because most hospital systems contain interfaces that connect disparate software applications, most hospital systems have vulnerabilities that can create security breaches. Therefore, EI requires a more sophisticated security system than those offered by individual software applications.

Business Intelligence/Analytics

Another outgrowth of EI is HIT "analytics," which allows data to be extracted from healthcare databases so that statistical information may be obtained. For example, HIT analytics provides a myriad of information regarding such things as the profitability of certain procedures; the medical performance of physicians or practice groups; and the usefulness of certain medications on patients of certain ages or with certain illnesses. HIT analytics also enables business forecasting, modeling and trend analyses.

Common Vocabulary

The HIT industry is under pressure to create technology that permits EI within or between healthcare organizations. Yet, for technologies to communicate, so must the people who create and use them. Therefore, it is important that persons creating EI communicate using a common nomenclature.

EI vocabulary principally consists of two standards: (1) Identifier Communications Standards (more technical in nature (the IC Standard)); and (2) Content and Structure Standards (clinical data representations) (known as the CS Standard).

Common examples of the IC Standard include a patient's Social Security number, and a physician's Universal Physician Identifier Number, the latter of which is now being replaced by the National Provider Identifier. Conversely, a universal CS Standard has not yet been adopted.

There are significant obstacles to the adoption of a common clinical vocabulary, because most clinical data is stored in a natural language text which must be converted into an electronic format before it can be communicated through software applications or platforms. To date, four standards are commonly used to document clinical observations and treatments. These include Diagnostic Related Groups (DRG); Diagnostic and Statistical Manual of Mental Disorders (DSM); International Classification of Diseases, revision 9 with clinical modifications (ICD9CM); and Current Procedural Terminology® (CPT). Other emerging standards include the Unified Medical Language System (UMLS), which is maintained by the National Library of Medicine, Laboratory Observation and Identifier Names and Codes (LOINC), and the Systematized Nomenclature of Human and Veterinary Medicine (SNOMED) International.

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Interoperability and Technological Compatibility

Historically, hospitals and healthcare systems have relied on paper medical records. Yet, in today's world, data can be transferred through electronic means at speeds many times faster than through paper records. The use of electronic HIT systems increases hospital profitability and overall hospital efficiency, reduces medical errors and streamlines workflows within the healthcare enterprise.

Notwithstanding, most hospitals cannot afford to completely replace their electronic systems to a new, fully integrated one. Therefore, many hospitals use different software applications which do not communicate easily if at all. This creates problems for care providers that need immediate access to patient information. This failure demonstrates the need for interoperability within the healthcare enterprise.

EI allows an enterprise to access information from multiple locations and databases. In turn, this saves an institution time and money, and improves the quality of care. Generally speaking, integration can occur in several different ways. First, a hospital can buy a full set of integrated solutions from one vendor. Second, a hospital can build a network of interfaces among disparate software solutions from different vendors. Interfaces are bridges between software solutions that allow them to communicate.

The Internet provides yet another new pathway to interoperability for care providers. Recently acquired HIT systems often use the Internet to enable physicians and nurses to obtain a patient's records from outside a hospital or healthcare system. Moreover, smart devices—such as carts, tablet and slate devices, pads and smart phones—allow clinicians to access real-time patient information from anywhere within a hospital.

The following characteristics of EI must be present in order to maximize interoperability:

- Link patient records from various sources and among institutions;
- Ensure the privacy and security of patient information as required by HIPAA;
- Be built on an open and scalable platform;
- Be accessible from remote locations;
- Assist clinicians with collecting relevant information;
- Assist clinicians with clinical care (research, alerts and reminders);
- Support payor-specific information;
- Support quality assurance activities;
- Be written for use on a common platform and using a common medical language;
- Support image storage and multimedia such as PACS systems; and
- Interface with financial systems.

Quality and P4P

The ability to access data across multiple systems is critical to improving the quality of patient care. Furthermore, a system known as "pay-for-performance" or "P4P" is gaining

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influence in healthcare communities within the U.S. Under P4P, hospitals and healthcare systems are eligible to receive higher Medicare and Medicaid reimbursement amounts if they can demonstrate certain types of operational efficiencies. The P4P program is an outgrowth of the Deficit Reduction Act of 2005 (the "Act") that was passed by the U.S. Congress. The Act, and its aftermath, represent attempts by the U.S. government and private enterprise (such as insurance companies and healthcare purchasing consortiums) to require hospitals to meet objective criteria that will increase the quality of care and reduce healthcare costs.

P4P initiatives are also being introduced in the private sector. For example, a program entitled “Bridges to Excellence” is seeking to monetarily reward hospitals and physicians that follow specific guidelines in the treatment of "at risk" patients. Currently, the recommended rewards in this program begin at $15 per patient per year for physicians that use evidence-based healthcare treatment methodologies. And rewards of $50 per patient per year are available for physicians who use interoperable electronic health systems.

P4P programs seek to improve the overall quality and standard of healthcare. EI optimizes the workflow within hospitals and healthcare systems, thereby ensuring that patients receive proper and timely care using best practices and evidence-based medicine. Without EI, none of the foregoing is possible.

Key Components of Enterprise Integration

To understand EI, the reader must have some basic understanding of information systems. Generally speaking, a hospital or healthcare system uses an amalgamation of software products that runs on the same computer network. In most instances, hospitals have acquired their software over time from a multitude of vendors. Yet most HIT vendors have not written their software in a way that enables it to communicate with the software of other vendors. Therefore, software modules known as *interfaces* are created to bridge the gap between software applications. Interfaces have different levels of automation or “triggers” that push or pull data from different applications and servers within the enterprise. Typically, interfaces are designed with what is known as point-to-point connectivity.

Generally speaking, hospitals may select separate software applications, integrated application suites or a combination (hybrid approach). Hospitals that implement separate software applications, such as groupings of "best-of-breed" or "best-fit" applications, must integrate each software application with others using interfaces. Integrated application suites, on the other hand, are fully ininteroperable from inception providing full EI. This means that the entire system was created so that all software applications communicate seamlessly through the use of a common database, search engine and protocols, among other things.

Key components of a fully integrated enterprise include the following:

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- Master Person Index – A database and rules engine that contains a unique identifier for every patient/person in the enterprise, and generally finds a patient's medical records regardless of the prior names used by the patient. This ensures that a complete medical record can be obtained for a patient for patient safety purposes.

- Single Sign-on with Context Management – This permits a user to enter one name and password in order to access multiple applications; context management passes the patient identifier from one application to the other.

- Data Warehouse – Permits access of information throughout the system by use of a central data repository or storage system. This functionality is more recently being delivered by "just-in-time" coordinated access across multiple databases (known as "threading"), which allows for on-demand compilation of patient records.

EI Enablers

EI does not just happen. Rather, EI is generally the result of work being done by hospital IT departments and vendors to build and connect interfaces or bridges between different software applications. Without EI, hospital employees must print information and route it to other employees by inter-hospital mail. In this scenario, data cannot be easily shared within the institution on a real-time basis. Conversely, if software applications are linked together by a series of interfaces, data sharing is enabled although there might be data transmission time lags within the institution. As the need for data sharing grows, however, the use of interfaces could cripple an HIT system if they cannot handle the volumes and user loads that a hospital requires.

EI is not possible without adequate computing power, sufficient network bandwidth and electronically stored data sets. EI is aided by the use of common protocols and language. If software applications have interface modules written in common protocols, they can be connected. Without common protocols, connecting disparate software applications is difficult (without employing additional translation and buffering software).

A bewildering array of groups and organizations is attempting to simplify the integration of healthcare systems through the selection of uniform standards. For example, a panel known as the Healthcare Information Technology Standards Panel or HITSP serves as a cooperative partnership between the public and private sectors for purposes of evaluating HIT standards to achieve interoperability among disparate software applications.

Toolsets, such as interface engines and scripting tools, are products used to facilitate integration. A subcomponent of integration toolsets is the interface engine. An interface engine provides a means of communicating between multiple software applications by pushing and pulling information from one software application to another.

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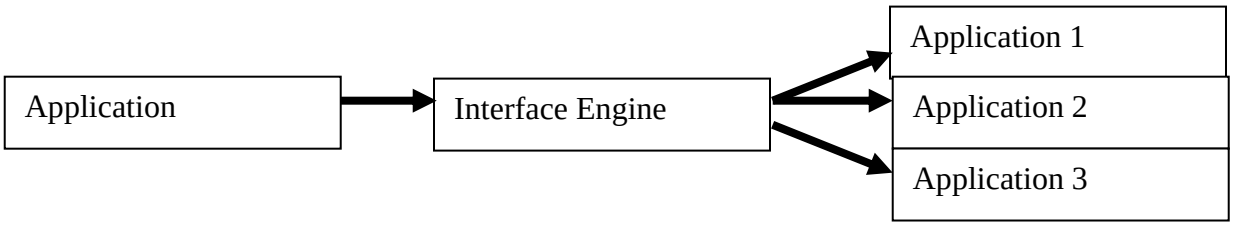

Scripting tools and languages provide an alternative to vendor-supplied interfaces. A scripting solution allows a computer to act in place of a user in operation of another application. Input scripting solutions typically run from one data source and enter information into applications. Output scripting solutions extract information from systems, using screen-scrape technology.

Significantly, a healthcare system's leadership must vigorously support integration. For example, new HIT systems that employ EI must be implemented with a holistic view of how they will fit within an integrated enterprise, and not just within a specific department.

One of the major stumbling blocks of EI is its cost. The investment required to fund EI can be significant. For smaller institutions, the benefit of EI can be obtained through the acquisition of a specific vendor's product suite. For more complex organizations such as large healthcare systems, the successful deployment of EI will depend on the system's ability to access data on a large scale by thousands of employees, many at the same time. In these organizations, EI requires new technology and a knowledgeable internal support staff.

Identifying the initial costs requires the creation of a project plan to define the stages of EI. In most instances, a hospital or healthcare system must integrate existing software with newer applications. Furthermore, EI is not a one-time implementation—it represents an on-going process and will change over time as new software is integrated with existing software systems.

Funding Sources

A hospital or healthcare system considering EI must determine how to fund it. Internal funding is the easiest source of financing. However, funding can also be obtained from collaboration with other healthcare institutions or federal or private grants.

Most lending institutions require the following information before issuing a loan commitment for a new HIT system: a technology scope document; a cost-benefit analysis; and an analysis of the organization's possible return on investment (ROI). Developing an ROI analysis can be challenging, as hard costs and realistic soft dollar savings must be addressed. Furthermore, a determination of cost avoidance should be included in ROI, which takes skill to determine.

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Regardless of the funding source, hospital executives must be familiar with the Stark and Anti-Kickback laws insofar as they pertain to the acquisition of electronic health records (EHR) and electronic prescribing. Under these new laws, a physician or physician practice group can obtain software from other institutions if (1) the software is predominantly used for EHR functions; (2) the software has e-prescribing capabilities; and (3) the software is considered interoperable. More detailed information on these laws can be found on the Federal Register's website at www.access.gpo.gov or at the HIMSS webpage at www.himss.org/asp/topics_stark.asp.

Lastly, information on funding sources can be obtained at the following Web sites:

1. The HIMSS HIT Dashboard. This web page provides information about grants at www.hitdashboard.com. This Web site provides information about healthcare organizations that have received grants throughout the U.S.

2. Government Web sites. Information on federal grants can be found at the following Web sites:
    a. National Institutes of Health at www.grants.nih.gov
    b. Centers for Disease Control at www.cdc.gov
    c. Association for Healthcare Research and Quality at www.ahrq.gov
    d. Health Resources and Services Administration at www.hrsa.gov
    e. Catalog of Federal Domestic Assistance at www.cfda.gov.

3. Foundations. Information on certain foundations that provide grants can be found at the following Web sites:
    a. Commonwealth Fund at www.cmwf.org
    b. Markle Foundation at www.markle.org
    c. Robert Wood Johnson Foundation at www.rwjf.org
    d. W. K. Kellogg Foundation at www.wkkf.org

4. Additional Information. Additional information on funding sources for HIT systems can be found at www.foundationcenter.org.

EI on the World Stage

Worldwide, HIT spending is astronomical. Yet from a functionality standpoint, HIT is significantly behind the IT used in other industries on the world's stage.

On a worldwide basis, there are limited international efforts to define common protocols to enable diverse HIT systems to communicate. What's more, different companies provide the core HIT technologies to healthcare systems on different continents. Consequently, unless these HIT vendors create products using common HIT standards, EI cannot occur on an international level.

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Perhaps the greatest barrier to creating EI on an international stage is the gap in communication between countries. It takes years to rewrite source code for complex HIT systems. Moreover, once written, a system's source code cannot be converted to another language for use in a different country. Furthermore, language translation cannot merely be provided at the graphic user interface level.

Whether coordinated and funded by the national governments or international agencies, communication failures doom an international HIT initiative unless language obstacles can be overcome. HIMSS—the world's leading HIT organization—could be instrumental in bridging these communications gaps.

Within the U.S., initiatives to create common HIT standards are lagging behind efforts in the United Kingdom, Australia, New Zealand and Canada. For instance, the U.S. is still attempting to develop HIT standards. On the other hand, the U.K., Australia, New Zealand and Canada have established standards, identified funding sources and are creating fully interoperable HIT systems.

In the U.S., HIT vendors have little incentive to build software systems that communicate with their competitor's systems. It will take a concerted effort of the public and private sectors within the U.S. to implement enforceable national HIT standards that provide for interoperability. In fact, for EI to take hold in the U.S., legislation may be needed on the federal level.

Standards Development

Various groups are seeking to establish HIT standards. For example, the stated mission of HITSP is to serve as a cooperative partnership between the public and private sectors for purposes of achieving a widely accepted set of standards that support HIT interoperability. HITSP is comprised of a variety of HIT professionals who seek to assist in developing a Nationwide Healthcare Network (NHIN) within the U.S.

Generally speaking, standard development organizations (SDOs), develop, coordinate, promulgate, revise and amend standards within the U.S. and abroad. Examples of SDOs include International Organization for Standardization (ISO), American National Standards Institute (ANSI), National Institute of Standards and Technology (NIST) and others. Eventually, the HITSP will establish standards for use within HIT. Until that happens, however, HIT vendors will continue to develop software and systems that do not communicate with other systems absent the creation of complex interfaces.

Conclusion

In recent years, HIT has become a focal point on the world stage. Despite advances in medicine, many of the nation's leading HIT vendors continue to create HIT systems that do not allow for the sharing of data. How can the U.S. send men to the moon, but cannot create effective computer systems that are fully interoperable, and that allow for hospitals to share patient data?

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The key to interoperability lies with EI. EI allows different software applications from different vendors to communicate back and forth.

Historically, HIT vendors have created their own proprietary systems, and have refrained from working together for fear of losing customers. What's more, hospitals have contributed to the lack of EI by using legacy systems and outdated technology platforms.

Despite these and other obstacles, the healthcare industry faces tremendous pressure to create interoperability. EI constitutes a means to increasing a hospital's efficiency and profitability by seamlessly enabling employees to share information with others. EI streamlines workflows and eliminates redundancies which, in turn, may hold the key to controlling spiraling health costs.

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