Healthcare providers spend between 1.5 percent and 3 percent of their total revenues on information technology. That capital must be wisely managed, but these investments are often made without regard to the actual ROI that the systems will generate.

A widespread EHR adoption plateau is expected, with entities unable or unwilling to adopt EHR. Prescriptive analysis is utilized to interpret and suggest optimal adoption behavior.

This study indicates that payment mechanism plays an important role in whether and to what extent reported benefits can be translated into a healthcare provider’s financial profits.
IT and Pay-for-Performance
An Opportunity for EMRs and Advanced Clinical System Initiatives

UNTIL RECENTLY, there haven't been any tangible financial incentives to invest in clinical IT. Notwithstanding recommendations from the Institute of Medicine, political advocacy and warnings from quality watchdogs, advancements in clinical IT initiatives gained traction mainly in organizations that have deep pockets and a strong commitment to “do the right thing.” It’s no surprise, then, that advanced clinical IT initiatives, such as CPOE and EMR systems, have progressed slowly, with cost remaining the major impediment to widespread adoption.

Now, with pay-for-performance programs emerging, hospitals and physicians may have solid financial incentives to rethink IT investments. To make the best P4P-related IT investment decisions, leaders need to guide their organizations by leveraging existing quality/IT systems, choosing IT applications that streamline the quality data reporting process and looking for easy win opportunities to improve quality by integrating existing databases.

First, organizations should work with insurers to propose standards that can already be measured. For example, organizations that participated in the Institute for Healthcare Improvement’s 100,000 Lives Campaign already have built much of the infrastructure to measure many potential P4P quality indicators. Data collection and quality improvement processes put in place to improve heart attack and heart failure recovery and prevention, reduce hospital-acquired infections, mitigate post-surgical blood clots and prevent ventilator-associated pneumonia should be leveraged in the P4P negotiation process. Organizations that are making quality improvement strides in these areas already have made significant investments in technology and process improvement initiatives. The outcome of progress in these areas not only benefits the patient but the insurer and employer as well. Thus, P4P programs should start rewarding those organizations for past efforts and current results by providing incentives to take quality improvement to the next level.

Next, organizations should assess their information system’s ability to provide reliable, consistent P4P data and to track incremental costs. In particular, physicians who don’t have advanced clinical data automation tools may not be able to provide reports on required quality indicators. The alternative — manual chart review and data collection — will certainly prove to be cost prohibitive.

Adding staff to prepare reports on quality indicators defeats the purpose of improving healthcare quality without increasing costs. Physician practices that invest in EMRs and clinical data integration will find that they are most likely already collecting the data required to receive P4P benefits.

Like the IHI, the Doctor’s Office Quality-Information Technology project is a three-year, national quality improvement initiative for physicians who wish to use EMRs to improve quality. EMRs that pass the DOQ-IT test are capable of sending clinical data from the physician office to data warehouses in the prescribed federal government standard. There are 33 clinical indicators required for DOQ-IT that help providers improve quality using IT. Thus, physician offices that are considering a large investment in an EMR should consider systems that are DOQ-IT certified. This not only will enable the practice to participate in federally sponsored quality improvement programs, but more importantly, a DOQ-IT certified system could help practices complete P4P data-reporting requirements with little or no manual review, collection or compilation.

Finally, healthcare organizations should look for low-hanging fruit. In many cases, existing data can be compiled and integrated to simultaneously improve quality, boost revenue and reduce costs. For example, nosocomial infections are a leading cause of death in the US. In addition to increasing mortality, these infections dramatically increase hospital cost through incremental un-reimbursed patient days, the inappropriate and ineffective use of antibiotics, and the additional clinical and diagnostic resources needed to treat patients who contract these infections. Further, Medicare is cutting payments next year for at least two infection-related DRGs.

Hospitals can improve infection control performance by implementing monitoring applications that draw upon existing clinical databases to integrate data from ADT, lab and pharmacy. These systems can reduce costs and potentially create P4P incentives at the same time.

For example, by being able to integrate pertinent patient historical data together...
with microbiology results to track infections across the organization, infection control personnel can then use pharmacy data to monitor inappropriate antibiotic use. These measures can save hospitals millions of dollars by reducing over-utilization of clinical services, uncompensated care and unnecessary drug costs. Thus, the potential to add this to the P4P incentive list seems more than feasible considering the obvious quality and cost benefit to the insurer, employer and member.

P4P programs that are now optional and incentive-based soon will be a requirement. In the future, organizations will be required to improve quality or risk a reduction in payment. Thus, CIOs need to look for creative ways to measure the qualitative benefits that support critical IT system investments to improve quality. P4P programs are just another way to support the justification of these investments.

Other cost savings and cost avoidance opportunities will emerge as more evidence comes in on the many quality improvement projects currently under way. Until then, organizations should continue to look for new ways to make cogent arguments in the interest of clinical system advancement.

The Fall 2007 issue of the Journal of Healthcare Information Management contains a collection of special interest columns and articles that focus on the economics of healthcare information technology. In this issue, there are several examples, strategies, opinions and case studies that will be of interest to healthcare leaders who are in the midst of justifying expenditures for clinical system initiatives to advance important quality improvement, patient safety, pay-for-performance or other strategic objectives. These articles include “Technology Governance Strategies for Maximizing Healthcare Economics Value”; “Economic Externalities of Health Information Technology”; and “Advancing Return on Investment Analysis of Electronic Health Record Investment”. These contributions and case studies provide useful knowledge and analysis on the various economic aspects of healthcare IT initiatives.

In addition, glean valuable information and insight from the special-interest columns and articles in this issue, including factoring information technology in healthcare; economics of HIT; analysis of new federal e-discovery rules that require digital records management; enterprise visibility and clinical workflow; and using informatics to support clinical and translational science.

Finally, I would like to thank the professional staff at HIMSS, the peer reviewers and the editorial review board for all the behind-the-scenes work that goes into producing each issue. JHIM continues to look for new ways to provide relevant, important and useful information for healthcare professionals, academicians and HIMSS members.

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The Fourth Factor of Production
Helping Caregivers Work Smarter Instead of Harder

THANKS TO A BOOK WRITTEN in the early 19th century, economics has an unflattering reputation as the dismal science. Thomas Robert Malthus’ characterization of my profession reflected his belief that economic analysis tends to lead to dismal conclusions, such as the inevitability of famine, poverty and war because populations tend to grow faster than their food supply.

Mr. Malthus did not say that being an economist was devoid of comfort. Studying economic activity can be fun when it produces a theoretical model that explains how a system works and provides guidance for avoiding dismal outcomes. The current popularity of Freakonomics, for example, has made economics appealing to a large audience of people who would not have expected to enjoy reading a book about a so-called dismal science.

Consequently, healthcare IT professionals should not be afraid of production theory, which has been a core economic concept for 200 years. It is an appropriate way to introduce the articles in this issue, which apply more recent economic concepts, such as ROI and the operational impact of incentives.

Applying production theory to healthcare in 2007 does not necessarily lead to an unpleasant conclusion. Indeed, the analysis that follows suggests that information technology is essential for avoiding dismal outcomes for healthcare over the next few years.

FACTORS OF PRODUCTION
Beginning with the Industrial Revolution in the late 1700s, the Scottish philosopher Adam Smith and his contemporaries set the stage for evaluating economic wealth by considering three factors of production: land, labor and capital. Land and labor are self-explanatory. Capital was defined as factories and machines that were operated by labor. Modern references to capital, as in the phrase “access to capital,” share the same meaning. Cash and credit do not have intrinsic economic value; they only become productive when invested in factories and machines.

In the mid-20th century, economists began to consider a fourth factor of production—information. They observed that nations or enterprises with equal endowments of land, labor and capital did not necessarily produce equal wealth. All other things being equal (a favorite saying of economists), economic theory indicated that the entity with better data and information would achieve superior results. The meteoric rise of companies like IBM and Hewlett-Packard in the 1950s and 1960s validated information as a fundamental factor of production.

The production factors model sheds light on healthcare’s problems and prospects in the first decade of the 21st century. Land can be quickly removed as a factor. Some hospitals may not be ideally located, because their customers have moved to another part of the market area, but nobody is worried about a shortage of land on which to build hospitals. On the other hand, labor is a problem for today’s producers of healthcare services. Professional caregivers of all types are in short supply, creating serious and well-known bottlenecks, such as bed closures and emergency room diversions. The normal economic response would be to increase the supply of labor, but creating new health professionals takes considerable time and money.

Even if money were not an obstacle, the lag time between expanding the capacity of educational programs and graduating competent caregivers ranges from five years for nurses to 10 years for physicians. Providers do not have the luxury of waiting this long to solve the immediate problems caused by the shortage of qualified labor. A quicker fix is needed.

Improving capital is an option, in theory, because new medical buildings and technologies can be acquired much faster than new caregivers. However, most American providers do not have the financial resources to build and equip a better production facility. Investment capital will be even harder to access because providers have little or no ability to raise capital by raising prices. A few providers, perhaps 1-in-4, have a realistic capacity to meet short-term capital needs through long-term debt.

To compound the problem, the two traditional payors (governments and employers) are unlikely to increase their inflation-adjusted payments for healthcare in the foreseeable future. Payors will continue to shift financial responsibility to consumers, who are largely unprepared...
to meet the financial obligations suddenly thrust upon them. The net result, rising receivables from insured patients, just adds to providers’ difficulty in borrowing money to solve the problem.

INFORMATION AND THE BOTTOM LINE
In light of current constraints on labor and capital in healthcare, the only viable solution is to increase production of the existing workforce.

Production theory offers two possible paths to increasing output-per-worker. The old approach involves giving workers more money to work more hours. It is not applicable in healthcare today, because caregivers are already working at, if not dangerously beyond, capacity. At this level, more hours could mean more errors and more risks to patients.

The new approach is giving workers more information to work smarter instead of harder, applying the insights of Peter Drucker, W. Edwards Deming, Crosby, Arro and other visionaries who pioneered the use of information to identify more efficient ways for combining land, labor and capital. Unfortunately, healthcare managed to avoid the information revolution that transformed leading industries in the United States and Japan after World War II. American hospitals and doctors were operating in 2000 pretty much the same way they operated in 1950.

The good news is that information has proven its transformational value in healthcare during the past few years. Even better news is that information is relatively available and affordable in provider organizations. It is not free, but management information can be produced faster than labor and more cheaply than capital. Economics 101 clearly shows why information must be factored into the production equation.

The critical challenge for today’s healthcare IT leaders is to develop vision and skills for financing investments in information technology with the money IT will save by eliminating waste in healthcare. This task will not be easy, but it will be worth the effort. On the other hand, the alternatives without healthcare IT are dismal. JHIM

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Welcome to the Digital Age

New Federal E-Discovery Rules Require Digital Records Management

Welcome to the Digital Age. Some 90 percent of business records are created and stored electronically, and 30 percent of records exist only in electronic format. In healthcare, we pride ourselves on having a paperless medical office and electronic health records. Litigation and the courts have caught up with this digital movement. On Dec. 1, 2006, amendments to the Federal Rules of Civil Procedure went into effect. The amendments require parties to address subjects relating to electronically stored information at pre-trial conferences and in all phases of discovery. Essentially, all e-documents and paperless medical charts are now fair game in all litigation. This includes millions of e-mails, audio files, voicemail messages, Internet use records, instant and text messaging, metadata, building access systems, surveillance cameras and more.

E-discovery is front and center in every piece of litigation an organization has and will have, including medical malpractice actions. Finding important e-documents and preparing to use them or explain them may have an impact on costly litigation. Those in charge of IT infrastructure and data management will be called upon to assist with this litigation.

Planning for e-discovery requires compliance with the new federal rule amendments as well as an understanding of how healthcare institutions communicate electronically because litigation outcomes may turn to the content of e-documents. The success or failure of litigation may hinge on how well a healthcare institution plans to manage e-documents.

Managing electronic information requires an information management plan that is essentially a document retention policy for electronic information. The plan must balance the legal requirements of the business, including special regulatory requirements to retain documents in healthcare, with best practices for data backup and destruction to maintain the health of the IT infrastructure.

Here are a few critical issues that healthcare organizations, attorneys and IT professionals should consider in creating an information management plan.

Finding important e-documents and preparing to use them or explain them may have an impact on costly litigation.

Build an information management plan. To build an information management plan, an organization must identify records with strategic business value for retention and the length of time they’re kept.

In the healthcare world, a dizzying array of federal and state regulations and JCAHO guidelines provides varying requirements for record retention. HIPAA requires six years of data retention for designated record sets, notice of privacy practices, authorizations, uses and disclosures and documents related to patient amendment of records. The medical chart has a five-year preservation requirement under Medicare. Managed care records have varying retention requirements depending on state insurance requirements. Special state statutes may create different retention requirements for records relating to HIV, drug and alcohol, psychiatric, genetic testing and other conditions.

A healthcare organization’s legal counsel should assist in developing retention requirements, based on weaving together the specific requirements of each state; an organization should only preserve what is needed and for as long as it is needed. This is especially true in dealing with protected health information as defined by HIPAA, because retaining personal health information subjects the healthcare institution to strict privacy and security requirements for stored information. An organization should routinely delete data that has no business value and is not protected by unique legal or regulatory requirements.

Document policies and procedures. From an e-discovery perspective, it is incredibly important to document policies and procedures so when an information management plan is called into question, an organization can justify the routine and good-faith business practices behind the plan.

Planning is the easy part; getting people to follow it is the hard part. An organization should educate employees on best practices – what is important to retain and what shouldn’t be retained. E-mail policies should be reissued to reinforce the fact that e-mail is not necessarily the best
or safest mode of communication. Often, just walking into someone’s office and conversing may be a better approach for communicating sensitive information.

**Understand technology and data storage.** The technology infrastructure in any healthcare organization is very complex. Electronically stored information is stored locally and dispersed throughout a network, backed up and saved multiple times by multiple people. A healthcare organization should take the time to understand what data is readily accessible to respond to e-discovery as well as to assist legal counsel to formulate e-discovery requests of the other side. IT systems and data governance must address all forms of electronically stored information.

Generally speaking, electronic data can be classified into three general types—active data, backup data and residual data. Active data is readily accessible data used for daily tasks and is usually stored locally on a hard drive. Hidden behind the files that are accessed is metadata, or embedded data, which provides valuable business information about when documents were created, accessed or modified. Metadata is the DNA of the documents; it contains an enormous amount of litigation-sensitive information that must be produced under the new rules. Another source of e-discovery information is backup data located on storage disks, tapes or a special network. Understanding the process for data backup is an important part of compliance with the e-discovery rules.

Residual data also is produced. Pressing the delete key does not typically erase all information pertaining to the document. Remember that electronically stored data exists not only in e-mail and voice-mail, but also in mirrored disks, shadow drives, removable thumb drives, deleted files and instant messages, to name just a few. Generally, retrieval of residual data is costly and requires special forensic expertise. There will be ongoing debate about whether residual data is readily accessible under the new rules.

Information management plans should assist the business in identifying business records subject to the plans, mapping and inventorizing their existence, retaining files for certain periods of time, documenting retrieval policies, setting a destruction schedule and auditing compliance. Roles and responsibilities for information and records management must be clear and consistently applied. Organizations should train employees on the information management policy, because compliance with the policy is critical.

**Address data preservation and litigation holds.** Information best practices need to address the strategic value of preserving information vs. destroying unnecessary data across all data types and on all storage media. It is important to understand that, without a legal requirement to the contrary, an organization may and should plan for the destruction of information as a natural part of records management. Businesses are not required to preserve equipment, information, metadata or storage devices except if there is a litigation hold or a regulatory requirement. When in doubt, organizations should check with legal counsel.

From a litigation perspective, a litigation hold must be instituted to avoid any accusation of spoliation of evidence, and expensive fines and sanctions. While litigation holds are exceptions to the normal information management policy, organizations should educate employees early on the procedures involving such holds. Organizations should appoint a committee to decide how to tailor the litigation hold appropriately to the case, how to address questions regarding the hold and how to decide when the hold may be lifted.

The chair of this committee may be called on to defend the scope of the hold against arguments that materials should not have been destroyed. Organizations should consider documenting the steps taken to implement a litigation hold.

**Use a team approach.** Litigation preparedness and compliance with e-discovery rules can be enhanced significantly by a team approach to information management. An interdisciplinary team that includes representatives from relevant business operations, legal, finance and risk management, should guide the institution's administration of the information management policy.

Having an IT specialist who is well-versed in the institution’s information management and capable of communicating IT information in plain English as part of the litigation process is key. This trained IT professional, in conjunction with the organization's lawyers and business operations executives, can take the lead proactively as part of the administration of the information management policy and reactively in administering the litigation hold.

**Pressing the delete key does not typically erase all information pertaining to the document.**

The IT specialist should identify what relevant data exists, what is reasonably accessible, and how to implement and defend the methodologies of data gathering. Additionally, the IT specialist can assist in identifying potential sources of electronic evidence that the company should request of the other side in discovery and can highlight issues in the other side's production of electronic documents, such as printing emails where metadata is stripped out.

Having a plan is essential; however, if the institution does not enforce compliance, the plan is worth nothing. Failure to follow an information management plan can set an institution up for severe sanctions, as well as the possibility of losing a case by failing to find critical evidence.

**Note:** This article is informational only and should not be construed as legal advice or legal opinion on specific facts.
Enterprise Visibility

Putting the Flow Back into Clinical Workflow

BY ITS NATURE, today’s hospital is a complex, dynamic and often chaotic organization—people and assets are constantly on the move. The resources devoted to locating, tracking and managing staff, patients and physical assets represent a huge expense of increasingly scarce enterprise capital.

But the expense is measured not only in unnecessary cost. Lost equipment, patient service bottlenecks, and staff engaged in unproductive “hunting and gathering” tasks—all related to the inability to locate, monitor and intervene in enterprise workflows—can adversely affect clinical quality.

Disrupted clinical workflows—even isolated ones—have a cascading effect throughout the enterprise. For example, a disruption in workflow in the emergency department has implications for patient wait times, support staff productivity, bed turnover, discharge planning, risk management and quality assurance, and so on.

Addressing the problem isn’t an elective decision either—the Joint Commission has issued a standard (LD.3.15) mandating that hospitals must implement plans to “identify and mitigate impediments to efficient patient flow throughout the hospital.”

Part of the solution may lie in making simple adjustments to manual processes, but across the broad spectrum of hospital operations, what’s needed is a comprehensive solution that instantly locates patients, staff or physical assets; identifies bottlenecks, unused capacity and available resources; and provides actionable information to streamline workflow and eliminate service interruptions.

USING RTLS AS A SOLUTION

RTLS describes a system of tags, readers, servers, wireless infrastructure and sophisticated software that delivers enterprise visibility into the location and status of tagged objects, which may include equipment, patients or staff.

Healthcare has been a beachhead industry for RTLS because of the peculiar nature of healthcare operations—mobile staff, mobile patients and mobile assets, such as equipment and consumables, that requires control and identification. This creates huge opportunities to offer solutions that address the chronic issues associated with locating and managing people, equipment, consumables and other elements of healthcare operations.

The market opportunity for enterprise visibility in healthcare is enormous. Fewer than 5 percent of North American healthcare facilities currently have asset management systems. RTLS in healthcare is poised for growth; according to Spyglass Consulting, 45 percent of healthcare organizations will use location systems for asset tracking during the next 18 months, and 21 percent will deploy the technology for patient tracking over the same time frame.

But using the terms “real-time” and “fully automated” with RTLS, when applied to healthcare operations, is somewhat subjective. Some RTLS tags update to the network periodically, or not at all unless prompted. Several RTLS products require staff interaction, such as a query or data input to trigger a response from the system. That’s not truly real-time, and it’s not fully automated. A true RTLS system is intuitive—it is persistent and pervasive, and it adds no additional workflow burden to already over-stretched staff.

To add another dimension of complexity to the RTLS debate, competing system architectures—RFID, WiFi, UHF, ultrasound and others—are said to each deliver the highest level of tracking precision in the most efficient manner. A WiFi solution might be the path of least resistance; however, there are significant issues with the performance, scalability and precision of WiFi-based RTLS.

An alternative solution that delivers a higher order of accuracy, reliability and scalability is a dedicated RFID or UHF system configuration. However, this requires implementation of a parallel wireless infrastructure. Each technology has advantages and flaws; the challenge is to architect the system to those technologies that will become industry standards—assuming there ultimately will be an RTLS standard.

Thanks to recent advances in RTLS technologies and the industry’s gravitation toward more standardized applications, healthcare-specific tracking solutions now are available in more scalable, reliable and cost-effective product configurations, and price points are coming down, making the total cost of ownership increasingly attractive. RTLS solutions are becoming increasingly granular, and the precision and accuracy of these technologies are sparking the introduction of clinical applications.

Wavetrend offers an OR bed RTLS that monitors patient throughput in the OR and creates an audit record of utilization. Blue Vector has developed a “high-value consumables” on-site refrigerator that is stocked and maintained by the vendor, and whose tagged contents are not purchased by the hospital until they are removed from the unit. Verisign has developed patient throughput solutions...
tailored to the emergency department and psychiatric wards.

**CAPTURE DATA, DELIVER ACTIONABLE INFORMATION**

Enterprise visibility is about more than just tracking, says Fran Dirksmeier, CEO of Agility Healthcare Solutions.

“What often gets lost in the discussion is the fact that the RTLS system architecture—WiFi, RFID, UHF or other—is simply an enabler,” Mr. Dirksmeier said. “The real value of enterprise visibility lies in the embedded applications that not only identify the location of a person or thing, but provide information about key metrics, such as ED wait time, status and flow in the OR, bed/room management, and patient throughput from entry through discharge. Further, the applications should be able to deliver alerts, provide decision support and care management, orchestrate resource utilization, and produce actionable reports.”

For those applications to deliver actionable information, the enterprise visibility solution must first capture timely data from tagged objects attached to people, equipment or consumables, and translate that data into a process-control tool. Process control describes more than status; it can include service requests, patient flow event management, automated alerts, asset orchestration, and a host of reporting capabilities including staff productivity, asset utilization, and clinical service efficiency. It’s the combination of sophisticated data capture and interpretive applications that makes enterprise visibility a decision support vs. a tracking technology.

**GETTING IT APPROVED**

Still, as with all technology solutions, enterprise visibility must sell itself first on the business case—a hard-dollar ROI and measurable business benefit.

Still, as with all technology solutions, enterprise visibility must sell itself first on the business case—a hard-dollar ROI and measurable business benefit.

replacement and leasing costs; improved staff productivity; improved patient service volume; better allocation and availability of physical assets; and better regulatory compliance with organizations such as OSHA and the Joint Commission. The typical payback period for enterprise visibility is currently running from 12 to 18 months.

Although the business case is a reasonable decision metric, it does not represent the absolute value of enterprise visibility. That value radiates from the clinical processes that are streamlined through staff productivity and workflow acceleration, from patient services free of bottlenecks, from efficient asset utilization, and from information that translates into enterprise-wide performance improvements.

The hospital-specific benefits of enterprise visibility span the gamut of daily operations, including materials and inventory management, patient throughput management, asset orchestration, staff workflow monitoring, risk management and consumables tracking.

Some specific examples include asset tracking (reducing lost equipment and equipment rentals, reducing search time, better equipment utilization and better consumables management); patient tracking (reducing risk of lost patients, reducing “look time” for patients during rounds, automatic charge capture, patient alerts, and patient status from registration through discharge); and workflow analysis (increasing patient throughput, improving staff scheduling and utilization, improving process and procedure efficiency, faster patient care, medication error avoidance, eliminating missing charts and efficient bed management).

In terms of solution characteristics, enterprise visibility should meet a number of non-negotiable criteria, Mr. Dirksmeier says. He’s looking for solutions that are:

- Integrated and comprehensive, capturing nearly every aspect of the hospital operation.
- Measurable, allowing hospitals to track the dollars saved with the solution.
- Scalable, allowing hospitals to expand visibility as their needs grow.
- Cost-effective, providing a solid return on investment.
- User-friendly, ensuring that the solution is easy to use and understand.

Mr. Dirksmeier also emphasizes the importance of a strong sales and support team, as well as a comprehensive implementation plan. He believes that these factors are critical to the success of any enterprise visibility solution, and that hospitals should not overlook these elements when evaluating solutions.

“Enterprise visibility is not just a technology solution,” Mr. Dirksmeier said. “It’s a business decision that requires a deep understanding of the hospital’s unique needs and goals. By partnering with the right provider and implementing a comprehensive plan, hospitals can unlock the full potential of enterprise visibility, improving patient care and operational efficiency.”
said. “It should be fully automated—the system should provide real time and retrospective reporting, department specific views, and include the ability to benchmark current processes and reengineer workflow. The system should be scalable, flexible, integratable and configurable, to blend into the diverse operating environments within hospital departments. Finally, the system should be easy to use and reliable—it should have room-level accuracy, real-time status, rules-based and role-defined access—to ensure that the right information is available to the right person at the right time.”

For hospitals, enterprise visibility is a critical element of any overarching resource management infrastructure. To gain a wider base of adoption, however, enterprise visibility architectures and applications must deliver more ubiquitous, reliable, flexible and cost-effective capabilities.

Issues such as network and device compatibility, implementation and maintenance, precision and reliability and solutions featuring richness, clinical and business value must be addressed — with success stories as evidence — to convince facility decision makers that now is the time to deploy tracking solutions.

Ultimately, enterprise visibility should be woven into a larger catalogue of distributed, mobile and desktop-accessible applications — such as the electronic medical record, finance, materials management and scheduling — that capture the right data, correctly interpret its significance, and deliver actionable information in real time to the people who need it.

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Good Dollars and Cents

The Right Terms in Your IT Contract Could Save You Money

For many healthcare organizations, acquiring, implementing and maintaining new healthcare IT can mean spending millions of dollars. Most eagerly look forward to getting the new system implemented and beginning to realize cost savings, improved quality of care and other benefits. The unfortunate reality is that many projects run well beyond their projected completion date and frequently exceed budgeted capital and operating costs.

While even the best-written IT contract cannot guarantee that a vendor will perform its obligations in a timely manner, there are many contract terms that can be included to help control both the initial system acquisition, implementation expenses and the ongoing cost of ownership. So what are those terms, and where does one start?

At the risk of stating the obvious, start at the very beginning—of the project, that is—when the idea of procuring a system is first hatched and begins to take shape in the form of a request for proposal. A thorough, well-written RFP can and should accomplish a few important pricing objectives.

Identifying Total Cost of Ownership

First, the RFP should include detailed comprehensive pricing spreadsheets that require the responding vendors to identify, based on criteria set forth in the RFP, the total cost of ownership over the anticipated useful life of the system, which often is viewed as being in the range of seven to 10 years. The pricing criteria should include a number of usual suspects—the size and geographic dispersion of the healthcare organization, growth plans, functional and performance requirements for the system, and services-related requirements, such as data conversion and interfacing strategies and requirements.

The criteria also might include some not-so-obvious suspects, such as whether the organization wants to command an enterprise-wide, unlimited user license (which may be contrary to a vendor’s ordinary software license pricing methodology); whether the organization intends to hold the vendor financially accountable for project delays caused by the vendor; and whether the organization intends to advance its own form of technology acquisition contract (vendors often cite this as a reason to increase the price, so it is advisable to circumvent this argument by putting this issue on the table right away.)

Specifying the precise format for providing total cost of ownership data creates a useful platform from which to conduct an apples-to-apples comparison of competing vendors’ pricing proposals.

Additionally, by creating an open competitive environment, the RFP process will help drive favorable pricing proposals or, at a minimum, set the stage for negotiating adjustments to a preferred vendor’s price if it does not compare favorably with other proposals. The potential loss of a deal typically will lessen, or even entirely eliminate, any pricing gaps.

Nailing Down the Details

After price and other factors have been evaluated and preferred vendors have emerged, the next step is to nail down in the contract all of the pricing-related details for the software, equipment and services that are being licensed or acquired. If done correctly, the rigor of the contracting process often will uncover details that had not previously been considered by the parties. Although few deals that make it to this stage fail to close because of pricing-related disagreements, that possibility nonetheless remains. Accordingly, until the ink is drying on the contract, it is critical that the healthcare organization preserve negotiation leverage by avoiding selecting a finalist vendor and excusing all other vendors from the process.

In any IT contract, software license fees ordinarily are a large component of the initial system acquisition cost and may present a significant ongoing cost. Software license fees frequently are based on a number of restrictions and conditions, including limitations on the number and types of users—for example, named and concurrent users—and the number and types of facilities at which, and equipment on which, the software can be installed and operated.

The implication of these restrictions may not be immediately obvious. If the healthcare organization wants to exceed, or even inadvertently exceeds, any of these restrictions, it will be required to pay additional license fees to lawfully do so. One example of this is a well-known
software vendor who became notorious for its practice in the late 1990s of auditing its customers to identify software usage that exceeded the limits contained in the contract. The additional license fees extracted from individual customers often equaled millions of unbudgeted dollars. To avoid this scenario, healthcare organizations should do two things:

First, an organization should ensure that all software license restrictions are fully understood and are in line with the organization’s present and future needs. For example, does concurrent use include being passively logged into an application, or is active use required?

Second, healthcare organizations should include in the contract incremental license fees expressed as a specific dollar amount, or a guaranteed list-price discount rate, so pricing will not be subject to the vagaries of future negotiations, when an organization’s leverage will likely be greatly reduced. If the guaranteed discount approach is used, the contract should include an obligation for an authorized financial executive of the vendor to certify in writing the amount of the list price from which the discount is calculated.

**DETAILING SUPPORT COSTS**

Initially, payable software license fees typically receive a lot of focus in the IT contract because they are an upfront cost that, frankly, is impossible to miss. Of equal, if not greater, importance are pricing details around the support fees that will be charged by the vendor; that’s because these fees usually will continue for many years and result in the payment of dollars that will exceed the software license fees many times over.

Annually payable support fees ordinarily are calculated as a percentage of software license fees. While the amount of these fees will vary from vendor to vendor, it generally will be in the range of 18 percent to 22 percent. The software license fees that provide the basis for the support fee calculation should be the discounted fees that will be paid by the buyer and not the vendor’s list-price license fees.

When the healthcare organization first becomes obligated to pay the annual support fee always is a hotly debated topic and is a significant financial issue that should be given very careful consideration. Vendors ordinarily want the buyer to begin paying support fees within a specified date after the contract is signed; the healthcare organization, on the other hand, generally does not want to begin paying for support before the system go-live date or even before acceptance of the system. The revenue recognition boogeyman usually makes an appearance when this topic is being discussed, but the bottom line for the organization is that it should not be forced to pay for a service until the underlying system that requires that service actually is up and operational. On this point an organization should push very hard.

The vendor will expect to have the opportunity to increase support fees on a periodic basis, usually annually. Depending on a number of factors, including the date or event that triggered commencement of support fees and the duration of the system implementation effort, the increases begin, they should be limited to the lesser of the most recent increase in the consumer price index, and 3 percent to 5 percent. Given the compounding effect of many years of increases, as a best practice, the healthcare organization additionally should include in the contract a statement that the support fees charged by the vendor never will exceed the then-current rates charged to other vendor customers.

Another important support fee-related consideration is the extent to which software improvements will be provided without an additional license fee charge. Many vendors exclude new, separately priced products from the stream of enhancements that will be provided as part of the baseline support fee. The obvious challenge this practice raises is trying to nail down a “new product” definition, which might be as easy as picking up Jell-O off the table. For example, one vendor historically has charged clients separate fees for virtually every new specialty practice module developed within its EHR product offering. Some of that vendor’s customers have been caught unaware, naively expecting that improvements to existing, albeit basic, functional capabilities would be provided under support and not packaged as a new product.

Also of significant importance in a highly regulated industry like healthcare is the extent to which the vendor will promise to make—and include in the cost of support—software modifications that are needed to comply with federal and state laws and regulations. Modifications also might be needed for other relevant standards and requirements that, while not legally compelled, may be practically compelled. Many vendors will provide ordinary-course federally required changes as part of their baseline support fee, but healthcare organization may want to seek a two- or three-year moratorium on support fee increases. After these annual increases begin, they should be limited to the lesser of the most recent increase in the consumer price index, and 3 percent to 5 percent. Given the compounding effect of many years of increases, as a best practice, the healthcare organization additionally should include in the contract a statement that the support fees charged by the vendor never will exceed the then-current rates charged to other vendor customers.

In light of the constantly evolving nature of the industry, healthcare organizations will be well-served to negotiate the broadest possible commitment from their vendors.
and other enhancements to the software. The healthcare organization typically will want to control, via contract terms, how often it will be required to implement a new release—often referred to as “lag-behind rights”—particularly if acquiring a product that is in the early stages of its lifecycle. If the vendor’s assistance will be required to implement a new release, a healthcare organization should ensure that it understands how the vendor prices those professional services.

For example, one vendor’s standard practice is to only quote a fixed fee for providing new-release implementation support for one of its products, as a standard practice. That can be a real waste of money for organizations with a large talented IT group that is able to do a lot of the heavy lifting. Some customers successfully have negotiated variances to this standard practice, but only because they were smart enough to ask the question in the first place.

**PROFESSIONAL SERVICE COSTS**

Another interesting subject in the world of IT finance is professional services. When people talk about completing a project “on budget,” they almost always are referring to the cost of professional services, which can be a real wild card if not carefully managed and controlled.

Vendors usually quote professional services in one of two ways—either as a fixed fee or a time-and-materials estimate. Many healthcare organizations are enamored with the idea of a fixed fee because they believe they have successfully built a large impenetrable fence around the total professional fees component of their project. What many fail to appreciate is that a fixed fee nearly always is tied to a fixed scope and a plethora of detailed assumptions. Think of them as unlocked gates in the fence that are easily opened – when the project will be completed, or time bounding; conditions related to the organization’s environment and other systems, such as interfacing and data migration assumptions; service volume assumptions (for example, the vendor will only set up the first 10 contracts in a contract management system, and all others are to be set up by the buyer); and so on.

While these types of assumptions are not inherently bad, they must be reviewed with a fine-tooth comb and vetted to assure the metes and bounds of the project’s scope are fully understood. Failing to do so might lead to the dreaded change order, and the resulting additional expense.

How vendors are able to quote a professional services fee that has integrity (not too high, not too low) without conducting adequate due diligence and planning on the front end of the project is a great mystery. Fortunately, this mystery need not be as challenging to unravel as whether it was Col. Mustard who murdered Mr. Body with a candlestick in the library. A healthcare organization should require a vendor to work with it before, not after, the contract is signed to develop a detailed, custom-tailored project plan and resource plans that will be attached to and made a part of the contract. Although it is nearly impossible to capture every issue ahead of time, the level of focus this process entails should dramatically minimize the number of doors in the big, impenetrable fence.

Another important contracting technique specifies hourly service rates by vendor personnel category in a schedule attached to the contract. These rates should provide an upper limit on the amount that can be charged by the vendor for services provided on a time-and-materia-

<table>
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<th>Percentage of hours in excess of estimate</th>
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<td>0-10%</td>
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Another important contracting technique specifies hourly service rates by vendor personnel category in a schedule attached to the contract. These rates should provide an upper limit on the amount that can be charged by the vendor for services provided on a time-and-materials basis, and it should provide the basis for any fixed-fee quotes. The rates should cover all of the categories of services offered by the vendor that are chargeable on an hourly basis, such as for implementation, project management, out-of-scope support, development and others.

After these rates are established, the service rates should be subject to the same increase restrictions described earlier with respect to support fees – for example, increases can occur only once annually; the first right to increase the rates might occur two or three years after the contract is signed; all increases should be capped at the lesser of the most recent CPI increase and a small percentage; and the rates should never exceed the vendor’s then-current rates, less a specified discount.

For time-and-materials projects, another...
THIRD-PARTY SOFTWARE AND EQUIPMENT

When acquired through the vendor in its capacity as a reseller, third-party software and equipment represents another core pricing-related consideration in IT contracts. Various negative incentives in the contract, such as vendor-imposed verification or certification fees, may prompt the healthcare organization to buy equipment and license third-party software through the vendor when the purchaser actually might prefer to “buy direct.”

To control third-party software and equipment acquisition costs under these circumstances, the buyer should seek terms in the contract that limit the price that may be charged by the vendor to cost plus 5 percent, for example. If requested by the healthcare organization, an authorized financial executive of the vendor should be required to certify in writing the amount of the vendor’s cost.

The healthcare organization also should include price protection in the contract relating to the cost of support and maintenance for these third-party products. In particular, it should ensure it understands the length of any included warranty periods, the availability and cost of any extended warranty periods, and the frequency and amount of any support or maintenance fee increases. Although it may be challenging to impose limits on the frequency and amount of any third-party software or equipment support and maintenance fee increases because of the vendor’s pre-existing reseller arrangements, the vendor minimally should be required to pass through those increases at actual cost without markup.

The pricing and cost-related considerations in an IT contract are numerous, but they’re not impossible to navigate. With a little planning at the RFP stage and a lot of diligent effort at the contracting stage, buyers can save a lot of money in their IT contracts. It just makes good dollars and cents.

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Ken Waldeck – San Francisco, Calif.
David R. Wilt – Roanoke, Va.
Using Informatics to Support Clinical and Translational Science

One initiative is translational research. Translational research is defined through its activities: “Scientists provide clinicians with new tools for use in patients and for assessment of their impact, and clinical researchers make novel observations about the nature and progression of disease that often stimulate basic investigations.” Its goal is to truncate the length of time between a scientific discovery through basic research at “the bench,” progressing to the clinical level or the patient’s bedside.

THE CHALLENGE TO INFORMATICS

The following scenario is an example of the inability of today’s infrastructure to support the connectedness required for translational science.

Recently, I heard Dr. Tom Romano (name changed to preserve his anonymity) discuss his research on Caenorhabditis elegans (C. elegans), a nematode. He mentioned that such research could potentially help treat diseases like diabetes and certain heart conditions—an example of bench to bedside. A few days later, the 2006 Nobel Prize in Physiology or Medicine was awarded to Andrew Z. Fire and Craig C. Mello for discovering a mechanism to silence genes in humans, using C. elegans.

I wondered whether one could have inferred the possibility of Dr. Romano as a potential collaborator in a clinical and translational science initiative, based on searching publicly available data using Google and another locally developed knowledge management system. I could not infer from his lab’s Web site a potential link between his research and diabetes; there is no mention of diabetes in the description of the lab’s research, in the citations’ list of recent publications or in recent abstracts. He was working in his own silo.

Searching the Community of Science expertise database, I found that Dr. Romano is listed with the following keywords: biochemistry, biological sciences, developmental biology, embryology, gene expression, genetics, molecular biology, C. elegans and developmental biology. However, there is no mention of his expertise in diabetes or heart conditions, reinforcing the silo.

Querying the database developed at our university to support clinical and translational science, I found that C. elegans is not a keyword and that Dr. Romano is not listed. I discovered that C. elegans is a keyword in the Computer Retrieval of Information on Scientific Projects thesaurus, a controlled vocabulary used to assign indexing terms or keywords to research projects. I learned that Dr. Romano has an ongoing NIH grant. There was no consistency in name recognition among the databases.

I searched the literature using Romano, C. elegans and diabetes as search terms, and found a recent paper that cites Dr. Romano’s paper, and links C. elegans research and diabetes. Thus, while I could not find a direct link from Dr. Romano’s publications to diabetes, I could find indirect links both in publications and through the links tab on his lab’s Web site.

Responding to my request for permission to use this case study, Dr. Romano wrote that, “None of the genes we study are related to diabetes, so I think any links between our work and diabetes would be pretty weak. However, some of the genes we study are similar to genes controlling heart development in other species. As nematodes do not have hearts, I wouldn’t necessarily expect researchers interested in the heart and working on clinical and translational science would be aware of our work. Perhaps that link may make a more realistic case study.”

A novice in molecular biology and its applications, I had found a link, but not the best one, and certainly not without significant effort on my part.

AN INFRASTRUCTURE RESPONSE

Many researchers on campus work on C. elegans. Their investigations and other similar research have the potential for translation to clinical applications—if not in diabetes, then in cardiovascular dis-
eases. However, linkages appear unrecognized either by bench scientists or clinical researchers. Breaking these silos is the heart of the problem for developing clinical translational science.

It’s true that a motivated researcher will find these interdisciplinary connections. However, it is more likely that people will participate only if they have an infrastructure that reduces the time and energy required for searching for and forming these relationships. One must discover first- and higher-order links between researchers and research topics, make the links visible, and include these in the CTS initiative. We must go beyond personal awareness and accidental meetings to form interdisciplinary teams.

One mechanism to map these hard-to-see networks is social-network analysis. Rather than broadcasting opportunities for collaboration by e-mail or other means, it’s more effective to target people based on searching a knowledge base and selecting prospects for the interdisciplinary teams. A targeted message is more likely to attract a researcher’s attention than a broadcast message, and a targeted message could persuade researchers to invest the time to explore the opportunity for collaboration and translation, thus breaking the silos. Systematizing the workflow across silos can reduce the time-to-application of biomedical scientific discoveries and the time-to-research of clinical and community healthcare issues.

To break the silos of research while simultaneously advancing science, the infrastructure should facilitate the back-and-forth translation of information — data, information, and knowledge — between basic researchers, animal researchers, clinical investigators and public health researchers. It must support the translation of information between the subdisciplines of each group as well (See Fig. 1).

Specifically, these infrastructures should support the following:

**Social networking among scientists.** They should foster integrated and collaborative scientific studies, through multidirectional communication, required to translate research into clinical and community practice; develop a dynamic interactive online community of researchers and practitioners; catalyze communication and networking among and between researchers, clinicians and community healthcare workers; give administrators, researchers and students facilitated access to powerful integrated, informational and infrastructure resources with user-friendly interfaces; and re-engineer the process of creating collaboration networks among researchers and practitioners.

**Scientific workflow management.** They should accelerate the pace of scientific discovery, facilitate innovation, and translate basic research to clinical and community practice by systematizing the workflow; reduce the time-to-practice of biomedical scientific discoveries and the time-to-research of clinical and community healthcare issues; and facilitate data and knowledge management through the adoption and development of standards and protocols.

**Logical data warehousing.** They should create a comprehensive intra- and inter-institutional logical data warehouse. The data warehouse will link clinical inpatient and outpatient data, research and other forms of data. Researchers should be able to access these data transparently while integrating and analyzing them with tools available at their desktops. They also should manage, preserve and effectively integrate the large amounts of data collected in the various phases of translational research.

**Scientist relationship management.**
They should foster integrated and collaborative scientific studies through the “push” and “pull” of information about, from and to researchers and practitioners, and they should facilitate data and knowledge management through the adoption and development of standards and protocols.

**Bases/banks/registries inventory.** They should ensure that the repositories created of databases, tissue banks, patient registries and so on are preserved and made available on-time and on-demand; provide a single point of access to repositories of data, tissue and others; and provide access to integrated support to use these repositories.

**Tools inventory.** They should ensure that the repositories of tools for analysis are preserved and made available on-time and on-demand; provide a single point of access to tools for research and analysis; and provide access to integrated support to use these tools.

Such a system will provide easy access to all the research across all the phases of bench-to-community, including a variety of databases and other resources spread across many labs and institutions. It will help proactively to develop networks of researchers across these phases. It will help researchers by pushing only relevant information to them as it becomes available in other fields of research, by keeping track of their preferences and their past searches and information requests.

Such a system would have made so much easier the relational search scenario depicted earlier in this column between *C. elegans* and the researcher’s community of interest.

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**REFERENCES**


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Technology Governance Strategies for Maximizing Healthcare Economic Value

Developing Management Systems for IT

By James Langabeer II, FHIMSS; Rigoberto Delgado, MBA; and Osama Mikhail, PhD

ABSTRACT

Based on industry averages, healthcare providers spend from 1.5 percent to 3 percent of their revenues on information technology. That can equate to a million dollars a year for even the smallest hospitals and as much as $50 million or $60 million a year for large health systems. That significant amount of capital must be wisely managed because these investments are long-term assets that can help transform the enterprise and contribute to the organization’s strategic goals. Unfortunately, in many hospitals these investments are often made without regard for the actual return on investment that the systems will generate.

ROI, or economic value, is difficult to quantify in healthcare because of the complex multi-dimensional processes and perspectives that exist. Administrators and providers often question how a clinical system can be quantified and compared with an ERP, research technology or any other information system. When value can be defined in so many ways—such as improvements in clinical outcomes, improvements in system uptime or reliability, or enhancements in productivity and operational business processes—quantification of economic value becomes much more ambiguous and therefore easy to neglect.

However, business value can be created by any combination of shifts in performance. Reductions in waiting lines, improvements in imaging capabilities, increased procedures per labor hour, extensions of system life and higher transaction processing all have potential value. However, ROI cannot be calculated or maximized if underlying key performance indicators are not defined and measured, both pre- and post-implementation. This article will build on solid governance strategies for IT that will help to ensure positive economics and improved productivity in healthcare. It also will discuss specific strategies and methods for extracting the most value out of IT in healthcare.

KEYWORDS

Economic value, IT governance, technology productivity, initial value point, return on investment.

MANAGERS of a typical healthcare facility must allocate scarce financial resources among a variety of different investment choices; these may include adding new clinical services, increasing beds or exam rooms, hiring additional physicians and staff or investing in technology and information systems. Each choice has a potential benefit to providers, such as improving the ability to diagnose or treat illnesses, increasing productivity of staff or building a brand and infrastructure for scale and reputation. Alternatively, each investment also can have a marginal or even negative impact on results, resulting in underperforming resources and even waste. In light of the current financial condition of most hospitals, where less than a nickel of every dollar generated by patient care revenue can be invested back into capital projects, every investment must be carefully analyzed to ensure that returns are maximized.

Hospitals and healthcare systems routinely are confronted with these strategic managerial issues about long-term direction and economic survival. Information technology can play a critical role in both of these areas, but only if proper governance strategies are put in place. Unfortunately, the sophistication and quality of IT governance practices used by different organizations varies considerably, and few have implemented best practices focused on sustainable long-term strategy.
MEASURING BUSINESS VALUE

IT governance can be defined as the process of investing in, implementing and maintaining information systems that achieve desired organizational outcomes. From a healthcare perspective, these performance outcomes typically include improved clinical outcomes and efficacy, such as the ability to diagnose patients more accurately, earlier or more comprehensively; improved economic and financial returns – for example, systems that streamline processes or enable greater labor productivity; and reduced risk or improved controls, such as compliance with laws and regulations like those of the Joint Commission or Sarbanes-Oxley.

Many advanced organizations are starting to change managerial processes to ensure that information technology contributes economic and business value and, in effect, are acting as good stewards of financial resources. These hospitals are adopting new governance models that focus the entire lifecycle of an application around capturing expected benefits and understanding total lifecycle costs.

However, such governance processes require organizations to make return on investment a critical component of pre-approval processes, mid-project evaluation and post-implementation reviews. Managing for business value requires strategic alignment, most importantly including the alignment along four vital functions — aligning of investments with the organization’s strategy; sharing of responsibilities and accountabilities between clinicians, IT staff, and operational managers; establishing ROI criteria and investment decision committees that continuously monitor value and ensure behavioral changes; and focusing on performance results and metrics.

Figure 1 shows how the economic value of healthcare IT is maximized through governance alignment. Each of these will be discussed in the remainder of this article.

THE VALUE-FOCUSED GOVERNANCE FRAMEWORK

Governing IT processes to ensure economic value is not just the responsibility of the CIO or CFO. In fact, since that the average tenure of a CIO in complex environments is less than four years, it is doubtful that the CIO can bring about meaningful changes in culture and behavior alone. Everybody from trustees down to operational unit managers must be incentivized and educated around value-maximizing behaviors. To create economic value requires IT governance that systematically analyzes, documents and manages IT projects to maximize key performance metrics in data, infrastructure and applications.

One of the major obstacles that challenges IT organizations is the lack of a value-intrinsic culture within their hospital or facility. In many industries, this is lead by the CFO and financial executives; however, in healthcare the finance team and administrators in general have been slow in transforming capital investment and resource allocation processes towards increased use of metrics and quantitative criteria for measuring and evaluating project success. So one of the first steps in the process is to establish formal quantitative criteria for return on investment.

A major challenge for the organization is to hold users and managers accountable for changing behaviors and process after technology goes live. A new system implemented in an old environment, with no associated changes in process or actions, will never deliver value. If the new system should have generated reduction in labor requirements, there needs to be accountability and discipline to follow through on this commitment. Incentives should be implemented to hold managers accountable for both the positives
and negatives of their project, although adjustments from lessons learned should always be part of post-project reviews. However, these same individuals should be allowed to share the benefits of the project via financial or other rewards.

**ROI: Proxy For Economic Value**

There are several activities involved in formalizing ROI criteria. The first of these is to establish IT investment committees focused on specific areas, such as clinical systems, supply chain systems, nursing, or research systems. Many facilities have created focused committees, but their role has been reduced to providing functional expertise or limited oversight in their specific area.

Committees should be utilized in a much more strategic and comprehensive way, with the following responsibilities:

- Defining a technology strategy for their committee and ensuring alignment with the organization and with upcoming projects.
- Recommending systems based on their potential need or value.
- Requiring and defining performance or quality metrics associated with each process for system upgrades and implementations.
- Requiring pro forma expectations for metric changes as part of the project proposal process.
- Screening new systems based on established criteria.
- Allocating a fixed budget amount using quantitative and metric decision criteria, at multiple points during the fiscal period.
- Requiring mid-project scorecards and reports that show earned value, project obstacles and updates on risk-return ratios.
- Providing “enforcement” and monitoring of behavioral and process changes to ensure commitment from managers so projects achieve the outcomes originally proposed.

These investment committees ensure alignment between their user group or stakeholders and the strategy of the organization. Investment criteria must suggest that a specific dollar amount or percent of total spending should be allocated to each area of the portfolio—clinical, operational, infrastructure or strategic. An investment committee should be named for each of these areas to manage recommendations for projects, ensuring that the impact on the business value in that area is met and that a disciplined approach to project governance is followed. Figure 2 shows the alignment of investments to strategy in the IT portfolio.

In addition, IT governance practices must incorporate baseline rules that establish when and how an IT project will be funded. In many respects, this is absent in hospitals today. The process is often fairly ambiguous and political, and decisions often are made based largely on the persuasive power of the project sponsor.

In the absence of formalized criteria, this is often the case, but it will have to evolve to a much more sophisticated approach as healthcare continues to face investment decisions with more limited resources.

Examples of more formal ROI criteria include shared information about assumptions, total IT capital budget, timing of requests for capital spending and thresholds required for approvals. In addition, the use of specific ROI templates, business cases and other tools should be encouraged or required as part of a standardized approach to becoming more formal and sophisticated.

In addition, IT investment committees need to define and measure the organization’s true cost of capital. Cost of capital assumes that total long-term benefits need to exceed long-term costs, taking into account IT projects’ costs plus those incurred in obtaining funds, such as loans, bonds and other financing. If total benefits do not exceed the project costs inclusive of financing, then effectively the project destroys or reduces economic value for the organization. The cost of capital is essentially the cost of acquiring resources for the facility, and is a blended weighting of sources of equity and sources of debt in the financing portfolio. The higher the cost of capital, the greater the requirements for IT projects to show value in the long run. If a technology costs $1 million and cost of capital is 10 percent, then total project benefits in that year will have to be at least $1.1 million just to break even on that investment.

One of the most common concerns in IT governance is that it is difficult to attach outcomes or metrics for a system.\(^3\) Difficult as it may be, all new technology has benefits, and these benefits need to be expressed quantitatively. For example, if a PACS system is put in place for sharing and managing clinical imaging, it definitely has qualitative benefits—it improves digital storage of images, preserves images for a longer period of time and enables remote access to patient data regardless of geographical location.

Historically, PACS has not been required to show economic value, but clearly each of these qualitative benefits also can be

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**Figure 2: Align investments to IT strategy portfolio**

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<tr>
<th>Investment Criteria</th>
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<tr>
<td>Clinical</td>
<td>40%</td>
<td>Patient Satisfaction, Quality, Productivity</td>
</tr>
<tr>
<td>Operational</td>
<td>40%</td>
<td>Efficiency, Workflow, Productivity</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>5% of total $</td>
<td>System up-time, reliability, access, TCO</td>
</tr>
</tbody>
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expressed quantitatively. For example, there is an associated economic benefit to replacing film with digital imaging. The cost of record retention, storage, management and potentially displaced employees are all hard costs that can be quantified. Quicker provider response time for reading images, and ultimately higher patient satisfaction and provider productivity, are also quantitative benefits of this type of system. Although difficult to measure unless thoroughly analyzed and modeled, the economics of the investment require thorough investigation of both long-term shifts in outcomes and costs. In effect, all systems—even those with primary value points of clinical or infrastructure goals—should be expressed in economic terms if technology is to contribute value in health.

Organizations should also establish a hurdle rate or a threshold that is greater to or equal to the cost of capital. In essence, this hurdle rate establishes criteria for quantitative benefits below which no projects will be considered. For example, if the cost of borrowing funds for a hospital is 6 percent, the CIO or CFO might require that all investments in technology must generate at least 7 percent returns, which would be the hurdle rate. If projects cannot achieve that rate of return, then they would not be accepted. Because some applications do not have a financial payback, then hurdle rates should be applied at the portfolio level instead and managed by each committee.

In addition to the hurdle rate, the formal ROI criteria must dictate which methods should be employed for evaluating economic outcomes. These methods include net present value, payback methods, internal rates of return and free cash flow methods. After the methods are in place and used by everyone seeking funds, the investment committees must continuously publish the “standards” for project acceptance. These include such invest-

ment heuristics as accept all projects greater than the hurdle rate; accept all projects with positive net present values; accept top-rated project in each value type (clinical, strategic and so on); or rank all projects by investment type and accept the top two or three, depending on the total capital expenditure budget.

After “ideal” investment allocations are made and projects are selected that meet the required criteria, it is important to define and measure the performance and productivity metrics that will generate value. Metrics should be established at a discrete level, either the process or outcomes basis. A pre- and post-implementation review of these metrics is necessary to ensure that behavior changed or that process improvements were made to generate the value described in the initial project proposal. Examples of detailed process metrics that can be measured and valued include cost per transaction processed; transactions processed per hour; nurse-to-patient staffing ratios; patients visited per nursing hour; physicians per available bed; reduction in cycle times; improvement in labor productivity, such as outputs vs. inputs; or reduction in bottlenecks provided by capacity expansions.

FOCUSING ON RESULTS

Departments of management engineering can be extremely valuable in providing independent, methodical and quantitative methods to evaluate the shifts in performance metrics. Because project sponsors and functional managers typically are highly vested in the decision, they rarely make unbiased judgments on investment value. A variety of tools—such as time and motion studies, cycle-time analysis, queuing models and statistical process control charts—help monitor behaviors and performance over time to ensure that an investment generates performance differential and long-term economic value.

Management engineering departments should be closely aligned with IT staffs to ensure decisions are based on facts, observations and actual behaviors. For example, if a cardiology system and a scheduling system are on the docket for the clinical investment committee, how do members compare the benefits, risks and costs? If the benefits are simply bullet points in a PowerPoint presentation, supported by qualitative opinions and testimonials from project sponsors, the systems cannot be compared or evaluated effectively. Breaking out each of the system’s benefits into

Figure 3: Creating value through lifecycle strategies

![Diagram showing lifecycle strategies]

1. Escalate initial point of earned value
2. Increase max. benefit range
3. Expand the benefit period

Costs/Value

Governance
Approval
Make
Investment

Implementation

On-Going Operations

Upgrade/
Replace

Develop Initial
Business
Case

Expenses

Benefits

Life Cycle/Time
performance metrics and quantitatively expressing the change in performance over time is the only way to make systems relative for investment purposes. Achieving a culture that understands that rational decisions require sophisticated valuation methods is a prerequisite, and developing this culture takes time.

After these metrics are defined, measured and reported routinely, they can be converted into associated cash flows (inflows and outflows) so a traditional ROI model can be developed. Using concepts based in the time-value of money, the associated cost of capital and operations can be expressed over time, and a net present value summation can be used to measure the total economic value generated by the system.

**STRATEGIES FOR MAXIMIZING VALUE**

Creating value from IT requires that a hospital or facility show discipline in their IT governance, consistently positive economic behavior in their investments and alignment of governance with organizational strategy. The use of formal ROI criteria and a portfolio approach are just two of the ways to generate value from healthcare technology.

In addition, governance must encourage project managers to focus on other key strategies over the system's lifecycle. This lifecycle approach is important because value is generated only in the long run and is completely dependent on key events, such as the point of initial value creation and the system's probable end of life. Figure 3 shows the value creation process over a system's lifecycle.

The first of these strategies is to define and escalate the initial value point, or IVP, the very first point in time during implementation or execution when a new system starts to generate limited “returns” or benefits. Small pilots, more rapid deployment and faster prototyping help to create value earlier in the project, which improves the expected business value because of compounding. Because healthcare projects are notorious for having long implementation cycles and substantial cross-functional deployment teams, project managers must precisely define the IVP and should get incentives for escalating the value point without jeopardizing project quality or performance any other way. Rapid prototypes, iterative small-scale deployments and other strategies should be encouraged to reach the initial value point faster.

Another key strategy is to find mechanisms to increase the maximum benefit potential. IT projects should be focused around maximum penetration rates, through greater deployment areas, more geographical coverage and other horizontal expansions. Integrating new initiatives that will increase the scope, number of users and other benefit potential is one way to continuously improve economic value. This means initial pilot areas should be selected based on their potential to affect total project performance rather than on the influence or power of departmental administrators. Selection of areas that have the highest percentage improvement opportunity, the “lowest hanging fruit” or are in the best position to leverage into other larger areas should be the highest priority for deployment planning.

Finally, the third strategy is to expand the benefit range. This encourages lifecycle management that stretches the benefit period, especially during later periods when costs tend to decline significantly while benefits remain stable. Methods for ensuring that benefits last longer are to make routine investments in upgrades, continued enhancements and modifications, improved reporting and other interim changes that support the usability of the system. Creating a plan to obtain an objective measure of project payoff is necessary. It is also important to avoid the emergence of competing non-strategic “flavor-of-the-month” solutions. This takes discipline to stick with the project and ensure long-term results. The lack of strategic initiatives to capture potential gains, especially when reallocating human resources, is problematic as is the absence of a functional plan to communicate benefits across the organization. However, dedicated management can overcome both if they are focused on expanding the project benefit range.

Hospitals that are successful in achieving these strategies during a project’s lifecycle and can simultaneously incorporate a value philosophy in the culture and governance processes will start to see significant positive contributions from their IT portfolio.

**ORGANIZATIONAL BARRIERS AND CHALLENGES**

Multiple challenges and barriers can prevent organizations from securing maximum benefit from IT initiatives. The first potential obstacle for organizations is maintaining an organizational culture that is receptive to metrics or outcome-based decision-making. Many advanced organizations are starting to change managerial processes to ensure that information technology contributes economic and business value and, in effect, are acting as good stewards of financial resources.

Many healthcare organizations have not fully embraced the use of quality and performance metrics, and scorecards that report institutional key performance indicators are noticeably missing or inconsistently used in most environments. Those that do have scorecards typically are limited to only a few high-level metrics, and many of these are not focused on long-term value. In addition, there is a lack of qualified teams focused on developing objective economic and financial evaluations of new technologies. This is particularly the case in the healthcare sector where most initiatives involve interdisciplinary, cross-functional processes, such as medical functions, engineering and business processes.

In many places, clinicians and administrators lack the time, resources or expertise to obtain quantifiable measures of performance. In other cases, there is a lack of understanding of the approaches used to obtain routine performance metrics. Also, many clinicians and providers feel that their work cannot be quantified, making the evaluation of potential benefits extremely
difficult. The use of performance improvement or management engineering departments is especially useful in providing this expertise and to find a means to secure quantitative data to support each investment.

A second organizational barrier is the tradeoff between optimal institutional coverage and operational scale. In other words, as the number of interdisciplinary participants increases, so does the ambiguity in the governance process. Because each faction has their own beliefs, interests and needs, there is more difficulty in comparing different investment types.

A third barrier involves maintaining management alignment between the office of the CIO and the CFO, as well as other senior administrators. Deployment of value-focused governance methods requires all executives to be aligned and that no back-door investments are made that do not follow the governance process. Workarounds, such as funding projects through operational budgets that does not run through the appropriate investment committees, is just one way that funding occurs when lack of alignment exists. However, it is equally important that the bureaucracy of the committees does not become excessive, which might limit creativity and initiative.

A fourth challenge involves ensuring that projects have a clearly defined vision. IT governance must require a post-project review to ensure that benefits are achieved through behaviors, actions and decisions suggested in the project proposal. One way to do this is to ensure that the project has a clear vision and an actionable mission, a concise statement that articulates the purpose of the project in terms that users can understand and support, such as, “Assisting the patient better and faster.” Other potential problems in this area occur when there is nonexistent end-user intelligence, absence of an advisory team or a lack of selective training strategies.

A fifth barrier is the danger of focusing too narrowly or only on the short term. It is easy for managers to give high priority to projects that show high non-economic returns, such as prestige or the appearance of being on the leading edge. However, the goal is to foster sustainable IT strategies in which investment opportunities are appropriately balanced for the short, medium and long-term. Balancing risks, investment types and time spans is very important for maximizing value.

A final organizational barrier is created by the mobility of the modern workforce. When a project sponsor or senior-level manager moves out of a department or the organization, a bit of complexity and chaos is thrown into most projects. For example, if several million dollars has been invested to supply the operating room with OR scheduling software, based on the strategy of the former OR director, and then that person moves on to a new organization, what happens to the project? What if the new director does not believe this system is valuable or should be continued? In hospitals where there is a lack of alignment around core strategies or goals, then each individual can change the agenda based on their own personal beliefs and preferences. However, alignment and focus around improving the key performance metrics is quantifiable. If the system can improve the outcome at a level that is greater than costs, then managerial transitions are less likely to negatively affect project success. However, without a focus on outcomes and value creation, personnel changes can have significant negative influence on information systems success.

**CONCLUSION**

IT governance processes need to be continuously refined to ensure that investments in technology translate into long-term economic value. Decisions to invest in one IT system over another are essentially an issue of resource allocation, because hundreds of competing solutions are vying for limited funds. As margins drop and cash on hand shrinks, investments in technology displace investments in other critical patient care areas, such as additional capacity, service lines or staff. The clearer the policies, the more aligned the investment process are to organizational strategy, and the more sophisticated the valuation process is, the better the long-term results will be.

Governance should start with a strategic perspective, crafting and aligning a technology strategy focused on clinical outcomes, operational, infrastructure or even strategic goals. Aligning investments to ideal allocation percentages, supported by long-term IT plans, will help create an initial allocation to be managed by focused investment committees. Requiring all systems to express benefits quantitatively, and then deliver them, is essential to comparing investment options and making optimal decisions. There are several strategies for creating value from information technology over a system’s lifecycle, and these must be incorporated in governance models to ensure that technology payoffs exceed their costs. Only by adding discipline, sophistication and rigor to governance will technology maximize economic value.

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During the late 1990s, investment by American industry in information technology was an average of eight times higher per worker than within the healthcare industry. Despite the large amount of spending on health information technology, there are still issues relating to costs, errors, efficiency and coordination of care, which reflect the limited saturation of health information technology within healthcare systems. For example, inefficient paper-based systems, inaccessible medical information during care, limited patient access to health information, misinterpreted handwriting and unavailable best treatment options affect the current healthcare systems.¹

To counter these issues, an executive order was issued in 2004, calling for widespread and nationwide adoption of electronic health records by 2014. Adoption has been slow — some estimates suggest that fewer than one in five physicians have adopted EHRs. In another survey regarding patient access to EHRs, only a small number — one in 25 — had accessed their information.

Small practices, or those with fewer than 10 physicians, are predicted to be the final adopters of EHRs. The tipping point, or time when the greatest number of adoptions will occur, is estimated to come between 2009 and 2012. Mid-range estimates predict that nine in 10 practices will adopt EHRs by 2024, a decade after the expected goal, with complete saturation unattained even then. Implementation costs and return on investment are listed, among other reasons, as the predominant factors limiting rapid adoption. A widespread EHR adoption plateau is expected, with entities being unable or unwilling to adopt EHRs. This will lead to incentive-based requirements to achieve widespread adoption and the full potential of EHRs. This paper looks at externalities of health information technology between the major entities — payors, providers and consumers. These externalities necessitate implementation of incentive-based programs to achieve benefit equilibrium. Game theory is employed to model the behavior of these entities to capture the most equitable outcome. Prescriptive analysis is utilized to interpret and suggest optimal adoption behavior.

Barriers to implementation include upfront costs, with EHR savings expected to actually benefit third-party payors. In other parts of the world, EHR adoption has been spurred by governmental subsidies.²,³

A widespread EHR adoption plateau is anticipated, with entities unable or unwilling to adopt EHRs. The dilemma of management is to determine methods that will encourage health information technology adoption, specifically EHRs, and lead to improvements in cost and quality of care in the healthcare industry. This process will lead to incentive-based requirements, which
do not necessitate governmental subsidies for EHR adoption. This paper looks at the externalities involved in the adoption of EHR and utilizes game theory to model outcomes.

**ADVANTAGES OF EHRS**

Healthcare stakeholders promote the use of HIT as a way to provide safe, affordable and consumer-oriented healthcare. This includes avoiding medical errors, the improved use of resources, accelerated diffusion of knowledge, reduction in access variability, consumer role advancement, privacy and data protection, and public health and preparedness. EHRs have been shown to decrease billing issues, medical and drug errors, and improve patient health, use of medical evidence, cash flow and collections, paper cost, quality, safety, research, compliance, and preventative care.

Personal health records are consumer-oriented information that enable consumers to better manage their healthcare. PHRs include data on medical history, medication, immunizations, allergies and more. Typically these are seen as electronic systems integrated with or a component of EHRs. Other technologies that are integrated with or a component of EHRs include decision support and computerized practitioner order entry.4,5,6,7

The need for quality measures is another reason for adopting EHRs. Increasingly, providers are being measured on quality, and that quality is tied to pay for performance or other programs that directly affect the payment to the provider. EHR systems make quality measures available for reporting and compliance requirements. In perhaps one of the largest EHR implementation case studies, the Veterans Health Administration showed improvements in employee-patient ratios and cost-per-patient decreases as compared with the US consumer price index increase. Quality also is improved through preventative screening measures and disease management.8,9

The president’s plan for EHRs coincides with these benefits, with the intent of empowering the patient and solving issues involving errors, quality and increasing costs. By 2014, healthcare information is expected to be accessible for most Americans at the time and location of service, and patient participation will be voluntary. To meet the target, the following activities are taking place to speed the adoption rate – the creation of standards, funding for demonstration projects, governmental adoption of HIT and the development of national leadership.10

Despite the political pressures and potential benefits, EHR adoption has been slow. One recent study showed the relationship between EHR adoption and provider size, finding that the adoption rate decreased as provider size—in terms of full-time physicians—decreased. The total cost of an EHR—which includes purchase of hardware, software, implementation, maintenance, training, customization and support for operational changes—remains high.4,5,6,12

Insufficient capital, return on investment, data use concerns, consumer education and costs are listed as the top limiting factors and barriers to EHR adoption. While pressure increases to adopt EHRs, issues remain regarding costs because a typical provider ROI cycle for an EHR application is three years. While benefits of EHR adoption extend to others, the provider must make the investment. Key stakeholders, such as payors, consumers or patients, and physicians and practices should collaborate to ensure sufficient capital is available, and share in the risks and rewards. Collaborative purchases and government incentives are expected to improve adoption and lower price points.4,5,12,13,14

**INCENTIVE APPROACHES**

While the healthcare industry spends less than other industries for electronic systems, they are still expensive. To encourage information technology adoption, some advocate direct or indirect incentives. Examples of direct rewards include regional grants and contracts, low-rate loans, pay for use, and provision of an EHR system in exchange for data that can be used by third parties. Examples of indirect rewards are pay for performance programs.

Regional grants and contracts would be used to promote EHRs at local levels, with the hope of creating local and regional data exchanges. Some solutions intended to encourage adoption, such as pay for performance, do not apply universally and require localized incentives. Federal low-rate loans also could reduce the barrier to entry of EHRs. Pay for use involves providing reimbursement based on new codes and modifiers, or through direct incentives. Pay for performance would provide incentives for those practices with the highest quality, which is expected to be enhanced through the use of EHRs.4,5,12,13,14

Incentives are intended to provide adoption momentum in the market. Providers of care are not adopting at a high rate as a result of the cost-benefits, business process re-engineering, and potential legal barriers. However, it has been demonstrated that quality and efficiency can improve by using electronic records, which leads to reduced medical errors and utilization. This creates the issue of whether the market supports technology in terms of societal benefit.

In terms of interoperability, support and IT infrastructure, smaller practices have a larger need. Some suggest targeting larger providers, which require lower incentives because they typically have well-established IT systems and support structures. After large providers adopt IT, smaller providers may follow. One study looked at targeting imminent adopters of EHRs, those providers ready to implement within one year. The idea is to move the adoption curve forward until the market is saturated and others feel compelled to implement. Larger practices or those with larger population centers had a higher percentage of adoption.12,14

The government also could implement policies that add to the business case of adoption. Various payors have tested different incentive approaches, but there is still much to be learned. Stakeholders are wary to offer incentives until the case is proven in support of IT adoption. In addition to continued incentives, education such as policies, procedures, methodologies, analysis and more will be needed to ensure continued success. This information can be shared among the healthcare community to improve healthcare and IT adoption.12

Providers currently assume most of the cost and risk of IT investment, and they do not receive the full return from implementation benefits. The costs and benefits factors may include practice size, specialty, geographic location, operational efficiency, affiliations, IT support and market incentives. An agreed-upon
level of incentives is one that compensates the additional cost of obtaining data, and is fair, equitable, attainable and reviewed for additional increases. Incentives offered by only a limited number of payors generate a first-adopter disadvantage and fail to provide sufficient motivation. Payor adoption of incentives will encourage the creation of standards to measure EHR utilization. Past implementations have shown that physicians often resist practice changes required by EHRs. In light of this, incremental approaches to adoption have been suggested. These include e-prescribing and online tools.12

In a state of rising costs, health information technology often is required to show a return on investment, but ROI may be hard to demonstrate when indirect benefits are realized. In other cases, while providers typically make the investment, the benefits are realized by non-investing entities, such as payors and consumers. This disincentive may influence safety and quality of care by providers.9

CONSIDERING ECONOMICS

Network externalities, specifically indirect network effects, are commonly described as chicken-and-egg problems. Current examples include broadband and 3G wireless. The demand is dependent on the infrastructure, and the infrastructure is dependent on the demand.

In supply-side economics, the costs decrease while demand increases, with regard to increases in scale. These network effects produce multiple equilibriums, with adoption perpetuating network effects. The demand curve increases as the number of adopters increase, but then decreases as unwilling adopters are introduced. In perfect form, the two end equilibriums of supply and demand are stable, while the center equilibrium is the critical mass. After this point is reached, the perpetuating positive loop occurs. In cases of network effects, it is advantageous for early adopters to receive a lower cost than later adopters because of the perceived value and to achieve critical mass. These network effects also perpetuate lock-in as well, with the switching costs involving the cooperation of others.13

An externality is a cost or benefit that affects the entity external to the immediate production or consumption. For example, if a provider produces information in a non-computerized format, this creates an additional cost for the payor in terms of processing. Likewise if a payor processes and produces return information in a non-computerized format, this creates an additional cost for the provider. These are examples of negative production externalities. Additionally this creates a negative consumption externality for consumers of healthcare services, including patients of providers and subscribers of payors.

Now consider if the opposite were true. If a provider produces information in a computerized format, this creates a cost reduction for the payor. Likewise, if a payor processes and produces return information in a computerized format, this creates a cost reduction for the provider. This, in turn, creates a positive consumption externality for consumers through reduced costs, in addition to improved quality.16

The marginal private cost is the additional per unit amount incurred by the producer. In this case, the marginal private cost would be the additional cost of a healthcare service—in other words, any support or costs associated with providing an episode of care. This can include but is not limited to the patient visit, claim processing, documentation, payment processing and more. These functional units can be further divided into categories for the provider of services, payor of services and the consumer of services.

The marginal external cost is the additional per unit amount incurred by those other than the producer. These include the costs incurred by the payor or consumer as a result of the provider producing a service. This also may apply to the provider through output from the payor or consumer.

The marginal social cost is the additional per unit amount incurred by all others and is the combination of the marginal private cost and marginal external cost. This may be generalized as the cost of healthcare.

As healthcare costs continue to increase, these are a combination of the cost functions from the producers and consumers. The marginal private benefit is the additional per unit benefit realized by the consumer. The marginal external benefit is the additional per unit benefit realized by others than the consumer. The marginal social benefit is the additional per unit benefit realized by all others and is the combination of the marginal private benefit and marginal external benefit.

Given this, equilibrium is sought between supply and demand. If the supply is equal to the marginal cost less any subsidy, and demand is equal to the marginal benefit, supply is equal to demand when the marginal benefit equals the marginal cost less any subsidy. In each of these cases as before, we consider EHRs’ capability to improve benefits to the producers, consumers and society a result of improved quality and cost of healthcare.16

The productivity growth period of the 1990s was largely attributed to the prior IT investment. Innovation is often cyclical and may arise from complementary products. When comparing past technological innovations to information innovations, the adoption time is much less for information; for example, consider the timeline for adopting gasoline engines, compared with that of adoption for the Internet. Often, the benefits of the innovation may also take many years to reach their potential.

With information, there is an increasing dependence on complements, or the value of combination. Total cost and benefit sharing is important because the individual costs or profits may not affect one another. It is vital for stakeholders to form a type

Small practices, or those with fewer than 10 physicians, are predicted to be the final adopters of EHRs. The tipping point, or time when the greatest number of adoptions will occur, is estimated to come between 2009 and 2012.
of integration or collaboration to maximize the benefits for all. With information technology, data can be utilized for individuals to contract on attributes of transactions that were previously unknown or unrealized. In one example in the movie rental industry, a model to charge a high fixed cost was phased out; a low fixed cost was introduced, as was a share in the variable revenue. This reduced prices for consumers and increased revenues for producers. Information systems facilitated this shift, enabling all parties to accurately track and report on the transactional data. With diffusion of computerized methods, monitoring costs decrease and enable participants to make efficient arrangements.

These topics are used in conjunction with healthcare IT and EHR adoption. Potential productivity growth realized by other industries has been largely unrealized in the healthcare industry because of investment. EHR adoption is plagued by the same network externalities affecting other industries, where the demand for EHRs has not yet reached the demand curve apex. The switching costs involve the cooperation of the existing market participants in EHR adoption, namely the payors, providers and consumers. As EHR adoption has externality implications, it is vital for participants to maximize the benefits involved. Transactional data standards exist and can be easily tracked between participants, permitting successful agreements to be reached.

**USING GAME THEORY**

Game theory is utilized for its methodology in the construction and evaluation of decision problems. The game modeling process involves each player and their decisions to be specified, taking into account each player’s inclinations. The purpose of creating a game model is to enable an enhanced outlook on the problem at hand. This prescriptive application of game theory seeks to improve decision-making strategy and to provide direction on the best decision choices.

The Nash equilibrium provides a strategy for each rational player to expect so no individual player can modify their strategy to achieve a higher payoff. This enables rational players to adhere to the recommended strategic guidelines and sets the same expectation from other players in the game.

Zang and Niv introduce a “costless” regulation in which the entry cost is subsidized by the incumbent, thereby limiting governmental intrusion to a regulator rather than the cost bearer. This regulation model may be applied to the healthcare industry, with the incumbent players subsidizing the adoption of healthcare IT. This eliminates governmental interaction in terms of monetary support and enables players to work towards the most beneficial outcome.

**MODEL AND RESEARCH DESIGN**

Backward induction is explored to solve the game. The last move in the expected game outcome is EHR adoption. Taking this final...
move as a future activity, it is possible to go backwards in time to the start of the game to determine the best set of moves the players can make in light of the final move and game outcome.

This game includes three players, or agents who make a decision. The first player is the payor, the second is the provider, and the final player is the consumer. All players are expected to act rationally—that is, play the game in a manner that maximizes their payoff. The costs involved are referred to generally and may include direct costs, such as computerization, or indirect costs, such as quality. For EHR adoption, a zero-sum game is considered upon adoption; that is, each player's outcome equalizes with one another. Otherwise, if the sum of payoffs were less than zero, there would be no incentive to adopt an EHR, and if the payoffs were greater than zero, a player would not be maximizing their potential payoff in the game.

During the first stage of the game, the payor establishes a given subsidy to any provider willing to adopt an EHR. This subsidy is variable and is based on the number of consumers covered by the third-party payor and the estimated number of services and related savings that could be achieved through use of an EHR. This stage requires the third-party payor and provider to establish a set number of covered services and expected savings over a set period of time; otherwise, the payor could oversubsidize the provider or the provider could be undersubsidized. This would be established...
through a contract or other such agreement. If there is a case such that the subsidy is greater than the expected marginal private benefit, the payor may choose not to subsidize expenses.

The second stage determines whether the provider accepts the subsidy and adopts an EHR. If there is a case in which the entry cost is greater than the third-party subsidy plus the marginal private benefit, the provider may choose not to adopt. This stage also involves the EHR-adopting provider’s desire to move toward those payors willing to subsidize the EHR, because this will maximize the provider payoff. This will force those payors unwilling to subsidize into market entry, as it may result in a potential loss of provider coverage. The second stage endpoint will involve completion of set payor subsidies to providers until a “tipping point” is reached; this point is desired to be less than or equal to the maximum subsidy benefit level realized by the payor.

The third stage involves creating a payor-based incentive to consumers who would be willing to participate with providers that have adopted an EHR. This is variable based on the number of consumers who have yet to adopt and the savings available by switching that consumer. This would require some arrangement in terms of which consumer service locations were covered and the particular rate invoked. In a case where the consumer switching cost is greater than the benefit, the payor may choose not to subsidize it.

The fourth stage determines whether the consumer receives services from a provider that has adopted an EHR and accepts the subsidy or lower payment rate. For consumers to maximize their gains, they would accept the subsidy with an EHR-adopting provider because this would provide the highest quality and lowest cost of care. Each player seeks to maximize their gains; the payor seeks to enable as many providers as possible with the least subsidy. The provider seeks to achieve the highest amount of subsidy from participating payors. The consumer seeks to achieve the lowest cost and highest quality of care.

Two equilibriums are reached during the game. The first occurs when the payor subsidizes the provider to the extent that it is profitable. The second occurs when the payor subsidizes the provider indirectly through the consumer, to the extent that it is profitable. The consumer subsidizes by paying a higher price to non-EHR provider services. Figure 1 below shows the pseudo-code for programmatic modeling of this system.

Following the possible paths, each player would choose the move that would maximize their payoff. Initially in the first decision, the payor would always prefer not to subsidize the provider; in the second decision, the payor would again always prefer not to subsidize the consumer. However in each case, either the provider or the consumer may only choose to adopt if a subsidy is offered, thereby reducing the payor’s maximum payoff.

The provider’s decision will be whether or not to adopt. The provider may choose to adopt without a subsidy, but that would decrease their payoff. Additionally if the provider chose not to adopt, efficiencies may be unrealized and the payoff would decrease. If the consumer chooses the subsidy and the provider does not adopt, the provider may decrease their payoff through consumer services. The provider would always prefer a subsidy to adopt.

The consumer may choose whether to accept a subsidy from a payor for services rendered by a provider. In this case, the consumer would always prefer a lower-cost, higher-quality service. Using backward induction based on rational players maximizing their payoff, the final move is for the consumer to accept a subsidy provided by the payor for the provider services. The payor would move to subsidize the consumer; the provider would adopt; and the payor would subsidize. This path is indicated by the arrows in Figure 2 above.

**CONCLUSION**

A game theoretic model is used to identify the optimal method for the game outcome, in this case EHR adoption, and may be utilized for improving adoption rates. The game theoretic model includes the players, stages, payoffs, equilibriums and recommended paths. Game theory is used to aid in the decision making process and to provide a strategy and course for individual and collective selections that enhance the problem solution set.

A programmatic model, as with the example given, can be employed universally or locally to systematically calculate cost, benefit and subsidy, with the goal of maximizing the system benefit. Computerized systems permit real-time tracking of these items for reporting and refinement purposes. Preference of outcome value is given to address current limiting factors, and based on these factors displays the prescriptive analysis for each player to maximize their benefit. This occurs until the end stage of the game and maximum EHR adoption has been achieved to the point where it is beneficial in terms of financial and qualitative costs.

Future directions include examining choice behavior and the factors that influence the players’ decisions, in other words, to determine factors that may cause the players to act irrationally, thereby minimizing their payoff, in addition to uncovering methods that mitigate, modify or explain player’s decision making behavior. **JHIM**

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Advancing Return on Investment Analysis for Electronic Health Record Investment
Impacts of Payment Mechanisms and Public Returns

By Susan Xu

ABSTRACT
This paper reviews a sample of studies reporting evidence on the implementation of electronic health record systems and identifies connections between reported benefits and hospitals’ internal returns as well as public returns to external stakeholders, such as patients, the government and insurers. The study indicates that payment mechanisms play an important role in whether and to what extent reported benefits can be translated into a healthcare provider’s financial profits. Under fee-for-service, reported benefits, such as reducing duplicate tests or improving preventive practice, will have a negative effect on a provider’s financial performance. However, providers can realize those benefits financially under capitation. EHRs can improve clinician’s compliance with pay-for-performance guidelines and promote the collection and report of quality data. But P4P’s financial impact on EHR adoption is not clear. The study also suggests that returns from adopting EHRs can flow from the internal improvements in a healthcare entity resulting in returns to external stakeholders.

KEYWORDS
Electronic health record, return on investment, fee for service, prospective payment system, capitation, pay-for-performance.

In 2004, President Bush outlined a 10-year plan to establish a national electronic health record system, with the belief that, “By computerizing health records, we can avoid dangerous medical mistakes, reduce costs and improve care.” According to a RAND analysis, potential savings enabled by widespread adoption of EHRs could average $42 billion yearly and overweight the projected costs, a mean yearly spending of $7.2 billion. The Office of the National Coordinator for Health Information Technology estimates that widely adopted EHRs would annually contribute 7.5 percent to 30 percent savings to national health expenditures.

Although the benefits are clear in theory, and policymakers, healthcare experts and payors strongly advise adoption of EHRs, progress toward widespread use of electronic systems remains slow. On average, healthcare organizations spend less than 3 percent to 4 percent of their budgeted capital on IT, much less than other information-intensive industries. Failure to demonstrate a positive return on investment is the most commonly cited barrier. The price tag for EHRs is high, while the benefits, such as reductions in medical errors, have yet to be linked to financial rewards.

A better understanding of the distribution of returns of EHR investment among healthcare providers and external stakeholders will help to answer the question of why there is a gap between positive macro benefits and costs analysis, and negative micro ROI. In turn, it will enable policy makers to seek EHR investment.
Incentive mechanisms that are aligned with benefits that stimulate widespread EMR adoption.

**STAKEHOLDERS AND EHR INVESTMENT**

Payors of healthcare services discussed here include government and employers, who finance healthcare expenditure, and insurers, who directly disburse payments to healthcare providers. The driving force behind payors’ initiatives in advocating EHR adoption is cost containment.

The federal government is by far the nation’s largest healthcare payor through supporting two major public healthcare programs, Medicare and Medicaid (including SCHIP), which account for 33.2 percent of national health expenditures in 2005. Medicare is a large part of federal outlay, accounting for 12 percent of all federal spending in 2005. Moreover, it has been projected that in 30 years, as a majority of the baby boomers enter retirement, entitlement spending for Medicare and Medicaid will consume correspondingly larger shares of federal and state budgets, and will threaten to crowd out other spending.

The majority of working Americans have private health insurance, generally through their jobs. Aside from the federal government, which is the nation’s largest employer, private employers are the financial foundation of private health insurance in the U.S. The escalation of health expenditures, which was represented by years of faster increases in the medical prices index than the consumer price index, forces employers to pay more for healthcare and places them at a competitive disadvantage in the international market. Taking the automobile industry as an example, as pointed out by Lee Iacocca, the retired chairman of Chrysler, more money per car is expended on healthcare than on steel.

Insurance companies generate profits from the difference between the total insurance fund collected and the total health expenditures they have to pay. As both government and private employers already cannot bear the burden of healthcare costs any longer, more effort on cost containment is a reasonable choice for insurance companies to maintain business.

EHRs are believed to be able to assist costs containment in several ways. First, EHRs can save money by improving the efficiency of the healthcare delivery system. Efficiency savings come from the ability to perform the same task with fewer resources. For example, sharing EHRs among healthcare providers can reduce the number of duplicate tests and thus save money. Secondly, EHRs have the potential to improve clinician compliance with established evidence-based guidelines, which leads to higher healthcare quality, and higher quality care is believed to save money. Thirdly, EHRs can make the care delivery process more transparent to the public, enabling payers to exert stricter review and weed out provider fraud, and improving market competition by giving consumers more information they can use to choose their providers.

So far, 35 states have either an executive order or a legislative mandate to stimulate the use of healthcare information technology. Most states are providing grant funds to support regional and local efforts, as well as state-level planning. Payors in the private sector also have made great efforts and offered substantial grants, loans and other financial incentives to stimulate healthcare providers to implement IT.

**PROVIDER RESPONSE**

Providers represent any entity that delivers healthcare services, such as physicians, hospitals, community health centers. By far, providers are the main investors in EHR systems. Providers welcome returns promised by EHRs, such as reduced malpractices and improved healthcare quality, which also could improve providers’ reputation in professional circles as well as with customers.

Several other considerations also influence providers’ decisions. Transparency enabled by EHRs is a two-edged sword because it can highlight clinical performance, whether it is good or bad. In contrast to payors’ efforts to control, physicians want to have a minimum of interference with the way they practice medicine. Physicians are concerned whether EHRs will impair their practice independence or authority. As the users of EHR systems, providers also want them to be user-friendly, easy to learn and secure.

No matter the mission (for-profit or not-for-profit) or size of an organization, making a reasonable profit is an important issue for healthcare providers. For this reason, healthcare providers want to know whether an EHR investment will bring positive returns. Many decision makers view EHRs as an opportunity cost rather than as a strategic investment. More often than not, an investment in an EHR is given a lower priority than other projects that could earn immediate medical benefits.

**PATIENTS AND VENDORS**

In a Kaiser Family Foundation’s survey, patients showed strong interest in EHRs even though most have had limited experience with such systems. Survey results from the Markle Foundation reveal that Americans want access to their personal health records electronically because they believe that such access is likely to increase their quality of care as well as improve healthcare efficiency by reducing unnecessary and repeated tests and procedures. Another Kaiser Family Foundation’s Survey in 2006 showed that patients were dissatisfied with the cost of the healthcare over all other categories. In general, Americans support a variety of government efforts to reform healthcare. However, support appears relatively fragile when rising costs or taxes will be involved. Therefore, it is still a long way to get consumers to vote for financing healthcare IT through tax money or patients’ payments.

Investments in EHR systems used to be very risky because of immature products, high entry and exit rates by vendors, lack of proven approaches and for other reasons. “One of the main
reasons for the unnecessarily high costs and lack of flexibility of today’s IT systems is that previous investments have been in systems that either do not comply with interoperable standards or use closed or proprietary turn-key solutions. A new study from Kalorama Information forecasts that the market for EHRs in the U.S. will grow at a 13.5 percent rate during the next four years, and by 2015, it will top $4.85 billion.

The growing market volume is a signal that the EHR industry will evolve into a shakeout stage, which, according to industry life cycle models, occurs after a dominant model emerges in what had been a fragmented industry; in the shakeout, unaligned firms are forced to exit. According to this model, the EHR industry is nearing the end of its two-decade fragmentation phase.

The market transition is reflected in the united efforts on and progress in developing and adopting interoperable standards. In May 2006, the Certification Commission for Health Information Technology finalized the first national certification standard for ambulatory EHR products and initiated the process of certification. Although it just got started, CHITI data suggest that there is at least anecdotal evidence to suggest that certification is becoming the differentiator in the marketplace. In general, certification will have a positive effect on EHR adoption by reducing providers’ investment risk, lowering product prices and driving the industry on the right track.

EVIDENCE REPORT OF EHR

An evidence report of the Agency for Healthcare Research and Quality systematically reviewed studies on the effect of health information technology from 1995 to January 2004. References of this report, case reports from winners of the Nicholas E. Davies Awards of Excellence and a literature search of PubMed for published reports on EHR from 2004 to March 2007 are the main resources to sum up the effects of EHR implementations in this study.

Reported benefits of EHR implementations, as listed in Table 1, support the assertion that EHRs can improve the efficiency of the healthcare delivery system. EHRs can facilitate or automate revenue cycle management. For example, the order entry function of EHRs is reported to contribute to the completeness of medical documentation and improve coding and charge capture. EHRs show a great potential in rationalizing the utilization of medical resources. Especially in the area of controlling overuse of drugs, lab tests and radiology, EHRs have demonstrated the ability to make a difference. RAND estimates that annual national savings in these areas can reach $12.6 billion, nearly one third of total annual savings possible by widely adopting EHRs. The readily available, comprehensive and integrated clinical information provided by EHRs also enables physicians to replace some office visits with more efficient communication channels, such as telephone contacts.

PAYMENT MECHANISMS AND ROI

To realize the financial gain on these reported savings, a healthcare provider must be able to translate those benefits either into revenue growth or cost savings, or both. That is, returns on an EHR’s impact on revenue is negative, which is the case for some “benefits” under certain payment mechanisms, the difference between cost savings and the revenue decrease — also described as the contribution margin — needs to be examined.
For healthcare providers, total variable cost is a function of volume (V), price (P) and quantity (Q), \( V \times P \times Q \). For the jth patient’s visit, \( p_i \) represents the price of each item used or the cost of each service provided, and \( a_i \) is the amount consumed. Variable costs of each patient visit are equal to \( \sum a_i \), the accumulation of amount multiple price per item, or cost per service. For each patient visit, \( V_j \) represents the type and intensity of utilization consumed. TVC is the summation of expenses of Q patient visits. Simply put, \( TVC = V \times Q \times P \).

**Fee for service.** Under fee for service, insurers usually determine a fee schedule listing individual fees for each type of service in advance. The fee schedule is generally based on community or statewide surveys of what providers are charging. Total revenue (TR) for healthcare providers under FFS can be formulated as \( TR = N \times PMPMR \), where \( PMPMR \) is the per member per month rate, \( N \) is the number of enrollees served, and \( TR \) is the total revenue. Under fee for service, a provider’s total revenue is the product of the number of enrollees and the per member per month rate (PMPMR), TR=N*PMPMR. Providers can increase their income if they can increase the number of enrollees they serve and, at the same time, control the quantity of patient visits Q and per-visit variable costs as a result of decreased utilization. Under capitated reimbursement, providers are paid a fixed monthly fee per enrollee, regardless of whether an enrollee sees the provider or not and regardless of how often an enrollee sees the provider. Under capitation, a provider’s total revenue is the product of the number (N) of enrollees and the per member per month rate (PMPMR), TR=N*PMPMR. Providers can increase their income if they can increase the number of enrollees they serve and, at the same time, control the quantity of patient visits Q and per-visit variable cost (V×P).

Capitation provides an incentive for providers to control Q, V and P all together. As pointed by Wang et al., 82 returns on EHRs under capitated reimbursement primarily comes from averting costs as a result of decreased utilization. Under capitation, providers can realize the most reported financial benefits by adopting EHRs. Wang et al’s research suggests that the higher the portion of capitated patients, the greater returns providers can reap from investment in an EHR.

To get a more accurate estimate, the ratios of patients that are reimbursed by different payment methods should be taken into consideration in quantifying returns on an EHR. Table 2 gives an example of how to do the calculation. If the EHR system will switch or has integrated multiple practice settings, such as outpatient and inpatient, it is better to further break down returns according to different settings, as the ratios %FFS, %PPS and %Cap, because the benefit structure for EHR implementation might be different in different sectors.

### PUBLIC RETURNS AND THE GAP IN ROI ANALYSIS

Thus, under certain payment mechanisms, some reported benefits can’t be realized by providers, or they may even suffer a financial loss in adopting EHRs. However, benefits that cannot be realized by providers are not lost; they are just transferred from each patient visit \( \sum a_i \times p_i \) below \( R_j \), or \( V \times P < R \), which provides an incentive for providers to control both V and P.

A prospective payment system puts V and P under control but still leaves Q untouched. As such, EHRs’ ability to control V, such as reducing duplicate tests, will increase providers’ income, while reported benefits that can reduce Q, such as reducing office visits, still have a negative impact on a provider’s financial results.

**Capitation.** Managed care organizations grew in response to uncontrolled escalations in the cost of providing healthcare in the 1990s. A mechanism used by these organizations for reimbursing providers is capitation. A provider is paid a fixed monthly fee per enrollee, regardless of whether an enrollee sees the provider or not and regardless of how often an enrollee sees the provider. Under capitation, a provider’s total revenue is the product of the number (N) of enrollees and the per member per month rate (PMPMR), TR=N*PMPMR. Providers can increase their income if they can increase the number of enrollees they serve and, at the same time, control the quantity of patient visits Q and per-visit variable cost (V×P).

<table>
<thead>
<tr>
<th>EHR Function</th>
<th>Potential Benefits</th>
<th>Returns</th>
<th>%FFS</th>
<th>%PPS</th>
<th>%Cap</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPOE</td>
<td>Improve coding and charge capture</td>
<td>$⊕$</td>
<td>$⊕$</td>
<td>$⊕$</td>
<td>$⊕$</td>
<td></td>
</tr>
<tr>
<td>Lab test Alert</td>
<td>Reduce lab tests</td>
<td>$⊕$</td>
<td>$⊕$</td>
<td>$⊕$</td>
<td>$⊕$</td>
<td></td>
</tr>
<tr>
<td>Telecommunication</td>
<td>Reduce office visit</td>
<td>$⊕$</td>
<td>$⊕$</td>
<td>$⊕$</td>
<td>$⊕$</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: $⊕$ suggests positive returns; $⊗$ suggests negative returns; $⊙$ suggests no financial effects.
the internal returns to a provider to the public value and thus to external stakeholders.

Table 3 provides a sample of the distribution of benefits between payors and providers under different payment mechanisms. Taking reductions in office visits as an example, if providers cannot realize the benefits, payors can as long as the quality of care does not decrease, and patients can save time and money as well.

A public ROI value proposition was developed and presented in Figure 1 to further explain the liquidity of benefits. Returns from an EHR investment can flow from the internal improvements in a healthcare entity, resulting in returns to external stakeholders, such as patients, insurers and employers. Other returns can flow to the economic environment and contribute to the improvement of the public-at-large benefit.

Benefits estimated at the national level usually include internal returns to providers, external returns to patients and payors, as well as part of public-at-large benefits. For example, in RAND’s national cost-benefit analysis,2 efficient savings are identified from 10 different sources, such as transcription improvement, utilization reduction in drug, lab test and radiology. By contrast, micro ROI analysis usually focuses on providers’ internal returns but bears the full cost of EHR; as a result, the net ROI of an EHRs project may be relatively modest or even negative.

That can help explain why there is a gap between micro negative ROI and macro positive benefits/costs analysis. As long as providers cannot reap all the benefits of their investment in an EHR system—in other words, if external returns exist in such an investment—the underadopted status of EHRs might not change fundamentally. Furthermore, as the objective of EHR investment focuses more on patient-centered quality of care improvements rather than revenue cycle management, more of the returns of EHR investment will be generated and transferred to patients and other external stakeholders. The ROI problem might be even aggravated, which does not bode well for further expansion of EHRs.

Exceptions may occur in large systems, particularly those that are operated by healthcare insurers or employers themselves, such as Kaiser Permanente and the VA, because the ROI analysis of such systems usually includes public values enclosed in the dashed circle of Figure 1. The Veterans Health Information Systems and Technology Architecture (VistA) won the 2006 Innovations in American Government Award. The innovation fact sheet33 pointed out that “the cost of maintaining VistA is $87 per patient per year, only slightly more than the cost of one unnecessarily repeated lab test.” In the VAs case, the logic is perfectly right, as both the cost of maintaining VistA and the cost of lab tests are financed by the government—what the left pocket invested, the right pocket gained back. However, for most healthcare providers, the cost of maintaining an EHR system will be recorded as a fixed cost, and the cost of a lab test is also a cost but might be reimbursed as revenue.

**PAY FOR PERFORMANCE**
There are now at least 115 private programs tying physician payment to performance, and some Medicare reimbursements are now being linked to quality performance. Highlighting the public effort is the CMS’ Premier Hospital Quality Incentive demonstration (HQID). The project will provide significant leverage in the healthcare market because of CMS’ buying power and its influence on private pay for performance programs.

More than 260 hospitals participated in the voluntary HQID program, and performance data in five clinical areas – acute myocardial infarction, heart failure, coronary artery bypass graft, pneumonia and hip and knee replacement, were tracked and reported. The top 10 percent of performers in 33 specific catego-
Hospitals received a 2 percent increase in reimbursement on their Medicare DRG payments. Hospitals in the second 10 percent received a 1 percent bonus.

Medicare has paid $8.85 million in first-year incentive payments and $8.69 million in the second year. If the demonstration program expands from the 260 participants to all 5,600 hospitals in the United States, the bonus cost will be substantial and might receive little support from lawmakers because Medicare is already very costly and program expenditures are growing rapidly. The Institute of Medicine suggests the use of a budget-neutral existing-funds model to support pay for performance programs. “This model reduces payments to all or selected types of providers for redistribution to those exhibiting higher quality in examined areas.”

In other words, the “fine,” or reduced payment, paid to low-quality performers will fund the reward pool. Actually, in year three of HQID, CMS will begin to penalize hospitals that do not achieve performance improvements above the demonstration baseline by lowering DRG payments by 1 percent or 2 percent.

In the demonstration program, the performance bonus is a percentage increase in the DRG payment. Pay for performance does not replace the prospective payment system, but rather is an extra payment mechanism for redistribution to those exhibiting higher quality in examined areas. In other words, the “fine,” or reduced payment, paid to low-quality performers will fund the reward pool. Actually, in year three of HQID, CMS will begin to penalize hospitals that do not achieve performance improvements above the demonstration baseline by lowering DRG payments by 1 percent or 2 percent.

The clinical decision support capabilities of some EHR systems can facilitate higher quality care, as shown in Table 1, and EHR's data mining and reporting modules can improve the efficiency, completeness and accuracy of collecting and reporting data for pay for performance programs. For providers that already have advanced EHR systems, the performance bonus will come as an extra reward. For those that already have been equipped with basic EHRs but have limited functionality to support decision making or data mining, pay for performance will provide a strong incentive for them to catch up, because the bonus will be relatively easy to obtain.

Pay for performance will give an impetus to providers that have already considered adopting EHRs. However, for those that have neither an EHR system nor an interest in implementing one, pay for performance approaches may make no difference; that is because the marginal cost is high; even worse, potential cuts in payments may leave them with insufficient resources to maintain their current quality of care. In light of the low adoption rate of EHRs so far, providers standing in this camp may not be in the minority, making it hard to estimate the overall impact of pay for performance on EHR adoption. To achieve the best incentive effects of P4P on EHR adoption, more exchanges of evidence-based experiences and some form of startup funds are necessary.

CONCLUSIONS AND LIMITATIONS

Reported benefits support the assertion that EHRs can improve the efficiency of the healthcare delivery system by reducing overuse and misuse of healthcare resources. EHRs also enable and
support new communication channels that are efficient and inexpensive between healthcare providers and patients.

Payment mechanisms play an important role in whether and to what extent reported benefits can be translated into financial returns for healthcare providers. For example, under fee for service, most reported benefits, such as reductions in duplicate tests or office visits, will have a negative effect on a provider's financial performance; under capitation, providers can reap those profits.

Returns from adopting an EHR can flow from the internal improvements in a healthcare entity, resulting in returns to external stakeholders. Existing ROI analysis typically focuses on providers’ internal ROI, and therefore the net ROI of an EHR project may be relatively modest or even negative. As long as providers cannot reap all the benefits of their investment in an EHR system—in other words, if external returns exist in such investments—the under-adopted status of EHRs might not fundamentally change.

EHRs can improve clinician’s compliance with P4P guidelines and promote the collection and reporting of quality data. But the true impact of the financial incentives offered under P4P related to EHR adoption is not clear. This study assumes that within the relevant period, the fee schedule, capitation rate or DRG rate is fixed and not affected by the adoption of an EHR. If the wide adoption of an EHR enables providers to deliver the same level of care for less cost, payors may reduce the payment rate, which will change the benefits distribution.

Pay for performance will give an impetus to providers that have already considered adopting EHRs. However, for those that have neither an EHR system nor an interest in implementing one, pay for performance approaches may make no difference.

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**EMR Adoption Model Q2 2007**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Cumulative Capabilities</th>
<th>% of Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 7</td>
<td>Medical record fully electronic; CDO able to contribute to EHR as byproduct of EMR</td>
<td>0.0%</td>
</tr>
<tr>
<td>Stage 6</td>
<td>Physician documentation (structured templates), full CDSS (variance &amp; compliance), full PACS</td>
<td>0.3%</td>
</tr>
<tr>
<td>Stage 5</td>
<td>Closed loop medication administration</td>
<td>1.5%</td>
</tr>
<tr>
<td>Stage 4</td>
<td>CPOE, CDSS (clinical protocols)</td>
<td>2.1%</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Clinical documentation (flow sheets), CDSS (error checking), PACS available outside Radiology</td>
<td>22.6%</td>
</tr>
<tr>
<td>Stage 2</td>
<td>CDR, CMV, CDSS inference engine, may have Document Imaging</td>
<td>39.7%</td>
</tr>
<tr>
<td>Stage 1</td>
<td>Ancillaries – Lab, Rad, Pharmacy</td>
<td>15.6%</td>
</tr>
<tr>
<td>Stage 0</td>
<td>All three Ancillaries not installed</td>
<td>18.3%</td>
</tr>
</tbody>
</table>

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Redesigning Care Delivery through Health IT Implementation

Exploring Trinity Health’s IT Model

By Donald K. Crandall, MD; Jane M. Brokel, PhD; Tammy Schwichtenberg, RN; Scott Henderson, MD; Randy Haskins; Doug Wakefield, PhD; Marcia Ward, PhD; and Brian E. Dixon, MPA

ABSTRACT

Trinity Health is a large multihospital healthcare system that developed a system-wide information technology strategy and implementation model. This study looks at how that system-wide strategy and implementation model, called Project Genesis, was used at Mercy Medical Center-North Iowa, a Trinity Health rural referral hospital, and how the care delivery system was redesigned using an electronic health record. This study was funded in part by a grant (UC1 HS15196; Rural Iowa Redesign of Care Delivery with EHR Functions) from the Agency for Healthcare Research and Quality to implement an integrated EHR system in the hospital and two clinics and assess its impact on patient safety, quality of care and organizational culture.

The study looks at redesigning care delivery using the Trinity Implementation Model that consists of local and system-wide planning components; physician and nurse ownership; order set development; clinical workflow redesign; and training and support. It then examines the initial experiences of the IT implementation at Mercy Medical Center-North Iowa, the impact on health information management, lessons learned and future steps to achieve a paperless medical record.

KEYWORDS

Trinity Health, electronic health record, redesigning care delivery, IT implementation methodology, physician and nurse ownership of IT, orders sets, clinical workflow redesign, training and support of IT, health information management.
ers. It has 193 staffed beds. MMC-NI has 12,961 acute discharges, 1,122 newborn discharges, 34,341 emergency department visits, about 585,000 outpatient visits per year and has 18 wholly owned primary care clinics. MMC-NI is part of a regional network and is affiliated with nine critical access hospitals and 25 primary care clinics.

MMC-NI received a grant (UC1 HS15196, or Rural Iowa Redesign of Care Delivery with EHR Functions) from the Agency for Healthcare Research and Quality to implement an integrated EHR system in the hospital and two clinics and assess its impact on patient safety, quality of care and organizational culture.

The project’s four major goals were to improve the quality and safety of patient care; to enhance organizational culture and safety among the project partners; to improve patient care workflow processes; and to generate significant organizational learning about the effectiveness of the EHR system and the implementation process.

At the time of publication, MMC-NI is in the third year of the AHRQ grant.

**REDESIGNING CARE DELIVERY**

Trinity Health was formed through the merger of two health systems. As a result of the merger, Trinity Health inherited a mix of hardware platforms, legacy systems and vendors. From this starting point, the organization adopted a system-wide strategy for information technology. This new strategy consisted of standardization across IT vendors, applications and management.

Trinity Health’s strategy, formally called Project Genesis, was guided by a steering committee. The steering committee consisted of executives from Trinity Health’s corporate office, local ministry organization leaders, clinical representatives, project management and information technology personnel. Strategic decisions were made by the steering committee while a project management office had responsibility for the day-to-day management of Project Genesis.

Trinity Health’s IT offices and support center are centrally located and managed from the corporate headquarters in Novi, Mich. Hospital-based IT personnel within local Trinity Health facilities are employed by and report to corporate IT leadership. Standardization on core vendors and centralization of software purchasing enabled Trinity to leverage its size to maximize its influence on current software functionality and future development, as well as minimize costs.

In addition to standardization across the organization’s IT infrastructure, Trinity Health selected one implementation process that involved a phased methodology. The first phase involving the clinical systems started in May 2001 and finished in January 2004. Phase one implementation at MMC-NI started in June 2001. It included installation of the central clinical data repository; interfaces for dictated reports, drug administration records and laboratory results; a results viewer (PowerChart); and an adverse drug event rules package.

The second phase of Project Genesis included implementing a new patient management system and the suite of clinical applications, which were nurse documentation, computerized practitioner order entry, a new pharmacy system, a new medical records system, an emergency department system and a new radiology system. Trinity Health implemented an enterprise master person index system before the second phase of Project Genesis to establish unique patient identifiers for the enterprise-wide information systems.

Those developing the Project Genesis plan determined that a “big bang” rather than an incremental approach would be used to implement the new systems. This approach consisted of bringing down all existing information systems, implementing the new systems, inputting patient data into the new system and converting users to the new system for all clinical areas at the same time, over the course of a single weekend.

The Trinity Health implementation methodology developed the components necessary for the big bang approach. These components included clinical workflow redesign, change management, organizational restructuring, multiple training cycles, pre- and post-measurement, readiness assessment and common technology tools. Hospitals applied the model in a systematic way using standardized applications and designs.

The Project Genesis methodology included collaborative learning that fostered a team approach among Trinity Health’s hospitals to support each other during cutover and implementation. At each activation, the implementing hospital was joined by staff from Trinity’s home office, other hospitals that had previously activated and hospitals that would be implementing in the future. This “see one, do one, teach one” approach emphasizes hands-on and highly interactive learning. This approach also created a team environment in which clinicians reported feeling supported during a time of extreme change, and they approached issues with the attitude that, “Everyone is dealing with this change together.”

**PLANNING: A CRUCIAL COMPONENT**

Organizational leadership directed Project Genesis to be centered on change management, which is why the Trinity Health formula for transformation is one part technology and two parts culture and work processes. Trinity Health crafted an 18-month “readiness process” to guide the change transformation for its ministry organizations.

The process involved more than selecting specific hardware devices for deployment within an inpatient setting and configuring the system to handle local order sets. Based on Trinity Health’s vision for Project Genesis, specific planning elements were designed to transform clinical and information processes, and align organizational structures to support new methods of delivering care.

**Physician and nurse ownership.** The first element of alignment involved securing physician and nurse ownership in the clinical transformation process. Clinician acceptance of health IT is a critical facilitator of adoption. There is significant evidence to support this, and scholars have suggested several strategies to gain clinician acceptance. Trinity Health secured clinician acceptance by engaging and supporting clinicians throughout the Project Genesis lifecycle.

The Trinity Health implementation model includes care area improvement teams, to review workflow; clinical transformation teams, to look at clinical outcomes; and clinical oversight teams, to...
work on management and systems. Many of the teams are focused on transformation within specific patient care services, while others are interdisciplinary and concentrate on organization-wide policies and tasks. All teams are interdisciplinary, comprising administrators, physicians, nurses, pharmacists and HIT staff. Structuring teams in this way ensures that all voices are heard, and that physicians and nurses play active roles in transforming the way in which care is delivered with the new EHR.

Trinity Health also identifies a group of physician champions at each ministry organization. This group represents a cross section of the medical staff, and its members have different levels of computer knowledge and commitment to the project. Many ministry organizations pay a physician a half to a full-time equivalent stipend to lead the local physician engagement effort.

Physician champions helped Trinity Health communicate to clinicians “on the ground.” Beyond communication of key information from the organizational leadership teams, these champions also helped manage the expectations of clinicians, helping them see that HIT is a journey and not a destination. The messages brought to the floors by the champions explained that the transition would be initially bumpy, but that work patterns would be established soon after go-live and smoother waters lay ahead. Physician leaders reported that they sought a “mature system” but that “none exists,” so the system to be implemented was a work in progress. This helped many clinicians at the local ministry organizations see themselves as pioneers, paving the way for others. The leadership at Trinity Health has supported this attitude by forming a partnership with its vendor to share clinicians’ ideas for system improvement. Establishing realistic expectations helped Trinity Health clinicians manage change, and view that change as an opportunity rather than a threat.

Clinician involvement and attitude management continues post-implementation, the final stage of the life cycle. In this stage, Mercy Medical Center formally transitioned its readiness clinical integration team to a post-activation change integration team, through which clinicians work together to review issues and make recommendations to local and Trinity Health leadership on how issues might be resolved. Issues that affect the whole system are documented and forwarded to Trinity Health for action. Staff at Mercy Medical Center monitor the requests and provide feedback to the requesting individuals and teams.

The change integration team helps keep alive the spirit of togetherness that the Trinity Health implementation model created. One Mercy Medical Center manager indicated that she continues to correspond with the managers from other Trinity Health member organizations and the Trinity Health home office she met during Project Genesis. A physician leader reported that some physicians, who before the EHR rarely spoke to one another, now regularly communicate with each other and work together to help resolve issues they encounter with the system.

Order sets. A second critical planning element is the development of standardized order sets. Order sets are widely used in healthcare as a way to combine medications and tests into a cohesive set rather than as individual items. Order sets have been demonstrated to provide time-saving benefits and contribute to greater acceptance of CPOE systems. 6 Evidence-based order sets — those based on scientifically valid clinical best practices — give healthcare organizations an opportunity to reduce variation in care and enhance compliance with treatment guidelines to improve quality of care and reduce the incidence of medical errors. 6, 9

Trinity Health, like many other healthcare organizations, sought to move toward the delivery of evidence-based medicine, which involves the use of evidence-based order sets. Because of this goal, Trinity Health incorporated the development of templates from Zynx Health for evidence-based order sets.

When it implemented Project Genesis, MMC-NI incorporated the review of Zynx Health into the existing process for developing and refining order sets. Trinity Health recommends that ministry organizations use standardized order sets either developed by other ministry organizations or evidence-based order sets from Zynx Health, which provides information on evidence-based guidelines plus recommended order sets. At MMC-NI, physicians from all service lines were asked to review order sets from other

**Standardization on core vendors and centralization of software purchasing enabled Trinity to leverage its size to maximize its influence on current software functionality and future development, as well as minimize costs.**

Trinity organizations and Zynx Health to decide which would work best. After the various physician and interdisciplinary teams completed their work, only a handful of order sets based on unique MMC-NI physician preferences remained.

Order sets are helpful in ordering for admission, discharge, transfer, specific diagnosis, pre- and post-procedural orders, and routine medical situations. For complex medical patients with changing clinical conditions, a standard order set may not match the current situation. For this reason, numerous nested order sets — order sets within an order set — were developed. Nested order sets include things like anti-coagulation protocols, sliding insulin scales, inhalation treatments and renal function assessments. The purpose of nested order sets is to add greater flexibility to standard order sets. Physicians are able to make minor adjustments in standard order sets by using nested order sets to respond to changes in a patient’s condition. This approach is more supportive of the clinical workflow in complex and changing medical conditions.

Clinical workflow. A third element in preparation for Project Genesis implementation was analysis of existing clinical workflow, a process often referred to as current state analysis. Clinical staff and implementation team members worked side-by-side to painstakingly document and map the steps typically needed to complete work before the EHR was activated. Future state work maps were created to document the care delivery steps and the flow of information within patient care areas targeted for transformation through the use of the EHR. Attention to detail is
important to determine how best to integrate healthcare IT into the clinical workflow and how to improve existing processes. A gap analysis of current state and future state identifies areas that need significant decisions, re-training or a potential work-around to complete the needed workflow.

Training and support. Training is an essential fourth component in preparing for the implementation of any new technology, especially in healthcare, where mistakes can result in serious harm. Preparing clinicians and staff for use of EHR and CPOE technologies remains a barrier to greater implementation of these technologies in inpatient and ambulatory settings.\(^{10}\) Trinity Health was acutely aware of this, especially because its big bang implementation approach created an instant change-over from paper-based to electronic processes in the course of a single weekend.

To prepare its clinicians and staff, Trinity Health established a training environment in which users learned how to use clinical applications and provided support to users before and after the go-live date. The training environments consisted of classrooms, training stations on nursing units and “Doc-ing” stations at which physicians received convenient, real-time training away from the patient care areas of the hospital.

The acquisition of sufficient training facilities was a primary aim of the local implementation team at MMC-NI. Because it had a large number of staff, substantial space was needed to accommodate group-training sessions. To obtain buy-in for the financial commitment for needed space and equipment, the implementation team devised a forward-thinking facility plan that highlighted how the space and equipment would be used after the Project Genesis implementation for post-implementation training, system upgrades, and for training on other applications, such as billing software and budget preparation training. The result was the creation of a large, multipurpose training laboratory in which education staff could successfully train staff on a variety of topics, not solely limited to the Project Genesis implementation. Of key importance in any healthcare IT implementation is acknowledging that implementation is just one step in a lifecycle of future upgrades and introduction of new applications.

Preparing staff for the go-live date was a primary focus for the implementation team. Senior leadership and team members knew that an unprepared staff would lead to incomplete adoption and possible failure.\(^{11,12}\) In addition to physical space in which education staff could train clinicians in how to use a computer and the clinical applications involved in Project Genesis, the implementation team knew that each clinical unit needed “super users” on the floor to assist colleagues during and immediately after implementation. MMC-NI used a “train the trainer” model to prepare hospital staff members to use the system and support others in using the system. Super users spent as much as 32 hours prior to the go-live date, and two to three weeks after that date, to support staff on their units in making the transition to the new workflows and use of clinical systems. A large part of their duties was monitoring the learning that was taking place in the clinical environment.

The need for significant training did not end after implementation. While super users did not play a significant role long after implementation, the need for ongoing training of staff remained high. As new employees are hired, they require training and orientation to the clinical systems and workflows. Existing employees require periodic training as order sets change, workflows are enhanced through continuous quality improvement, best practices change and software upgrades are deployed.

As part of its organizational transformation, Trinity Health prepares each local ministry organization for ongoing user support after the go-live date. Education coordinators and other education personnel learn to incorporate user support into existing organizational processes, such as new employee orientation and continuing education seminars. Human resource personnel guide updates to annual performance reviews and job descriptions to support the new skills required to deliver care.

LOCAL PLANNING AT MMC-NI

Preparations for the implementation of Project Genesis Phase Two EHR at MMC-NI began in February 2003. The preparation took place over the course of 24 months. Readiness required significant participation from staff, clinicians and senior leadership at Trinity Health and MMC-NI, including the hospital’s CEO, CFO, the chief nursing officer and vice president of medical affairs. Preparations included communication and engagement plans for organizational change, decisions for order sets to be used, development of clinical decision support rules, comprehensive process redesign, information system build and design, user acceptance testing, staff and clinician training, and further enhancement of the hospital’s infrastructure, such as networking and device selection.

MMC-NI went live with the second phase of Project Genesis on July 8, 2005, using the big bang approach. All systems—clinical documentation, EHR, CPOE with more than 250 order sets, 54 clinical decision support rules, emergency department triage and tracking, pharmacy alerts, medication list management, medical records system and patient management systems—were implemented at the same time. The hospital then spent the next 18 months in transition management, which involved evaluating the hospital implementation, and upgrading software, hardware and human processes as needed.

Before activating the EHR, MMC-NI halted the use of the McKesson bar-code medication scanning application they had used for more than a year because it could not be integrated into the Cerner Electronic Medication Administration Record, or eMAR. The medication bar-coding system was reactivated a year later using integrated technology from a Cerner bar-code scanning medication administration system.

INITIAL EXPERIENCES AT MMC-NI

At the end of the three-year planning and implementation cycle, MMC-NI had an online functioning inpatient enterprise HIT system. The enterprise system, standardized across Trinity Health, consists primarily of Cerner applications, which provide core EHR functions, including CPOE, clinical decision support, an emergency department module, a radiology module, a pharmacy module, an electronic medical records module and an interface to the laboratory information system, and clinical documentation transcription systems.

The system also has linkages to evidence-based medicine...
databases like Zynx Health and Multum, which enable access to extended knowledge resources and clinical decision support functionality. The system also provides an electronic medication administration record and point-of-care barcode scanning, which support accurate delivery of medications and automatic logging of administered medications directly into the patient's medical record.

MMC-NI had previously brought one of its 40 ambulatory clinics online with an outpatient EHR. Additionally, MMC-NI recently implemented an ambulatory EHR at its Mercy Family

Table 1: Post-implementation electronic vs. paper information

<table>
<thead>
<tr>
<th>Information Available Electronically</th>
<th>Information Available on Paper</th>
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<tbody>
<tr>
<td>Admission history and physical</td>
<td>Anesthesia record</td>
</tr>
<tr>
<td>Allergies</td>
<td>Birth certificate</td>
</tr>
<tr>
<td>Assessments – all disciplines</td>
<td>Blood unit record</td>
</tr>
<tr>
<td>Autopsy reports</td>
<td>Code and arrest record</td>
</tr>
<tr>
<td>Blood bank results</td>
<td>Consent to treatment</td>
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<tr>
<td>Case management</td>
<td>Death certificate</td>
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<tr>
<td>Consult reports</td>
<td>EEG and EMG results</td>
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<tr>
<td>Discharge instructions and summary</td>
<td>Cath lab reports</td>
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<tr>
<td>Education materials, family and patient</td>
<td>Nursing care plan</td>
</tr>
<tr>
<td>ER physician and nursing notes</td>
<td>Pathology results</td>
</tr>
<tr>
<td>Financial assignment benefits</td>
<td>Patient advanced directive</td>
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<tr>
<td>Health maintenance</td>
<td>Physician progress notes</td>
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<tr>
<td>Health risk factors</td>
<td>Pulmonary bronchoscopy reports</td>
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<tr>
<td>Intake and outputs</td>
<td>Vascular results</td>
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<tr>
<td>Interdisciplinary team notes</td>
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<tr>
<td>Lab results</td>
<td></td>
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<tr>
<td>Medications, including home meds</td>
<td></td>
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<tr>
<td>Nursing interventions</td>
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<tr>
<td>Operative reports</td>
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<tr>
<td>Orders, inpatient and outpatient</td>
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<tr>
<td>Pre-hospital phone calls</td>
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<td>Radiology notes</td>
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<td>Rehab treatment notes</td>
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<td>Respiratory therapy notes</td>
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<td>Social services notes</td>
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<tr>
<td>Vital signs</td>
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Medicine Residency Clinic, resulting in a complete longitudinal health record for patients who receive healthcare at these clinics. MMC-NI intends to implement the ambulatory EHR at affiliated ambulatory clinics across northern Iowa in the future.

The goal of Trinity Health was integration of information technology into as many care processes as current technology and human systems would allow. Like many other healthcare organizations that have implemented enterprise systems, MMC-NI had to face the reality that some care processes had to remain on paper. (Table 1.)

The hospital estimates that about 80 percent of patient information is now available electronically. Progress notes from physicians comprise the largest amount of data that remains on paper, except in the emergency department, which has implemented an online template-based physician progress note. The implementation of structured clinical documentation for progress notes, history and physical, discharge summaries and procedural notes is in the pilot phase of implementation within Trinity Health using Cerner PowerNote2G functionality.

Despite the immense challenges and risk of failure, Trinity Health blazed a trail toward transforming the way care is delivered to patients. The successful implementation of healthcare IT systems at a rural hospital was a major win for Trinity Health, enabling the system to move forward with successive implementations at its other rural facilities.

MMC-NI currently is working with its network of critical access hospitals and primary care clinics, Mercy Health Network-North Iowa, to create a similar implementation model for activation of the EHR in seven of its nine affiliated critical access hospitals in northern Iowa.13

MMC-NI also is experiencing success. The new care delivery processes, although continuously reviewed and improved, have taken hold, and clinicians have accepted the EHR, CPOE and eMAR technologies. The hospital has also experienced some cost savings and gains in productivity, especially in its health information management department. Finally, the quality and safety of the care delivered at the hospital has increased. These initial successes signal that an organizational transformation has occurred, one that Trinity Health can continue to replicate and from which others can learn.

HEALTH INFORMATION MANAGEMENT

The health information management department observed an increase in access to information after Project Genesis. After the implementation, clinicians and staff at MMC-NI now have access to a majority of patient information via computer as opposed to paper, and much of the documentation that clinicians do is completed online. The health information management director views this as an overall increase in access to information for both clinicians and staff within the department.

Online documentation has reduced the turnaround time between clinical encounters and the completion of clinical documentation related to encounters. Not only do clinicians complete reports faster, but health information management coders can access reports quickly from their workstations after clinician completion, significantly reducing the need for physical retrieval of documentation from file folders and other department personnel. The health information management director expects that coders one day may be able to do their work remotely, possibly from home; but for now, coders will continue to work from the hospital.

Chart assembly — the process of aggregating a variety of information from a patient’s chart into a packet for delivery to a requesting party, such as another provider or the patient — is also more efficient because the health information management department has the ability to print the record with just a few clicks of the mouse.

In addition to better access, conversion to electronic records brought a significant reduction in the size of the paper record. The HIM department is responsible for the management of medical record charts and the paper record contained within those charts. While this did not change with the implementation of Project Genesis, the volume of paper handled by the department did decrease. Before the EHR implementation, a patient may have had as much as a file box full of documents and reports, but now patients generally have only a thin file folder of paper records, the facility’s HIM director said.

Physicians have benefited from the implementation through the use of an “electronic signature” function within the Cerner PowerChart application. Many traditional HIM tasks are now done online, which saves both physicians and HIM staff considerable time. One physician who used to be the most delinquent in completing clinical documentation now is one of the quickest to finish because of the system, the HIM director said. Before Project Genesis, HIM staff often had a difficult time getting physicians to go to the medical records department to complete charts; now, physicians are able to electronically sign documents and orders. The system enables HIM to do tasks quickly, such as sending reminders to physicians to sign the few remaining documents that are on paper.

The director is looking ahead to future innovations that will continue to enhance HIM at Mercy Medical Center. Currently, Trinity Health is developing an integrated imaging solution that the director would like to see implemented at MMC-NI within the next two years. As of August 2006, two Trinity Health ministry organizations were participating in pilot studies of imaging software that can digitize a patient’s paper records, thus enabling critical clinical data to be scanned at the nursing station and integrated into the EHR immediately. HIM staff could scan less important information later, perhaps after discharge. By scanning the few remaining paper documents of the medical record, HIM will be able to produce a completely paperless medical record. Even so, scanned documents have limitations; for example, the lack of discreet data elements in scanned documents severely limit subsequent data mining efforts.

Trinity Health is also experimenting with additional innovations to reduce HIM expenses, such as a backend voice recognition system that, when integrated with the hospital’s dictation system, can translate dictated reports into an electronic form. Front-end voice recognition will be used in specific clinical settings in the future.
SUMMARY OF LESSONS LEARNED

MCC-NI was one of the first Trinity Health organizations to implement Project Genesis. As a result, several issues were identified that are being addressed as Trinity Health refines its implementation process. One area where there is room for improvement is interdepartmental workflow after implementation. Roles and responsibilities change after implementation, and step-by-step directions are needed in the readiness process to address these changes.

The order set design process also has been refined. Early implementations focused on utilization rather than standardization. This experience resulted in the formation of new teams and structures at Trinity Health to redirect the work effort. These include care area improvement teams for acute care settings; those focused on specific venues of care; care transformation teams; those focused on care delivery processes, such as the care of the patient with outcomes; congestive heart failure and teams that provide support and consistency, such as data standards. Through the work of the care area improvement teams and clinical transformation teams, Trinity Health is re-evaluating order sets and documentation templates to move toward a more standard approach throughout the system.

Improvement can be observed in the training of users. In the early phases of Project Genesis, the application used in the training environment had limited functionality and failed to give trainees a true indication of the full functionality of the application. In more recent implementations, Trinity has improved the training environment to better reflect the production environment. It also has allowed access to the production system prior to the go-live date to enable clinicians to pre-build their favorites folder and set up user preferences, which facilitates the transition to the live environment. Additionally, a planned continuing education curriculum approximately 90 days after the go-live date enables clinicians to dive deeper into application functionality and refresh previous learning.

Trinity continues to work with its vendor to address specific issues in functionality identified by clinicians using the system. Issues are particularly prevalent in special treatment areas such as the intensive care unit. The continuing difficulty of the dual environment, in which clinicians must manage both paper and electronic records, is a daily challenge.

The implementation of an EHR is a clinical process transformation, not a software implementation project. It is a journey that needs to be led by a team of committed clinical and administrative leaders to be successful. The journey will span years and spread across the continuum of care. Things will not be perfect at the start, but will require continued clinical input into the development and modification of the system to meet the current and future needs of caregivers. Clinicians will have no safe harbor available to hide from the EHR; their input and support is needed at every step. For the healthcare system, there is significant potential for cost savings, increased quality and reductions in adverse events with the widespread use of the EHR. This is not a journey for the faint of heart, but a journey the healthcare system must take.

LOOKING TO THE FUTURE

Trinity Health is moving closer to its vision of an integrated EHR that can be used across the continuum of care, accessible from anywhere, with real-time decision support at the time clinical decisions are made. It is in the pilot phase of implementing a system-wide medical record scanning solution, structured clinical documentation and back-end voice recognition. Additionally, it is in various stages of planning or building additional clinical applications for the operating rooms, intensive care unit, obstetrics and oncology services.

To measure care and financial performance outcomes, Trinity Health has developed a strategy to integrate clinical, operational and financial information into a decision support data warehouse. Financial and administrative data have resided in a decision support warehouse for several years, and the system now is extracting clinical data into the warehouse. Access to the clinical data will enable Trinity Health to track clinical outcomes, care delivery improvement opportunities and make needed modifications to order sets and documentation templates to improve clinical processes and outcomes.

Trinity Health is making significant strides to meet the goals for healthcare IT as outlined by President Bush in 2004. Clinicians will have a patient’s complete medical history, computerized ordering systems and electronic reminders; quality initiatives will measure performance and drive quality-based competition.

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Scott Henderson, MD, is a physician champion and co-director of medical informatics at Mercy Medical Center North Iowa.

Randy Haskins is regional IS director for Trinity Health and Mercy Medical Center North Iowa. He provided assistance and review for technical system implications and installation for MMC-NI.

Doug Wakefield, PhD, is a professor and director of the Center for Health Care Quality.

Marcia Ward, PhD, is professor and associate head, Department of Health Management and Policy, Director, Center for Health Policy and Research, College of Public Health, University of Iowa.

Brian E. Dixon, MPA, is health IT manager at Regenstrief Institute Inc., Medical Informatics. He currently supports AHRQ’s health IT initiative, including the grants and contracts awarded by the agency.
REFERENCES


13. This project also is sponsored by AHRQ. For more information, visit the AHRQ National Resource Center for Health IT Web site: http://healthit.ahrq.gov.

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Digital Transformation in Home Care

A Case Study

By Sandy Bennis, RN, BSN; Diane Costanzo, RN, MSHA, CMSRN; Ann Marie Flynn, MA, BSN; Agatha Reidy, RN, MSHA; and Catherine Tronni, MBA, RN, C, CPHIMS

VIRTUA HEALTH is a community health system in southern New Jersey comprising four hospitals, two long-term care facilities, two home health agencies, two stand-alone surgical centers, an ambulatory care center and fitness center. Virtua has 7,200 employees and 1,700 physicians. Virtua Home Care is a large business unit that is divided into two separate agencies and a branch office. Each agency has a director of nursing charged with overseeing the operations of the company. VHC’s staff includes 180 nurses, 80 certified home health aides, 70 therapists and more than 50 office and support staff. With an average daily census of more than 1,000 clients, VHS serves Burlington, Camden and Gloucester counties in southern New Jersey.

In the winter of 2004, VHC made the decision to move from a paper-based system wrought with defects, inefficiency and duplication to an electronic medical record system. The purpose of the EMR was to provide a framework for standardization that could be easily replicated and electronically communicated between clinicians to provide an outstanding patient experience.

“There is currently nothing more important to achieving the delivery of safe, effective patient-centered care than the successful adoption of the electronic medical record,” said Dr. Mark VanKooy, chief medical information officer for Virtua Health. “It will enable us to take full advantage of the astonishing progress we have witnessed in medical knowledge and technology by delivering the right information to the right individuals at the right time to do the right things to keep our patients healthy and safe.”

VHC made the decision to implement the Misys home care information system, which included support for clinical docu-
Leadership came to the realization that the digital transformation was not going to be successful until they examined the processes that support the business.

To drive this culture-changing strategy, Virtua senior leadership decided that a department of specialists would be trained as “Black Belts” to use the statistical methodology of the Six Sigma tool box and translate them into the DMAIC format (Define, Measure, Analyze, Improve and Control) to improve process (Table 1).

In fall 2003, a dedicated Black Belt was delegated to home care to reiterate the business unit both clinically and financially. It was imperative, as they embarked on this new journey with the nursing informaticists, to use the Six Sigma business tools and work closely with the home care Black Belt. The staff and leadership team already had used these tools in two previous successful Six Sigma projects.

**THE TRANSFORMATION PROCESS**

Knowledgeable in complex clinical processes and not bound by the technology at hand, the informaticist analyzed physical workflow, digital workflow, roles and physical layout. Leveraging the Six Sigma tools previously described, the informaticist was able to redesign workflow and support new levels of functionality.

VHC realized that simply installing new devices and software did not guarantee success or a return on investment. The clinical informaticist role, missing from the initial phase, became a principal solution to realizing the benefits of the new system. This role is multi-faceted. At Virtua Health, the clinical informaticist’s “technical” duties are broad, ranging from operational assessment, design and implementation planning to training content development, go live support and maintenance monitoring. The “people” proficiencies include a strong orientation toward team facilitation, change management and adoption of adult learning styles.

Because home care already had implemented the new system, the process and role assessment consisted of analyzing the staff’s assimilation of the new system into their workflow. This was accomplished through interviews with key staff and managers, and by observing the clerical and clinical staff as they performed their day-to-day work activities. The informaticist lived with the clerical staff as they processed information and scheduled new

mentation, scheduling and billing processes. Additionally, tablet computing devices were deployed to be used for clinical documentation. The implementation was staggered over the course of a year, finishing in September 2005 after all clinical staff were oriented to the application. A primary goal of the project was to identify productivity improvements and cost reductions. Some of these opportunities included improving quality of clinical documentation, improving clinical utilization and staff productivity, reducing FTEs and minimizing billing errors.

Given a long system implementation process, it was only natural that processes were put in place during the transition to bridge the gap between paper-based and electronic processes. But the department was not showing any progress toward reaching their original goals after a year of user training and deployment of this tool. After close examination, leadership came to the realization that the digital transformation was not going to be successful until they examined the processes that support the business. It was no longer possible to roll out a new system by solely providing end user training and laying it on top of existing workflows and outdated roles.

True integration of technology into the clinician’s everyday work life takes examination of workflow and process redesign before any technology deployment. Technology is the enabler that enhances clinical productivity and improves decision-making processes. Digital transformation needs to be partnered with clinical transformation to be successful. VHC learned this lesson late in the transition. Realizing that change was essential, Home Care leadership recognized the need for nursing informaticists, who would examine the clinical, technological and business processes after implementation. This article describes the informaticist’s role, tools and techniques used in the process and the realized benefit when change occurs.

**SIX SIGMA CULTURE**

Leadership was at a crossroad as they began the journey with the nurse informaticists to align processes and to achieve the anticipated return on investment that the project had originally indicated. The next steps included examining the home care service line operationally to facilitate the digital transformation.

Home care services were examined from the beginning of the process, at patient referral, through the patient admission process, to the rendering of patient services, through the billing of services to the collection of cash. The primary focus of the analysis centered on key operational issues surrounding the utilization of the Misys Home Care Information System. Leadership welcomed the role of the informaticist to ensure that the agency was optimizing the use of the new technology, and they were committed to improve overall operational processes and to support the entire business unit.

One key factor that VHC leadership team was passionate about was its tradition as a Six Sigma organization. About six years ago, Virtua Health partnered with General Electric to learn their Six Sigma methodology and adopt their systematic toolkit to enhance business and quality initiatives throughout the organization.1,2

Six Sigma is a process improvement methodology that uses data and statistical analyses to identify and fix problems. Six Sigma also refers to a deployment model that aligns employees with a series of high-impact projects. During the past 10 years, Six Sigma has delivered a variety of sustainable benefits to companies from many industries. These benefits include reducing costs, increasing revenues, improving process speed, raising quality levels, deepening customer relationships, and introducing efficient processes and discipline to an organization.1
patients. Clinical staff were accompanied by the informaticist nurse as they cared for patients in their homes. This assessment yielded an in-depth understanding of areas for improvement.

The informaticists found that the transition to the technology application was a challenge for some staff within VHC. Many factors influenced this transition — leadership changes, limited system administrator support and the nature of home care, in which nurses function very independently. As a result, there was still a heavy reliance on paper processes and “business as usual” for some staff members. Also, the information system had been significantly underutilized, and many duplicative manual processes continued to run in parallel with digital practices. For example, the clerical staff performing intake and scheduling duties continued to document patient information on paper rather than entering data directly into the system.

On the clinical side, the use of the system during the patient visit was not consistent across the two agencies. Several nurses were documenting on paper and waiting until after the visit to enter data into the application. Also, the assessment found that managers were spending a significant amount of time resolving technical issues, cutting into the time needed to manage their clinical teams’ utilization and productivity through oversight of patient assignments and scheduling. Underutilization of the billing module had caused days in accounts receivable to rise to almost 90 days.

After reviewing the clinical informaticist’s detailed assessment of the current state workflow and roles, improvement opportunities were prioritized. Key initiatives focused on the redesign of roles and responsibilities, processes within intake and scheduling, closer monitoring of clinical productivity and optimizing the application. With two identified process owners leading the charge, two teams of front line staff and managers were formed, and the design phase was set in motion. One team focused efforts on roles and responsibilities, while the other team dedicated their time to workflow.

Understanding the what, how and why for change, and matching the right tool to the task was critical to success. (Table 2) With guidance from the home care Black Belt and facilitation by the clinical informaticist, one by one, the future state of major processes and key roles was dissected and redesigned using LEAN, workouts and change acceleration (CAP) techniques.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Deliveries</th>
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| Define  | Identify process customers and their requirements  
          | Identify the boundaries of the project using high-level process map  
          | Complete an approved project-chartering document |
| Measure | Develop accurate system for measuring the process result  
          | Develop a detailed drill down on the process flow  
          | Report the current process performance for the targeted customer requirements |
| Analyze | Compare the current process performance with customer requirements  
          | Identify key drivers that lead to the current process performance  
          | Identify target for the improved performance |
| Improve | Determine the statistical relationship between the key process drivers and the process outcome  
          | Propose and pilot potential solutions  
          | Determine operating ranges for the proposed process drivers |
| Control | Ensure accurate measurement of the improved key process drivers  
          | Confirm that improved drivers are delivering the targeted process results in actual practice  
          | Develop a tracking and rapid reaction plan to detect and correct any process backsliding to ensure that gains are sustained |

Table 1: Five phases of Six Sigma

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<table>
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<tr>
<th>Problem</th>
<th>CAP</th>
<th>WorkOut (Includes FMEA)</th>
<th>LEAN</th>
<th>Six Sigma</th>
<th>Design for Six Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>I know the answer but I’m going to meet a lot of resistance</td>
<td>I have a rough idea of where we need to go. I want my team to work together to improve the process quickly. I want to identify and prevent failures before they occur. (FMEA)</td>
<td>I have to do more, faster with less. I want to be sure my team is as productive as possible</td>
<td>The process is important and it isn’t working. I’m not sure why. I need to understand my process better and pick the right solutions.</td>
<td>This process is so broken we might as well start from scratch and we have new programs we are just starting – I need to build in my customers expectations.</td>
<td></td>
</tr>
<tr>
<td>Deliverable</td>
<td>-change management</td>
<td>-Help those who do the work come up with and own great solutions</td>
<td>-Speed</td>
<td>-Meet customer expectations</td>
<td>-Meet customer expectations</td>
</tr>
<tr>
<td></td>
<td>-Deal with resistance</td>
<td>-Prevent errors and failures (FMEA)</td>
<td>-Efficiency</td>
<td>-Eliminate defects</td>
<td>-Eliminate defects</td>
</tr>
<tr>
<td></td>
<td>-Maintain the gains</td>
<td></td>
<td>-Productivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catch phrase</td>
<td>“Why are we always surprised by resistance?”</td>
<td>“the people who do the work know it best” “We need to identify failures and eliminate or reduce them” (FMEA)</td>
<td>“we need to do more with less…. And faster too!”</td>
<td>“We need to get it really right for our customers!”</td>
<td>“We need to design this process correctly before we let out customers experience it.”</td>
</tr>
<tr>
<td>Turnaround</td>
<td>≤ 1 day</td>
<td>1 – 2 days ≤ day (FMEA)</td>
<td>3.5 – 5 days</td>
<td>6 – 9 months</td>
<td>6 – 9 months</td>
</tr>
<tr>
<td>Facilitator</td>
<td>CAP/WorkOut Coach</td>
<td>CAP/WorkOut Coach</td>
<td>Black Belt (FMEA)</td>
<td>Informaticist/Black Belt</td>
<td>Black Belt</td>
</tr>
</tbody>
</table>

* Adapted with permission from Adrienne Elberfeld, Six Sigma Master Black Belt-Virtua Health
to create buy in among key stakeholders and to create a lasting change in systems and structures. CAP sessions were utilized by both teams with the help of trained facilitators.

During the CAP sessions, process maps of current-state workflows were created to visualize the high-level view of processes. Complete brainstorming sessions were conducted to formulate the future state plan. This information led to a series of Work Outs, one- or two-day events during which a sponsor and process owner ensures accountability and follow up. Work Outs are used when the group has a rough idea of where it needs to go and wants to work together to improve the process quickly. The goal is to identify and prevent failures before they occur—failure mode and effect analysis, or FMEA. Staff participation is critical because they are the ones who are defining the process improvements and mapping the future-state process.

As the teams mapped their future-state processes and roles, they also outlined the steps in each process and the roles no longer part of the “new world.” This technique was central to achieving greater system utilization and return on investment. For example, according to the team's design, the field RN would document directly in the system, thereby eliminating manual documentation steps. Based on the same design, the intake coordinator would replace the paper log with the electronic tracking feature in the new system. This ultimately would save steps for the scheduler, who would access the electronic tracking feature in the system on their desktop. The responsibility for resolving technical issues was delegated to the system administrator. Key productivity reports and clinical reports were designed to facilitate proactive management of staff and patient care.

Once approved, the team's design was translated into a detailed implementation plan by the clinical informaticist and process owners. Key interdependencies were considered, and milestones were marked on a timeline. The informaticist collaborated with home care staff to develop training content material, using knowledge about adult learning styles and process diagrams, developed during the design phase. Implementation planning ended with the development of a dashboard of metrics that assisted with the execution of the system on their desktop. The responsibility for resolving technical issues was delegated to the system administrator. Key productivity reports and clinical reports were designed to facilitate proactive management of staff and patient care.

Along with the detailed implementation plan, a communication plan was developed. Home care leadership communication centered broadly on a set of concepts introducing the future-state design to those who had not been members of one of the design teams. Communication to all members of the agency as to why change needs to occur and what it means to them in their role is critical. Open communication needs to be ongoing throughout the process.

Results were attained in the following way. Process owners, with guidance from the clinical informaticist, blended the future-state design with critical features of the new system. Implementation was twofold, consisting of training and coaching. Training content materials were developed directly from the design phase material and illustrated new roles and processes for staff. Coaching occurred daily in the clerical and clinical work settings. The informaticist and home care leaders met regularly, using their measurement dashboard and monitoring the progress achieved along the way during execution.

**MEASUREABLE BENEFITS**

**Quality.** The first recognized benefit could be seen in the streamlining of documentation by all clinicians. Results were demonstrated during state and federal surveys and the Joint Commission accreditation process. Prior to the implementation of the EMR, home care had received two recommendations—one for the use of “Do Not Use” abbreviations and the second for physician orders not matching the plan of care. After the transformation process, no abbreviations on the “Do Not Use” list were observed during the Joint Commission survey. Home Care was compliant for the regulation of timeliness of physicians’ orders that aligned with patient care plans. These results were attributed to the application design that physicians’ orders are automatically generated, flagged for signing and electronically tracked for signatures when the clinician enters the plan of care. In early 2007, clinical quality was recognized by a deficiency-free state and federal survey.

During the most recent Joint Commission survey, home care received two requirements for improvement. One was for home health aide supervision not completed by a registered nurse every 14 days, a DOH/CMS regulation. The other was for the mandatory child health fall risk assessment not being completed at the start of care. Both of the areas identified were quickly addressed by using the EMR. Through the use of mandatory fields, compliance is enforced by requiring supervision at every home health aide visit and by establishing a falls risk assessment in the EMR. The agency is currently meeting outline benchmarks. The leadership team recognizes that the use of technology has improved and enhanced our quality measures.

One of the key national quality indicators for home care agencies relates to rates of acute care hospitalization. This indicator is the rate at which patients return to acute care during the 60-day episode of home care. When reviewing the national finding of the acute care hospitalization indicator, the agency score went from 22 in the first quarter of 2005 to 17 by the third quarter of 2006. This indicates that the agencies are maintaining the patients at home effectively during the 60-day episode, and VHC is in the top third of all home health agencies in the nation. The improvement was attributed to the development of key reports during implementation that are generated on a routine basis and monitored by care managers to identify risk situations early in the patient’s care and proactively instituting preventative measures.

Carol Mullin, vice president of clinical quality and performance improvement for Virtua Health, recognizes that, “Technology is one cornerstone of our journey for continuous quality improvement.”

**Productivity.** Through standardization, VHC also saw...
improved productivity by staff. In 2006, the average number of nursing visits per patient was 7.6, but in 2006, the number was reduced to 6.6. This equates to a reduction in costs per admission from $1,400 in 2005 to $1,281 in 2006. The improvement demonstrates more efficient planning of patient care. Through the redesign, roles were clarified and utilization of services was reinforced as the responsibility of the care managers. Telephone care conferencing, 1:1 reviews of the patient care plans with the clinicians and managing visit frequency were key strategies that resulted from the design phase and resulted in improved productivity. One of the results of the transformation process, which was evident at the onset, was the establishment of a marketing position. This role has greatly improved referrals; has developed a “pull” system as opposed to a “push” system for referrals; and has increased awareness of the payor mix. Now, each manager can see the book of business that they have by team, person or agency.

Revenue enhancements and cost reduction. The cost of the new information system to the agencies was approximately $1 million in capital, with maintenance fees totalling $200,000 annually. As stated previously, all areas were reviewed, and process redesign occurred in all areas, including billing. Revenue and contribution margin benefits are seen in all of these areas because of the specified and standardized work processes.

At the beginning of the project, days in accounts receivable averaged about 81.89 days. After process redesign efforts, days in accounts receivable improved to 48.42 days. The timeliness of documentation, along with enhanced systems utilization, enabled this improvement. The accounts receivable improvement equates to an additional $1.7 million in cash and collections. The revenue per day improved from $50,931 per day to $55,245 per day (Figure 1).

Restructured management roles to enhance the new world enabled the accomplishment of the new system and structures. The entire clerical support staff role was recreated to meet the current needs of the agencies, which included the elimination of the manual, paper-based, redundant processes no longer needed in the “new world.” Retraining staff and support in the new process led to a successful implementation. After redesign, it was apparent that the workload had been reduced. This result led to a reduction in the workforce of 14 full-time equivalents, which equates to savings of about $500,000.

Executives believe a return on investment has been achieved. (Figure 2). Re-evaluation and course correction when needed continues quarterly to ensure that the new process is working.

CONCLUSION

Before this project, the agency was intuitive and adaptive. People could fill in the blanks if information was missing, and they would get the job done. After the transformation, staff had to be specific and had to follow a standardized process in each department to
realize the benefits of the digitization process. It was during the uncovering of variation and reaching of consensus, standardizing and delivering best practice care in a safe and supportive environment that the organization fully understood this new world.

The nurse informaticists brought many benefits to the home care agency. Today, the results are found throughout the entire agency. This journey was a transformation of the entire functionality of the agency. The results of this process realized benefits in clinical quality and compliance, improved revenue and cost reduction. **JHIM**

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**Figure 2: Achieving return on investment**

<table>
<thead>
<tr>
<th><strong>Costs:</strong></th>
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<tbody>
<tr>
<td>Automation $1M capital, $200K maintenance/yr</td>
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</tbody>
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<table>
<thead>
<tr>
<th><strong>2005 – 2006 Benefits:</strong></th>
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</thead>
<tbody>
<tr>
<td>Streamlined Clinical Documentation</td>
</tr>
<tr>
<td>Improved Visit Utilization</td>
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<tr>
<td>Improved Clinical Quality Indicators</td>
</tr>
<tr>
<td>Improved JCAHO Compliance</td>
</tr>
<tr>
<td>Decrease Costs/ Admission</td>
</tr>
<tr>
<td>AR _ $1.7M</td>
</tr>
<tr>
<td>Revenue _ 10%</td>
</tr>
<tr>
<td>CM _ 24.4% (&gt; $350K)</td>
</tr>
<tr>
<td>FTE Reduction of 14 = approx. $500,000</td>
</tr>
</tbody>
</table>

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Demand Management in Healthcare IT

Controlling IT Demand to Meet Constrained IT Resource Supply

By Gregg Mohrmann, MPA, PMP; Craig Schlusberg; and Roger Kropf, PhD

ABSTRACT

Healthcare is behind other industries in the ability to manage and control increasing demand for IT services, and to ensure that IT staff are available when and where needed. From everyday support requests to large capital projects, the IT department’s ability to meet demand is limited. Organizational and IT leaders need to proactively address this issue and do a better job of predicting when services will be needed and whether appropriate resources will be available. This article describes the common issues that healthcare IT departments face in the efficient delivery of services as a result of factors such as budget constraints, skill sets and project dependencies. Best practices for controlling demand are discussed, including resource allocation, governance processes and a graphical analysis of forecasted vs. actual thresholds. Using specific healthcare provider examples, the article intends to provide IT management with an approach to predicting and controlling resource demand.

KEYWORDS

IT demand management (ITDM), resource management, resource allocation, project management, healthcare IT organization, portfolio management, IT governance, IT management and governance (IT-MG) systems, strategic alignment.

IT ORGANIZATIONS have always had difficulty managing and controlling demand for staff. Although IT is viewed as an integral part of the organization, it is often viewed as a cost center that will do whatever the business needs and whatever gets sent its way. This often translates into the “everything is a high priority” mentality.

Typically, IT departments, like other service-oriented departments operating in a similar model, cannot handle all the demand that comes from the business. Resource constraints, limited budgets and conflicting strategies ensure that IT departments are challenged to adequately staff projects.

Consistent with market findings, Forrester Research believes that IT demand management, or ITDM, is needed. ITDM incorporates the aggregation and management of strategic, tactical and operational demand for IT services. Even though meeting demand requires hardware and software, the limiting factor to getting the job done is typically internal staffing constraints. Internal staffing will account for 38 percent of IT budgets in 2007, or twice the size of any other component of IT spending. To meet demand and continue to focus on improving efficiency, IT needs to focus on this critical resource and adopt ITDM processes to ensure that the right resources are in place at the right times.

According to Gartner Research, at one time or another all CIOs will be asked if their IT organizations are efficient from a staffing perspective. In some cases, CIOs will initiate this analysis, especially if they are new to their role; more often, questions about IT efficiency will come from outside the IT organization. Healthcare organizations traditionally have significantly constrained budgets for IT, compared with IT budgets in other industries. Accordingly, healthcare organizations invest less in demand management and do not always ensure that resources are assigned to work that supports the strategic direction of the organization.

To be effective, executive management needs assurance that the money provided to IT through the budgeting process will be spent wisely, and that IT actually has the resources available to deliver the projects and operational work being proposed. Effective IT demand management addresses and meets this need. Challenges, critical success factors and best practices are pre-
Healthcare organizations face specific challenges to managing their demand for services so that demand lines up with the capacity and capability to provide those services. Here are the challenges and issues that make effective resource management critical in light of ever-increasing demand.

**Limited budget and limited staffing.** Healthcare organizations are typically faced with smaller IT budgets than their counterparts in other industries, and smaller staffs as a result. Limited staffing and skill sets not only make doing the work harder, but make it more difficult to effectively plan staffing needs.

**Inability to understand current demand.** Healthcare organizations do not have a defined protocol for tracking requests for IT work, regardless of whether that work is project-related or operational, such as service requests, production problems and maintenance. Customers request services through many different channels, including calling their preferred IT analyst or even calling the CIO directly. For IT to be successful, there needs to be a defined and well-communicated project intake process. This process should be different for small projects vs. large projects; for example, large projects will need a defined scope along with a project charter and a governance process that ensures project alignment with business strategies. However, all projects must follow an efficient, working and understood process for requesting and tracking IT work.

**Limited visibility into staff productivity.** Questions always come up in relation to staff effectiveness—how much work is the staff actually delivering? Are a few highly talented IT staffers doing the work of many? Why is so much overtime being logged? IT departments often are faced with burning issues of the day and do not do an effective job of tracking individual project work. There are few spreadsheets or systems that match units of project or operational work with the staff resources performing them. The concept of resource management is well-defined in industries like manufacturing, insurance and financial services, but typically not in healthcare delivery. To make appropriate decisions, IT managers need to know exactly what their employees are working on, what their skill levels are and what demand is coming from the business.

**IT planning is separate from business planning.** Planning for IT projects and their associated budgets is often done separately from formulating the organization’s strategic plan. IT budgets are often proposed with limited input from the business side, resulting in IT departments frequently soliciting funds for projects that are not on the executive management’s priority list. IT planning should ensure that, at a minimum, projects are aligned with the organizational direction and goals for the particular year, or set of years, in which the projects are scheduled for delivery.

**Limited portfolio management.** The concept of portfolio management for healthcare organizations is in an earlier stage of maturity than in other industries. Portfolio management is the process of defining and managing a specific group of work packages or projects within a defined budget. It enables the IT organization to show the specific strategic alignment, financials, risks and resources needed for a group of projects or operational activities. Often, portfolio management in healthcare IT is non-existent, and IT management does not have the real-time data to describe their plans to executive management. Portfolio management is important in aggregating data into useful reports for executive decision making and to ensure that the business and IT know what particular IT services will cost, what the cost benefits are, and what can be accomplished with the limited IT resources available.

**No central repository for work tracking.** IT organizations do not have a single source of information about the effort they are spending on their work. If work is tracked at all, it is done so in a number of disparate ways, providing the CIO with a hodgepodge of information to sort through. Having a central repository that catalogues all work, regardless of whether it is related to projects or operations, along with all the time and documentation associated with that work, enables more effective resource management and understanding of active and planned demand. Having a reporting capability built into a central repository makes executive bottom-up and top-down reporting much easier and more accurate.

**Importance of proper forecasting**

Addressing the challenges associated with ITDM can seem daunting. The most important factors in meeting the challenges are effective resource forecasting and work tracking. Forecasting and tracking facilitate an understanding of what IT staff are working on and when—a cornerstone of ITDM.

IT needs to effectively plan for work based on the volume of project requests, operational needs and current resource availability. The business side of healthcare organizations is deservedly demanding when it comes to IT, and it requires that IT departments are nimble when it comes to managing requests and accurate with their estimates of when work will be delivered. For example, when an organizational director submits a help desk ticket, it is important to be able to determine where in the queue that ticket falls, what resources are required to address and close the ticket, and when the request will be completed so IT staff can plan their work accordingly. Communication with the director should be clear and complete. Delivery planning is especially important during the budget planning process to show when particular projects can be completed, based on current resources and operational workloads.

That sometimes can be a struggle for an IT staff. Healthcare IT resources are constrained, and staff burnout is a significant consequence. Signs of burnout include increased stress, low morale, decreased productivity and even hostility toward taking on more work. If an IT organization can effectively and accurately measure the work that staff members are doing, then IT management can more effectively balance individual workloads. Accurate forecasting also enables management to hire more staff before they are needed to prevent staff burnout. A good all-around IT staff is hard to assemble and hard to maintain — it is important to retain the best staff and not overwork the key “go-to” individuals.

It is particularly difficult to achieve executive buy-in on the IT work currently under way, and, more importantly, on the work
that IT is planning for the future. One of the key reasons for this is executives’ limited information on constraints affecting IT resources. Aside from just being told about limitations, ITDM can help demonstrate IT resource constraints in graphical and tabular formats that are intuitive. The best sources of information to gain buy-in from executive leadership are reports that show resources matched up against the anticipated demand during a specific timeframe or for specific resource roles. That enables leadership to be actively involved in planning on how to handle potential resource gaps.

Providing leadership with a view of what IT is spending (in terms of dollars and resources) and delivering (in terms of both project-based and operational services), will demonstrate that IT is effectively controlling its resources and managing its money. This information, along with a better understanding of the associated return on investment, enables better planning and helps elicit executive management support.

Healthcare IT sourcing is particularly difficult because there is high market demand for skilled staff resources. With a tight market and limited dollars available for use by the CIO, it is important to understand what resources are needed, at what skill level, and at what point in the future so IT can manage an effective sourcing program. By having accurate resource forecasts based on known demand and a factor for future demand and resource roles, sourcing additional resources through a direct hire, contractor or third party becomes easier and enables the CIO to better plan a forward-looking budget.

Healthcare IT traditionally has taken a reactive rather than a proactive view of resources and demand management. Much of the time spent reacting to issues that occur because of constrained IT environments could be prevented with a proactive approach to demand management. For healthcare IT organizations to be competitive in their own industry and ensure that they can become more efficient over time, they must become proactive in forecasting.

**BEST PRACTICES IN DEMAND MANAGEMENT**

Resource forecasting is a cornerstone of ITDM, but it and other demand management components need to be effectively implemented to create a successful system. An effective, best-practice ITDM strategy includes top-down and bottom-up reporting that is both beneficial to line management in IT and also to the organization’s leadership.

A well-balanced and efficient approach is one that incorporates resource information; demand-intake information for both project and operational work; intuitive reporting; a good communication plan; an automated system or repository to capture all information; evidence of IT strategic alignment; and the management responsible for keeping all components running smoothly. Putting these components in place requires a good plan of action with the following well-defined rules.

**Establish resource managers.** While a project manager is responsible for individual projects, a resource manager is responsible for planning an employee's overall schedule. In some organizations, this role may be filled by a direct supervisor or other line manager, a mentor or a central staffing function. For example, in the LAN services group, the group manager might be the resource manager for all staff in the group. That manager is responsible for knowing what staff are currently working on and what they have been forecasted to work on. The resource manager function is key to effectively allocating staff.

**Employ a resource allocation strategy.** Managers must determine how to allocate valuable resources to operational and project work. The best approach is to split a person's 40-hour work week into segments broken into operational work, such as service requests, maintenance and system problems; personal and administrative time, such as vacation, jury duty and other such time constraints; and project work. Forecasts need to be based on all these components, and it will be necessary to describe in detail to management what people are actually doing.

For operational and administrative work, resource managers should create a baseline for each group of employees on a specific team. For example, the LAN services group might be predicted to spend 20 percent of its time on service requests. For project work, managers should identify specifically what each employee is working on and note that staffing situations can change daily.

**Healthcare organizations invest less in demand management and don’t always ensure that resources are assigned to work that supports the strategic direction of the organization.**

**Emphasize consistency in work planning across projects.** Quite often, projects are planned according to what the project manager believes is the best way to accomplish a project. If the manager believes that Project Management Institute rules should be followed and another manager does not, there will be inconsistency across projects or project managers. To address this and myriad other disparate issues in work planning, the project management office needs to mandate a consistent project management methodology that project managers are taught and expected to follow. Consistency is key for large-scale project demand management. There is plenty of room for flexibility in any good methodology, but the organization must achieve a level of consistency at the highest level. It is most important that this methodology be carried through to workplans so that the phases of a project, the key work being done and any potential bottlenecks at particular stages are clearly visible when IT leadership rolls up reports for internal and external organizational management purposes.

**Standardize resource roles.** Effective demand management requires that resources can be “rolled up” into increasingly higher grouping levels for purposes of planning and reporting. For example, clinical managers, senior clinical analysts and clinical analyst roles may fall under the category of clinical IT staff. It is important to understand the makeup of the pool of staff resources and the role of each individual in the IT organization. However, IT organizations may have hundreds of roles, and not every role can be viewed and managed on its own.
To efficiently manage demand, roles should be grouped. Typical high-level role categories in a healthcare IT environment include clinical analysts, financial analysts, database developers and DBAs, web developers, infrastructure resources, interface resources and project managers. At the highest level, role categories like these will help plan, manage and track where time is being forecasted and spent. In addition, standardized roles enable the creation of cost matrices by role, which can help track IT spend vs. delivery of services and, consequently, help drive efficiency and enable better visibility into the total cost of ownership and return on investment.

**Create a reporting strategy.** A critical component to any demand management strategy is understanding which reports will be used for daily management and which reports will be provided to IT and business leadership to detail how IT is providing services to the rest of the organization. It is important that these outputs show strategic alignment, resource constraints, risks, financials and project priorities, and they also should tell a story that helps IT become more proactive and use its funds more wisely. The case study in this article shows a sample of the desired reporting outputs in more detail.

**Develop intake processes.** Most healthcare IT departments have demand coming from throughout the organization. Requests come from the help desk for incidents; service requests are e-mailed, faxed and called in; and project requests come from multiple locations, including from the IT staff directly. The IT organization has to develop the appropriate definitions for each type of work and plan where these types of work should be funneled.

Ultimately, all work needs to be compiled in one place where management can assign it to resources and accurately project when work will be done. It is essential that any refinement of current intake processes or implementation of new processes be thoroughly communicated to all business and IT staff for the intake process to be successful. It will take some time for people to realize that calling their favorite IT analyst is no longer an acceptable way to get problems fixed. This is often a system problem in an organization, but IT can make significant progress through effective intake processes.

**Offer a single repository of information.** The common theme in all of these components is that information will ultimately reside in a single repository. Whether that is in a database, spreadsheet or a new breed of system known as an IT management and governance system, or IT-MG, it is important that data be aggregated in one location to accurately report on it. An IT-MG system is recommended for facilitating this data manipulation, especially in larger IT organizations.

**Provide training.** Thinking through and plotting a training strategy is critical to the success of any demand management strategy. Training needs should be identified based on responsibilities and training logistics. Classroom training in demand management and portfolio management has proven to be the most effective way to train, although it is not always the most cost-effective. Having training in a classroom also ensures that all participants can ask questions and participate for the entire training period without distraction. Handing out a brief exam at the end helps ensure that trainees actually understand the material being taught.

**Communicate, communicate, communicate.** An approved communications plan and consistent and well thought-out communications to the right audience are a must for demand management. Without effective communication, the same old processes and behavior will occur, and fingers will get pointed at the lack of communication. Communication is important if any changes are to occur in the status quo, but especially when the changes are as significant as those expected from a new demand management strategy.

**UNIVERSITY HOSPITALS: ADOPTION OF A STRATEGY**

In 2006, First Consulting Group helped to implement demand management at University Hospitals in Cleveland, the primary partner for the Case Western Reserve University School of Medicine and an IT department for which FCG serves as an outsourcing partner. University Hospitals’ executive leadership was looking for better visibility into the demand for their IT resources and better ways to control that demand.

University Hospitals was in the midst of an aggressive series of system rollouts, and executive leadership wanted to ensure that the right staff would be available at the right time. The CIO was particularly interested in ensuring that the required skill sets would be available when needed and that no particular group of IT resources would be overtaxed. The planning committee determined that instituting an ITDM process and establishing a 12-month view of resource demand and capacity would enable the system to effectively plan.

Fortunately, University Hospitals already was using the Clarity IT management and governance system from Computer Associates for project management, project workplans and employee time tracking. An automated IT management and governance system is not a requirement for demand management, but it is a considerable help in establishing an effective program, especially in larger IT organizations. Automated IT-MG systems offer streamlined data entry and manipulation, and integrated modules for such critical processes as time entry, resource forecasting and capacity planning.

As a management tool, IT-MG systems facilitate the demand management process, and they also are kept current themselves as a result of being used and updated with demand management data. By having an IT-MG system in place, University Hospitals knew what projects their IT staff were working on and how many hours were being charged to those projects. To implement ITDM, University Hospitals would need to leverage that knowledge and use it to begin forecasting the staff’s time.

To do this, University Hospitals realized that it would need three key pieces of data—an understanding of how much time staff needed to spend on operational work, such as fixing problems, conducting routine maintenance, addressing service requests and even general administrative time like department meetings, corporate e-mail and vacation time; an estimation of how much time could be spent on actual project work, or in essence, the time that was “left over” after their required operational work; and a solid forecast of time and budget to be spent on future projects.

To address the first component, the system first ensured that a resource manager was assigned to each IT staffer for purposes of
planning their work. University Hospitals then established what became known as “operational allocation plans,” or placeholder projects to which associates could be assigned for purposes of forecasting their operational work. Operational work was broken down into administrative time, maintenance time and production problem time. An allocation plan was established for each of these areas. Next, resource managers reviewed each associate’s work and determined the appropriate forecast for their time, by percentage, to each of the allocation plans. For example, web developers might be forecasted to spend 25 percent of their time on problems, 10 percent of their time on maintenance and 15 percent of their time on administrative duties. That would leave 50 percent of their time to work on projects.

University Hospitals used the CA Clarity system to track their resource allocations, as resource allocation is one of the strong suits of IT-MG software. In truth, a good IT-MG system is a practical addition to any IT department. It can be used for a multitude of IT work management, governance, project and portfolio management functions, and it streamlines the introduction and use of concepts like ITDM. An IT-MG system also offers a real-time transactional approach, and its ability to maintain data in a data warehouse allows for extensive prospective and retrospective reporting and analysis. An automated system is not a requirement to get started with demand management; however, IT organizations can start allocating resources with as little as a spreadsheet.

After the resource managers allocated staff to operational allocation plans, they were able to work with the project managers to allocate staff to the actual projects on which they needed to work. After planning was complete, the system had its first complete view of its staff’s operational and project allocations. One of the output reports from this process is shown below (Figure 1). This report is used to review the amount of time allocated for each staff member. For any future time period, the resource manager is able to identify the amount of time being forecasted in each of their staff’s schedules for maintenance, production problems, administrative time and projects, also known as “tactical” projects. The report also shows in graphic form when more than 100 percent of an associate’s time is allocated.

The third data point that University Hospitals needed to effectively forecast resources was a much better understanding of future projects. As indicated in one of the previous sections, methodology and process for proposed projects is typically lacking in healthcare, and IT departments constantly struggle with project prioritization. The key to solving this problem is a sensible and flexible project intake process by which a consistent approach is taken for getting the right projects into the queue.

There are great ideas and processes in place for project intake,
and its intricacies warrant more discussion than is feasible in the article. ITDM relies on effective project intake that takes into account project cost, benefit, risk, strategic alignment and several other factors. At University Hospitals, after projects are properly scoped and then approved for operational or capital expenditure, they are considered to be a “proposed” project. Roles then can be allocated to projects, so that the projects appear on the output reports with an appropriate forecast of expected staff needs.

For the demand management reports to account for future project demand, it is important to assign roles to projects after they are approved, even though the projects still have a ways to go before they will be kicked off. This means allocating roles such as project manager, clinical analyst and Web developer to the project, even though the specific resource’s names are not yet known. University Hospitals uses its system to save time by automatically assigning roles based on the type of project and its complexity.

For example, an IT system upgrade project of medium complexity might require 0.5 full-time equivalents of project manager time, 0.25 FTE of financial analyst time and 0.25 FTE of interface analyst time. Based on a template, these roles and allocations are pre-assigned to proposed projects and can be changed later when the project’s actual requirements become better known.

With the proposed projects added to the mix, the system is able to achieve true ITDM through the use of reports (Figure 2). This example of a report demonstrates the demand for clinical and functional analysts over a 12-month period. The bottom section of each bar represents the total number of FTEs worth of analysts that are being forecasted for operational work, such as problems, maintenance and administration. The middle section indicates the forecast for project work. The top section indicates the time forecasted for proposed projects. The black line running horizontally through the chart represents the forecasted staff complement for
each month. In this example, the downward trend in the black bar is a result of contracts expiring for current contractors. In many organizations, the black bar will remain relatively flat because the number of staff may not fluctuate much.

Several conclusions can be drawn from this type of chart. It appears that there is enough staff capacity to handle the work that the analysts will need to do in September and October of 2007; however, as current projects wrap up and future projects kick off in early 2008, it appears there will not be enough analysts to handle the demand. Staff could be hired or contractor contracts renewed to meet the upcoming demand, or it might make sense to defer some projects based on the lack of staff capacity.

At University Hospitals, this chart can be displayed for one particular grouping of roles over time, as shown above, or for all roles for one particular month. So, in addition to seeing the analyst group for the next 12 months, leadership could see a snapshot of October, for example, that includes analysts, project managers, Web developers, interfaces, resources and others.

**ONGOING CHALLENGES AND LESSONS LEARNED**

Along with the visibility that ITDM provides comes the challenge of maintenance and upkeep. University Hospitals has found that several routine steps must occur to keep the demand management reports accurate and current. First, accurate ITDM requires consistent and timely data review because incorrect data is magnified on the reports. On a weekly basis, University Hospitals resource managers are responsible for reviewing their staffs’ allocations.

Reports such as the one in Figure 3 are useful in this process. It helps identify whether forecasted time is in line with actual hours being reported. The time that a staffer has been allocated to future work appears in the “Allocation” column, and the actual time that they billed on their timesheet appears in the “Actuals” column. By comparing actual to allocated time, the resource manager can tell whether a staff member has been working on the projects to which they have been allocated and whether a discussion or a change in future allocations is warranted.

Second, project managers must keep project plans up to date, including tasks, finish dates and other workplan parameters. As project timing and resource needs change, projects and their associated resource allocations need to remain current for the output reports to be correct. In addition, proposed projects need to be maintained, with new projects getting into the system, and cancelled, completed, and “on-hold” projects being tagged accordingly.

Next, various ITDM parameters need to be adjusted when they change. For example, as employees are hired, terminated or

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**Figure 3: Resource allocation vs. actuals**

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<th>SMITH, SUAN</th>
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transferred, the capacity parameters must be adjusted in the system. Resource and role groups, proposed project templates and workday calendars also need to be maintained. Orientation and training for new staff needs to encompass ITDM as well so new employees understand the value and the importance of keeping their information accurate and current.

CONCLUSION

IT demand management should be a significant part of running a healthcare IT organization. Management needs and deserves to know how the funds they are allocating to IT projects and operations are being used and whether IT can meet the staffing demands of current and future projects. By employing some key tactics to manage incoming demand for IT work, determine the proper supply and resource makeup, and communicate actual supply and demand to executives, healthcare IT organizations will be in a better position to obtain necessary funding, become more efficient and effective, increase customer satisfaction, reduce employee negativity, and start to show a real return on investment.

ITDM is no longer a future-state or leading-edge technology—it is being employed effectively in several industries and is gaining traction in healthcare IT organizations that recognize the opportunity and the ability to do more. JHIM

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REFERENCES

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- Distinguish bars or pie chart sections by pattern, not color.

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