Return on Investment

Exploring the Elusive ROI

Clinical ROI: Not Just Costs Versus Benefits

Also in this issue...
Preventing Error with EMRs  Data Integration  Electronic Prescribing
EDITOR’S INTRODUCTION
2 ROI and IT: Strategic Alignment and Selection Objectivity
Richard D. Lang, EdD

COLUMNS
THE H.I.T. FUTURIST
4 Return on Investment: Going Beyond Traditional Analysis
Jeffrey C. Bauer, PhD

LEADERSHIP
6 In Search of the ROI from CPOE
Rick Krohn, MA, MAS

LEGAL
10 Creating a Healthy Relationship with Your (Next) IT Vendor
Diana J.P. McKenzie and Alexandra N. Collins

GOVERNMENT/REGULATION
12 At Least 44,000 Patient Deaths This Year: How Do You Measure ROI?
Dave Roberts, MPA, FHIMSS; Joyce Sensmeier MS, RN, BC, CPHIMS; and Pat Wise, RN, MA, MSN

THE PHYSICIAN PERSPECTIVE
15 Life After Go-Live, Part 4: Preventing Error with an EMR
Eric Rose, MD

ARTICLE RESPONSE
15 A Cat’s Perspective: Being a Vendor in a Selection Process
Mark Groper

INDUSTRY LEADERS
18 An Interview with Pam Arlotto, Healthcare IT Strategist

FOCUS: RETURN ON INVESTMENT
20 Finding Value from IT Investments: Exploring the Elusive ROI in Healthcare
Lynn H. Vogel, PhD

29 Who’s Counting Now? ROI for Patient Safety IT Initiatives
Lucy Mancini Newell, MBA, and Doug Christensen, RN

36 Clinical ROI: Not Just Costs Versus Benefits
Barry P. Chaiken, MD, MPH

42 The New England Healthcare EDI Network
John P. Glaser, PhD, Greg DeBor, and Laurance Stuntz

ORIGINAL CONTRIBUTIONS
51 Analyzing Computer-based Patient Records: A Review of Literature
Tricia L. Erstad, MSN, RN

58 Advancing the State of Data Integration in Healthcare
Joyce Sensmeier MS, RN, BC, CPHIMS

62 Health Integration Cost Cutting
James Donlon

67 Antecedents to the Adoption of ASPs in the Healthcare Industry
Ebrahim Randeree, MBA, Susan P. Judd, MSHA, MBA, Rajiv Kishore, PhD, H. Raghav Rao, PhD

72 Electronic Prescribing: Ready for Prime Time?
Helene Levers Lipton, PhD, Robert H. Miller, PhD, and Julian J. Wimbush, ScB
In healthcare, the expectation for information technology (IT) to deliver cost savings and quality improvements has never been greater. As a result, leadership must continually evaluate IT’s capacity to support the organization’s quest for strategic goal attainment.

Particularly, healthcare executives should be primarily concerned with how well IT integrates and aligns with the goals of the organization as well as the objectives of each individual business unit. This is best described as a state of accord when the strategic objectives of the business are in a harmonious state with the supporting IT systems. IT’s strategic role must be evaluated mostly by those who use it (business units) and not those who provide it (the IT department).

The elusive return on investment (ROI) from IT projects can be realized with a process alignment that merges the forces of core business objectives and IT opportunities in one direction: the achievement of strategic initiatives. Although there are many approaches and measures to guide this alignment process, success becomes more realistic when the goals of the organization are clearly defined and accountability in applying IT as a means to an accomplished end — is shared. Thus, success in integrating IT with key business initiatives will be one of the most important challenges healthcare organizations will face in the near future.

Many important and costly IT initiatives are justified via the traditional ROI exercise. This methodology alone may not be suitable for measuring how well IT contributes to the success of the organization. Although an ROI may predict how long it will take a capital investment to return anticipated savings via cost reductions or new revenue, it lacks a suitable measurement for the “qualitative” aspects that can contribute heavily to the realization of strategic objectives.

Thus, the traditional ROI must be augmented with an account for improvements in customer relationships, internal processes, innovation, patient safety, and other qualitative factors that cannot be evaluated with short-term financial measurement techniques. The new ROI methodology must be more goal-oriented, agile, and scalable. It needs to be all of these things to adapt to the speed at which new technology advances, as well as the frequent changes that occur in business strategy resulting from competitive pressure and the ever-increasing external scrutiny for quality improvement.

The new ROI methodology must be more goal-oriented, agile, and scalable.

Under the traditional ROI evaluation, many IT initiatives that could potentially help the organization realize important goals would never go forward because they may lack a measurable financial return. Implementing an integrated planning and evaluation process, CIOs and business leaders can document how well IT projects support strategic goals and objectives. This approach requires that good baseline data are recorded for each initiative and standard of measure.

As with financial metrics, evaluating the improvement in a targeted process will require a well-documented baseline, mutually agreed-upon goals, and acceptable methods for measuring progress. Many IT project benefit analyses fail because no one takes the time to record a snapshot of how things were before the initiative began. Establishing a good baseline measurement process can be the most important factor in determining how much the IT investment contributed to the achievement of a strategic imperative.

Once the project has been deemed worthy for consideration, the development of a sound business reason should be a principal condition for project prioritization and inclusion in the IT project portfolio. Measuring the financial return on IT is important but should not be the sole criteria as to whether an investment will help the organization realize strategic goals and objectives. Other qualitative factors should be given strong consideration in the prioritization process (e.g., patient safety, quality improvement, stakeholder support, strategic alignment, regulatory requirements, etc.).

Subjective justification is one of the reasons qualitative factors are often eliminated from the project evaluation process. Attempts to justify the benefits of clinical IT systems may be considered subjective because improvements in patient safety, length of stay, and clinical efficiency are extremely hard to quantify financially. Hence, an objective qualitative scoring system could be used to weigh the potential contribution of an IT project towards realizing a strategic goal for the organization. Moreover, using a standard qualitative benefit-scoring matrix can clarify the project’s intangible worth by illuminating its strategic alignment potential and promoting IT project selection objectivity.

If, in fact, competing projects score evenly, senior management can make fundamental decisions regarding which core business and clinical...
processes are most critical to safe patient care, business improvement, cash flow, and ultimate strategic success, and adjust the IT project portfolio accordingly.

Finally, I must confess that my introduction for this month’s topic contains not one original thought. Kaplan and Norton delivered the idea of the “balanced score card” and strategic alignment years ago. Many others have written about various methods for measuring IT’s qualitative contribution to the corporation. What’s most confounding is how long it has taken healthcare to adopt a flexible IT justification process that complements the “fuzziness” of clinical IT projects and their projected benefits.

Perhaps our previous track record of mangled enterprise-wide system implementations, Y2K budget overages, along with the dot-com fizzle has made CEOs and CFOs leery about allocating a larger portion of the shrinking resource pie to IT. Nevertheless, IT can be an effective tool that an organization uses to reach strategic objectives.

Posting clinical IT initiatives until hard dollar savings can be proven will have a negative long-term impact on a provider’s ability to deliver safe, effective, and reliable patient care. In an environment where less cost and more service seem to be the common public cry, the effective use of IT is the only way organizations can meet these lofty demands. With limited and constrained resources, healthcare executives must apply a judicial project selection process coupled with a vigilant assessment of how well the organization implements and utilizes technology to truly assess the IT ROI from both a quantitative and qualitative perspective.

The Fall 2003 issue of the Journal of Healthcare Information Management (JHIM) contains a collection of special interest columns and articles that focus on another very important issue — Return on Investment. In this edition, there are a number of examples, strategies, opinions, and case studies that will be useful for leaders in HIT organizations struggling to justify expensive but important IT system projects.

Articles in the areas of Finding Value from IT Investments, Clinical ROI: Not Just Costs Versus Benefits, ROI for Patient Safety IT Initiatives, and The New England Healthcare EDI Network are just some examples of how IT leaders are providing new and interesting ideas related to the ROI philosophy and alternative methods for IT project justification. In addition, special interest columns and articles offer the reader valuable information concerning the following topics: Return On Investment: Going Beyond Traditional Analysis, Life After Go-Live, Part 4: Preventing Error With an EMR, In Search of the ROI from CPOE, and Creating a Healthy Relationship with Your (Next) IT Vendor, as well as other original contributions.

Finally, I would like to thank all of the professional staff at HIMSS, the peer reviewers, and the JHIM editorial review board for all of the behind-the-scenes work that must be accomplished to produce each issue. JHIM continues to look for new ways to provide relevant, important, and useful information for healthcare professionals, academicians, and HIMSS members. If you have any comments or suggestions that could help us improve in any way, please feel free to email me at: rdlang@know-power.com.

RICHARD D. LANG, EDD
EDITOR, JOURNAL OF HEALTHCARE INFORMATION MANAGEMENT, AND PRINCIPAL, KNOW-POWER, LLC, GLENSIDE, PENNSYLVANIA

References

Return on investment (ROI) is one of several analytical tools that can be used to build a case for or against potential investments in information technology. However, ROI gets more attention than it deserves — particularly when it is the only criterion used to make a decision. A careful reexamination of ROI is definitely needed to put the concept in proper perspective for healthcare in the 21st century.

ROI is conceptually elegant, which is an economist’s way of describing an idea that makes sense in theory but may not make sense in practice. Its practical shortcomings need to be recognized so that ROI does not get misused. One of its most serious problems is absence of consistency. A review of literature reveals the use of several different equations to compute ROI in healthcare (to the limited extent that computational details are even given in the literature). Consequently, comparisons of returns across organizations or over time may be meaningless because ROI is not computed in a standardized manner.

Numeric values for the variables used to compute ROI are equally imprecise. In theory, the rate of interest is a valid proxy for the cost of capital, and it is used in most models to adjust future returns to a constant monetary amount. In practice, a meaningful interest rate is impossible to define with certainty in today’s dynamic and unpredictable marketplace that offers many alternatives to conventional financing. The definition of returns is equally fuzzy. Most healthcare providers are making “heroic” assumptions just to estimate future revenues at an institutional level, so attributing a specific dollar value to the income from a single investment in IT is effectively an arbitrary act in a marketplace characterized by discounts and bundled pricing. (If this paragraph is confusing, that’s the point. ROI is much more art than science.)

The practical shortcomings of ROI are well illustrated by healthcare’s chronic underinvestment in IT. Hospital financial officers have helped keep their organizations on an expensive paper trail because automated alternatives presumably did not have a positive ROI. In contrast, leading American industries such as financial services, communications, and transportation have stayed profitable because they increased investments in IT when competition started battering their margins in the 1980s and 1990s. Banks, for example, survived by investing in ATMs and online banking services rather than hiring more clerks and building more branch offices. Healthcare needs to learn from these examples. IT investments may not yield a positive ROI by conventional analysis using historical data, but the future costs of health personnel compel a new look at automation. For example, the number of pharmaceutical prescriptions is expected to increase as much as 50 percent by the end of the decade due to advances in the drug discovery process, but the supply of pharmacists will increase by 10 percent or less. The ROI on IT-based solutions for drug administration will be pushed dramatically upward by increasing costs of labor.

Of course, a relative change in input costs will not overcome the inherent subjectivity of ROI analysis. A more objective method will still be needed to guide healthcare executives in choosing the best solution.

Economics offers a viable alternative, cost-effectiveness analysis (CEA). Unlike ROI studies comparing “guesstimated” income streams from a single investment with the present value of its costs, CEA forces consideration of all alternatives for getting a job done. CEA begins with careful specification of a production objective, such as the number of prescriptions to be filled per year and the maximum number of drug administration errors that will be tolerated. Financial officers will then evaluate the costs of all viable solutions, from hiring a lot more pharmacists and nurses to acquiring robots that fill and deliver bar-coded prescriptions. The best solution is the least expensive alternative, regardless of its ROI, because the alternatives have been compared on objectively measured costs for a specified outcome.

Financial purists will surely object to CEA when the least-cost solution does not pay for itself in a technical sense. However, the emerging strategic challenge is staying in business (SIB), which is how hospitals will be forced under unprecedented circumstances (e.g., rising expectations of consumer protection and declining revenues) to reevaluate basic activities like filling prescriptions, keeping records, managing inventory, and allocating labor. Some investments will need to be made because the...
alternative is shutting down. Unfortunately, no approach to investment analysis can compensate for bad market dynamics or diseconomies of scale. Some absolutely essential investments will still be unaffordable under normal circumstances. Therefore, when a health system’s survival depends on acquiring a technology with negative ROI, its executives need to take a different approach. Emerging alternatives include cash flow analysis and studies of total costs of ownership (TCO).

Another approach — one with considerable promise — is establishing a joint venture to leverage an investment that can be shared across several organizations, such as a picture archiving and communications system (PACS).

State-of-the-art security in IT systems even opens the possibility for sharing technology with competitors, a practice already common in the automotive industry (e.g., Covisint for materials management) and transportation (e.g., Apollo and Sabre systems for airline reservations and ticketing).

Although healthcare providers have a long-standing tradition of purchasing technologies because insurance covered operating costs, leasing merits careful consideration in today’s cost-conscious environment. The growing service provider business also provides opportunities to access technologies that would otherwise be unaffordable. For example, PACS services can be acquired for a per-file fee that allows the health system to pay only for the image storage it needs. Last, and definitely not least, outsourcing is rapidly becoming a financially attractive way to acquire needed IT services when ROI gets in the way of doing what has to be done.

ROI is not inherently bad. Rather, it suffers from some serious limitations. ROI deserves to be one of the tools for analyzing investments; it should never be the only one. Uncertain times call for creative thinking. Fortunately, the healthcare industry is developing new ways to invest in essential technologies that don’t pass the test of old-fashioned thinking. ROI is not eternal.

**About the Author**

Jeffrey C. (Jeff) Bauer, PhD, is a nationally recognized medical economist and health futurist. He is senior vice president of the Chi Group of Superior Consultant Company, Inc., Southfield, Michigan.

“A**nother approach — one with considerable promise — is establishing a joint venture to leverage an investment that can be shared across several organizations, such as a picture archiving and communications system (PACS).”
Once again this year, reducing medical errors and improving patient safety has led the list of information technology priorities for CIOs, according to the 14th annual HIMSS Leadership Survey. Past reports from the Institute of Medicine (IOM) and The Leapfrog Group detailing the extent of medical errors, plus a steady stream of recent clinical studies that reinforce the persistence of medical errors throughout healthcare delivery, have forced the industry to focus on patient safety as the defining characteristic of near-term IT strategic planning.

But patient safety is about more than just medical error prevention. It is also about correct treatment planning, clinical excellence, correct diagnoses, correct processes and procedures, and correct patient therapies. Patient safety is a somewhat ambiguous term, but in its truest form it demands perfect information, perfect processes, and perfect clinical decisions across the spectrum of patient care. That's just unrealistic, but patient safety can be improved by removing its main obstacle — medical errors.

Advocates of e-healthcare have championed computerized physician order entry (CPOE) as the single most important technology solution to the issue of medical errors as well as a catalyst of healthcare’s digital transformation. Supporters claim that CPOE reduces cost, improves patient safety, minimizes risk, and supports clinical efficiency. It’s a growth industry — according to a recent study by Frost and Sullivan, the CPOE market could reach $363.3 million by 2007, up from $224.4 million in 2002.

But there’s another side to the CPOE story. Today only about 10 percent of U.S. hospitals have full CPOE systems, and few use them to their full potential. And according to the 2002 Dorenfest IHDS Survey of 1,426 delivery systems, only 30 percent are in the process of evaluating or implementing CPOE systems. In the same survey, less than 25 percent respondents had most physicians entering orders electronically. 8 percent had over half of their physicians entering some orders electronically, and 21 percent of respondents had “some” physicians entering some orders electronically. This represents an unrealized business value of CPOE due to underutilization.

Despite mounting industry pressure to “do something” about medical errors, CPOE has yet to gain wide acceptance, but why? CPOE systems have a baseline price tag of around $2 million to $5 million, which places them beyond the reach of most non-institutional providers. CPOE also demands cultural change and the adoption of standardized workflows — not an easy task across the entire organization. In a study of CEOs, CIOs, CFOs, and COOs conducted by Modern Healthcare, the major reasons CPOE is not being implemented include: pushback from physicians and clinicians (53%); focus on HIPAA (39%); a perception of cheaper, friendlier solutions (30%); and lack of money (19%).

Has CPOE Been Oversold? There have been a number of high profile successes — and setbacks — in CPOE implementation, some within the same institution. For example, following a $5 million initial investment in CPOE, Ohio State University Health System reported the following results: turnaround time for medications was reduced by 64 percent, turnaround times for radiology tests decreased by 43 percent, and lab test turnaround was reduced by 25 percent. But in a CPOE study of the same hospitals conducted by the Journal of American Medical Informatics Association using financial metrics, it was found that, although cost per hospital admission declined slightly among all participating hospitals (from $5,967 to $5,661), cost per admission at one participating hospital (The Arthur G. James Cancer Hospital) actually rose from $6,427 to $6,518. Such results provide a confusing picture, from a business perspective, of CPOE’s value.

At Cedars-Sinai Medical Center in Los Angeles, there is no uncertainty about CPOE’s impact. After a multi-year commitment to CPOE that went live in 2002, Cedars-Sinai suspended its CPOE program in early 2003 in the face of a physician revolt, sparked by a complex, error-prone rollout of the CPOE application. According to Dr. Langberg, CMO at Cedars Sinai, four complex factors led to the decision to temporarily suspend implementation of CPOE: physician resistance, insufficient workflow planning and analysis, lack of physician input, and the need for greater training and support.

To be fair, there have been some
clear victories. Brigham and Women’s Hospital in Boston has reported that CPOE accounted for an 81 percent decline in medical errors over the course of the implementation. Interestingly, 64 percent of the overall decline occurred following the implementation of the first, and simplest, version of the technology, which included features such as predetermined lists of medications and doses, display of patient data, basic drug dosage, interaction, and duplication checking. The net savings of the BWH system are estimated at between $5 million and $10 million per year.

Montefiore Medical Center in New York has also scored some CPOE success, albeit during a prolonged period of development and implementation. Since 1999, Montefiore’s CPOE system has yielded a 50 percent reduction in prescribing errors, a 60 percent improvement in the time elapsed between prescription writing and prescription receipt; and improved workflows. Christus Health in Texas and Parkview Health in Indiana have reported similar successes.

**How Do We Measure Success?**

Determining the return on investment from clinical systems is a notoriously imprecise science; trying to devise numeric or statistical measures that demonstrate the ROI of such systems in business terms is even dicier. As a result, finding measurable evidence of CPOE effectiveness from a business perspective is elusive, due to the nature of the yardstick being used. But if CPOE can’t be substantiated by traditional business analysis, how can its value be proven? Indicators of CPOE effectiveness must not only include traditional financial benchmarks, but also such “squishy” non-financial metrics as quality and patient satisfaction. It’s a problem-ridden methodology, easily challenged and derided.

Nevertheless, a fair ROI calculation of any clinical system must not only include quantifiable financial benefits, but also less tangible “soft returns” such as quality improvement, business transformation, staff productivity and operating efficiency, patient satisfaction, and cost avoidance. Using a holistic approach to the ROI assessment of CPOE, the list of benefits includes direct and indirect, tangible and intangible measures, including:

**Charge Capture.** CPOE systems improve the accuracy of charge capture, which should result in streamlined billing (and payment), as well as preemption of billing disputes and government scrutiny, plus more efficient inventory and supply chain management.

**Medical Errors.** The marquee value proposition of CPOE is its impact on medical errors and clinical outcomes. CPOE systems have demonstrated the ability to measurably reduce the incidence of medical errors. Accurate, legible, timely orders that have been checked for possible errors yield better outcomes and improved patient satisfaction.

**Decision Support.** CPOE systems use rules-based logic to provide critical information to the physician at the point of care, which should result on a cumulative basis in better clinical ordering and outcomes.

**Clinical Quality.** Better clinical outcomes should translate into a reputation for quality — which radiates among staff, patients, and payers. This should create a competitive advantage in attracting qualified staff, creating brand preference, and improving payer-contracting relationships.

**Productivity and Workflows.** As a forerunner of digital transformation, CPOE serves to transform business and clinical processes, accelerate transactions, and streamline interactions. In addition to the economic benefits of improved efficiencies, CPOE can contribute to employee morale and retention.

**Community Image.** There is a public relations bump that comes from taking a high-profile approach to patient safety. Customer preference gravitates towards healthcare institutions that are on the cutting edge of healthcare delivery, and the resulting publicity often yields additional patient volume.
Professional Ethics. Somewhat ethereal but still a factor in the ROI equation is the moral obligation of the U.S. healthcare industry to protect patients from avoidable errors in treatment. To the extent that CPOE contributes to this goal, it should be considered an investment whose return is measured in human rather than business terms.

Cost Avoidance. Perhaps the most compelling business case in support of CPOE is cost avoidance. According to the Institute of Medicine (IOM), the increased hospital cost of treating adverse drug events (ADEs) averaged $4,600 per incident. In 2000, the median compensation award for medication errors was $668,000. The risk management and legal liability issues are significant: in one study it was found that 19 percent of medications in 36 hospitals and skilled nursing facilities were ordered erroneously. Of these errors, 7 percent were potentially harmful. This translates to 40 potentially serious medication administration errors occurring every day in a typical 300-bed facility.10

Conclusion
From a planning perspective, the lesson of CPOE implementation — with an eye towards ROI — might be to keep it simple. The failure of Cedars-Sinai CPOE implementation can be clearly traced to a highly complex initiative that was attempted in the absence of an appreciation of the impact CPOE would have on physicians, systems, and workflows. A more reasoned approach, like the one being taken by Montefiore Medical Center, allows system integration to be conducted incrementally. In this way, the consequences of mid-course corrections tend to be less dramatic.

At the end of the day, it is unlikely that a business case can be made for the benefits of CPOE based on direct cost reduction or cost avoidance — there just isn't a clean way to measure...
a causal relationship that can be expressed in business terms. The ROI from CPOE must be viewed in a larger context, including its overall impact on outcomes, operations, productivity, and patient satisfaction.

Furthermore, CPOE must not be mistaken for the “magic bullet” of patient safety or medication error prevention, whose impact is either absolute or insupportable. CPOE addresses an important aspect — but not the entire challenge — of patient safety. Finally, we’re in a climate of rising expectations regarding clinical quality and patient safety, and the value of technology solutions like CPOE may best be viewed simply as a means of staying in the game.

About the Author
Rick Krohn, MA, MAS, is president of HealthSense, Inc., a leader in e-healthcare technology development and business transformation. He can be reached at rikrone@aol.com or 912-772-4018.

References
Creating a Healthy Relationship with Your (Next) IT Vendor

Diana J.P. McKenzie and Alexandra N. Collins

We are now so firmly entrenched in the information technology age that it would be difficult for any of us to name a company that has not undertaken a major technology implementation project. Similarly, we would each be challenged to name a company that managed to complete such a project without experiencing at least one setback during the process.

Recently, significant attention has been focused on techniques to remediate failed (or failing) information technology projects and the associated vendor relationships. For companies that implemented major technology projects in the mid- and late 1990s, however, the more timely and appropriate dialog focuses on assimilating the lessons those companies learned from their previous (and sometimes current) IT vendor relationships. For companies in this position, often the major goal in reorganizing their technology relationships is to avoid having their next technology relationships experience the same types of problems that they experienced with their prior IT vendor.

Most of the work to create a healthy relationship with an IT vendor should be completed before the contract is signed.

Development of Project Scope

It is often a complicated process to transform a general project description set forth in a proposal document into a detailed description of services and specifications (or statement of work) that is attached to the contract. The customer’s ability to develop an accurate scope of services depends heavily on having the proper resources available.

Often, if a customer has outsourced some or all of its IT functions previously, the customer may not have an internal IT resource that is capable of creating a detailed description of large-scale, complicated transactions. In such a case, the customer should consider hiring an external IT consultant to assist it in evaluating the current state of the customer’s IT resources, the type of services that customer will need going forward (which may also include an evaluation of the potential areas of growth and/or change in the customer’s business), and whether the envisioned project will require a division of responsibility between the customer’s existing and new IT vendors, as well as in creating the detailed specifications and requirements for the project.

As a rule of thumb, a customer can never put too much detail into the statement of work. The statement of work will be used as the guiding document throughout the life of the project, and will be referred to more often than the terms and conditions of the agreement. Creating a more detailed statement of work may be helpful to prevent a vendor from arguing that certain functions are excluded from the scope of the services and would only be provided for an additional fee.

From a contractual perspective, customers can include an additional protection, either in the statement of work or in the contract, in the form of a statement that the vendor will perform all of the tasks, functions, and obligations that are ancillary to, or necessary for, the complete and adequate performance of the services described in the statement of work, which will put the vendor on notice that the customer will not tolerate minor disputes regarding the type of tasks that are to be performed in connection with the project.

Developing a detailed statement of work prior to contract execution is crucial, as the customer’s leverage diminishes significantly after the contract is signed, and there are rarely mechanisms in place to prevent costly disputes that may arise around the scope of the services and the price for the services, and delays in the project as these disputes are resolved.

Service Levels

Another important element in creating a manageable ongoing IT relationship is establishing realistic performance goals. Most customers use ser-
service levels as a means of ensuring that they are getting the most for their money, and to evaluate the vendor’s ongoing performance against historical performance and desired outcomes.

Tensions will arise in the relationship when the vendor cannot meet the service level requirements for the agreed-upon price, or within the agreed-upon specifications. To ensure that a positive balance is maintained between the parties, service levels should have five characteristics — they should be objective, measurable, repeatable, meaningful, and realistic:

- For service levels to be **objective**, the measurement criteria should be clear, understandable, and remain the same regardless of the circumstances. Both the vendor and the customer know whether the service level was met, and the perception of the measurement should be the same from each party’s perspective.

- For service levels to be **measurable**, the service levels should be focused on aspects of the performance that are capable of being quantified and evaluated in a meaningful manner. Measurable service levels will give both parties an unambiguous understanding of the vendor’s performance of key aspects of the services.

- **Repeatable** service levels enable the customer to evaluate the vendor’s performance over time, and allow the customer to determine whether its long-term technology goals are being achieved. One-time service levels may have meaning at certain times in a transaction (for time-certain events such as the creation of a procedures manual), but generally the types of services that a vendor will provide to a customer will be services that are performed repeatedly or continuously, and so the service levels should enable the vendor’s performance of those services to be measured over time in a similar manner.

- For service levels to be **meaningful**, they should provide both the customer and the vendor with useful information regarding the vendor’s performance of the services, such as the manner in which the customer is using the services or areas where problems exist with the vendor’s performance.

- Finally, service levels should be **realistic**. Holding a vendor to an unreasonably high standard of performance will not only increase the price, but likely create tension in the relationship between the parties, and more often than not, represents a level of performance that the customer does not require.

---

**Desired Results**

Before signing an IT-related contract, a customer should have a reasonably clear picture of where it would like to be at the end of that relationship, the benefits that it would like to receive, and the goals that it would like to achieve. Part of the exercise of crafting a detailed description of services and reasonable service levels is having a vision of how the services and the project will evolve over time. Available technology and certain aspects of the customer’s business will most likely change during the life of an IT project. Building in an appropriate level of flexibility into the relationship with the IT vendor may help the customer and vendor address changes in the customer’s system architecture or business strategy without serious disputes.

Customers can also benefit from an evaluation of the effects that the technology and/or services will have on the company’s economics and productivity prior to the commencement of the project. Having an idea of the type of return the customer can expect on its technology investment may encourage the customer to try an alternative approach or to craft the scope of services differently. Finally, an additional aspect of considering the future evolution of the services is planning for the end of the relationship with the vendor, including whether the transition of services would be to a new vendor or back in-house, and envisioning how the vendor would need to cooperate with the new vendor or with the customer to effectuate that transition.

If a customer carefully evaluates its IT environment prior to the project, the goals that it hopes to attain during the project, and its exit strategy, and is realistic and detailed in the performance that it would like the vendor to achieve, the customer will have a better chance of maintaining a well-balanced and beneficial relationship with its existing and new IT vendors.

---

**About the Authors**

Diana J.P. McKenzie is senior partner and chair of healthcare technology law at Gordon & Glickson LLC, a Chicago law firm focused on providing legal services related to information technology and e-commerce markets. She can be reached by telephone at 312-321-7671 and by e-mail at djpmckenzie@ggtech.com.

Alexandra N. Collins is an associate and focuses her practice on information technology transactions at Gordon & Glickson LLC. She can be reached by telephone at 312-321-7678 and by e-mail at ancollins@ggtech.com.

**Note:** The information contained in this article is current as of May 15, 2003, and is subject to change at any time. This article is intended to alert the reader to some of the legal issues discussed herein. The impact of the law for each particular situation depends on a variety of factors; therefore, we strongly recommend you engage legal counsel to assess and help minimize your legal liability based on the particular requirements of your institution. Like any article, this is not meant to be used as a substitute for legal counsel.
It seems like almost every week, we see another article reporting the magnitude of medical errors. Last April, USA Today published an article by Tim Friend titled “Spotlight on Medical Errors” that explored this topic. However, Friend’s article only highlighted a few, high-profile error cases. The Institute of Medicine reports that conservatively anywhere from 44,000 to 98,000 patients die each year in the United States alone due to medical errors. When will America wake up to this outrage and decide to actually do something about solving this tragedy?

Now is the time for America to realize that the application of technology can have a significant impact on reducing these deaths. For example, starting last March, there has been a significant amount of activity within the federal government regarding the use of an electronic health record to reduce medical errors. Specifically, Centers for Medicare and Medicaid Services Administrator Thomas Scully, who controls a large portion of U.S. spending on healthcare regarding the use of an electronic health record to reduce medical errors. Specifically, Centers for Medicare and Medicaid Services Administrator Thomas Scully, who controls a large portion of U.S. spending on healthcare, convened a meeting in Washington, D.C., to discuss how to employ standards and utilize an electronic health record (EHR) throughout the United States.

Also last March, Department of Health and Human Services (HHS) Secretary Tommy Thompson convened a Town Hall Meeting in Dearborn, Michigan, to discuss the use of technology in healthcare. Secretary Thompson announced that HHS was adopting uniform standards for the electronic exchange of clinical information within the federal government.

It’s not like there aren’t examples available to demonstrate how to improve healthcare utilizing technology.

IHE Expands Integration — Features User Success Stories

Despite the advanced state of information technology, integration is still a distant dream for most providers and system users. Optimal patient care requires efficient access to relevant information at the point of care. However, in the reality of today’s healthcare enterprise, multiple separate devices and systems gather and store patient information across the spectrum of care, unable to communicate effectively.

Disentangling and reassembling the disparate strands of information is a daunting task. Institutions that succeed do so at great effort and cost. Not even the most advanced institutions have fully begun to realize the potential of computer systems to reduce medical errors, improve the efficiency of care providers, and enhance the overall quality of clinical care.

User success stories were featured at the HIMSS 2003 Annual Conference last February providing evidence that this may be changing. The Integrating the Healthcare Enterprise (IHE) initiative has created a framework for interoperability that is implemented by 90 percent of radiology vendors and embraced by the Radiological Society of North America. Thirteen poster presentations described IHE implementations at leading healthcare organizations around the world.

Some of the benefits achieved include timesavings and reduction of errors during patient registration, elimination of manual checking of archiving images, ease of retrieval of prior results, ubiquitous availability of images and reports, and reduction of lost studies. Mayo Clinic Jacksonville achieved the goal of establishing an electronic environment that is both filmless and paperless. “Instrumental in the integration was the implementation of Integration Profiles and transactions as defined by IHE,” stated Richard L. Morin, PhD, FACP, Brooks-Hollern Professor at Mayo Medical School. Images are now distributed to physicians throughout the Clinic campus and off-site using PACS workstations. Image management and archiving are now centralized and fully digital.

While the initial success of IHE focused on the radiology department and its workflow, achieving a broader objective will require integration of information systems supporting additional functions, applications, and departments within the healthcare enterprise. Currently in the fifth year of development, IHE is working on both horizontal and vertical development of the initiative.

IT infrastructure planning and technical committees are developing new functionality to support interoperability for Enterprise Master Patient Index, Query/Display, Advanced Security, and Synchronized Patient View — priority areas for horizontal expansion. Recent collaboration with Health Level 7 (HL7) will result in a combined HL7-IHE Interoperability Demonstration at HIMSS 2004. To expand vertical integration, subcom-
mittees are identifying the workflow problems in cardiology, in collaboration with the American College of Cardiology (ACC), Laboratory and Pharmacy domains. It is expected that each clinical domain will have its own requirements driven by the needs of practitioners and patients and by the related vendor community.

The ROI and Value of the EHR

The national Nicholas E. Davies Award program provides several examples of value and return on investment (ROI) of the electronic health record (EHR). This award program, founded in 1994, draws national attention to healthcare provider organizations that have made outstanding progress in the implementation of an EHR. Winning organizations are able to demonstrate significant impact on the system on their quality and cost of healthcare. The program is named after Dr. Nicholas E. Davies, who was a practicing physician, president-elect of the American College of Physicians, and a member of the Institute of Medicine (IOM) Committee on Improving the Patient Record. Dr. Davies was tragically killed in a plane crash in 1991 just as the IOM report on Computer-based Patient Records was being released.

The program was modeled after the Baldrige Award and is intended to bring national attention to the healthcare provider organizations that have made exemplary progress toward implementing an electronic medical record and are able to demonstrate significant impact on the system on their quality and cost of care.

The first recipients of the award were not able to demonstrate ROI in the traditional sense of the word, i.e., a positive effect on the organization’s financial bottom line. Cost was justified to boards of directors as “value enhancing.” Physicians and other healthcare providers were spending less time looking for lost medical records, chart pulls for clinics were significantly decreased due to the availability of electronic records, the number of patients seen without a medical record declined significantly, and multiple paper forms were eliminated.

Recent Davies Award winners cite not only enhanced value, but also are able to positively affect the financial bottom line. Heritage Behavioral Health Center, Decatur, Illinois, built in rules and prompts during the design phase of their system, which sharply reduced the deficiencies in client records, dropping repayments to payers for non-compliant documentation or ineligible services from $49,477 to $7,741 in the first year.

Queens Health Network located in the borough of Queens, New York City, noted tremendous cost reductions with the launch of their “filmless” radiology. A $993,000 savings per year was realized with the installation of a computerized radiology system. The reduction of printing and distributing four copies of each result was reduced. The reduction of printing and distributing paper results accounted for $49,477 to $7,741 in the first year. Queens Health Network located in the borough of Queens, New York City, noted tremendous cost reductions with the launch of their “filmless” radiology. A $993,000 savings per year was realized with the installation of a computerized radiology system. The reduction of printing and distributing four copies of each result was reduced. The reduction of printing and distributing paper results accounted for

Picture Achieving Communication System (PACS) and voice recognition systems. These savings include film, supplies, file room space, personnel services for scheduling, filing, and making appointments and results reporting. This department realized additional savings of $370,200 in transcription costs. The practice of distributing four copies of each result ceased. The reduction of printing and distributing paper results accounted for an additional $20,550 savings per year.

Maimonides Medical Center (MMC) of Brooklyn, New York, realized that any IT investment would need stringent justification. Prior to 1996, technology investments at Maimonides had not provided measurable results, creating the perception that information technology did not offer value. MMC recognized that metrics are key drivers to measure success; an interdisciplinary committee was created for each IT project to identify and benchmark clinical improvements and savings expected from the new technology.

Cumulatively, since 1996, the beginning of their rollout, MMC’s electronic medical record has achieved a 9.4 percent ROI, a 3.84-year payback, and positive net cash flow by year four. Clinical results were equally dramatic: length of stay was reduced from 7.26 to 5.05, medication delivery time from order to patient bedside was reduced from 276 to 88 minutes, and radiology time from order to final report went from 180 hours to 14 hours, a reduction of 92 percent.

Conclusion

The facts are clear. Too many patients are dying each year due to medical errors. Our federal government is demanding action. Now is the time to learn from the successes of others. The Integrating the Healthcare Enterprise initiative sponsored by HIMSS and RSNA is one such success story. Key decision makers in Washington, D.C., are now seeing the value of IHE and its application to improving healthcare. The Davies Award Program also provides examples around the world of success stories. HIMSS Advocacy Initiative is working with both federal and state leaders to educate them on the lessons learned from these success stories so that improvements can be made before more patients have to needlessly die.

About the Authors

Dave Roberts, MPA, FHIMSS, serves as HIMSS Director of Public Policy and staff liaison to both the HIMSS Advocacy Committee and the HIMSS Government Relations Roundtable.

Joyce Sensmeier MS, RN, BC, CPHIMS, serves as the HIMSS Director of Professional Services and staff liaison to the IHE initiative.

Pat Wise, RN, MA, MSN, serves as the Director of the Electronic Health Record Initiative and the staff liaison to the EHR Steering Committee and Davies Award Program.
CONGRATULATIONS

CHP, CHS and CHPS Recipients!

Congratulations to the following individuals who have achieved the Certified in Healthcare Privacy (CHP), Certified in Healthcare Security (CHS) and Certified in Healthcare Privacy and Security (CHPS) credentials from November 13, 2002 through June 30, 2003. The CHP, CHS and CHPS credentials recognize those individuals who have met the eligibility requirements and passed the examination. CHP, CHS and CHPS encourage continued personal and professional growth in the practice of healthcare privacy and security, and provide a national standard of knowledge required for certification. In addition, the credential assists employers, the public, and members of the healthcare profession in the assessment of a healthcare privacy and security professional.

CHP

Richard M. Abell - Overland Park, KS
Christine W. Austin - Bismarck, ND
Monica L. Baggax-tomney - Fitchburg, MA
Patricia A. Beato - Rochester, NY
Sandra K. Berryman - Arlondville, GA
Sheryl J. Blecker - Annapolis, MD
Karen Briscoe - Joliet, IL
Carlos Brown - Pleasant Grove, AL
Diann H. Brown - Kennedale, TX
Linda S. Bugdanowitz - Wichita, KS
Douglas Clarkston - Sterling Heights, MI
Ruth A. Cover - Weeping Water, NE
Ronald M. Cowan - Lewistown, PA
Lisa Fay Cox - Indianapolis, IN
Susan L. Dahl - Sacramento, CA
Londa G. Dahmke - Colfax, WI
Marta D. DeLaTorre - Fresno, CA
Sharon E. Dunham - Geneva, IL
Rose T. Dunn - Saint Louis, MO
Vickie Linn Eliot - Foresthill, CA
Audrey C. Erdmann - Dent, MN
Karen J. Fleming - Boise, ID
Thomas A. Flynn - Hackensack, NJ
Gregory D. Frost - Baton Rouge, LA
Joe Fuchs - Walnut Creek, CA
Michelle S. Fuchs - Great Neck, NY
Chris P. Geraghty - Maplewood, MN
Brenda J. Gramling - Spokane, WA
Judy E. Hagerty-Paglia - New York, NY
Lois E. Hamill - Fountain, CO
Carolyn P. Hartley - Cary, NC
Nancy K. Henry - Goff, KS
Donna S. Hogg - Forsyth, GA
Jean K. Howard - Napa, CA
Gwen H. Hughes-Wright - Belgrade, MT
Susan M. Jackson - Baton Rouge, LA
Melissa H. Jarral - Aiken, SC
Tammy L. Johnson - Mc Arthur, OH
Patricia B. Johnston - Dallas, TX
Elaine P. King - Alpharetta, GA
Michelle D. Kirby - Redding, CA
Edward A. Krasovec - Media, PA
Tina C. Lamb - Midland, GA
Jerylyn K. Lawler - Oradell, NJ

Carolyn M. Maguire - Verona, NJ
Ronald G. Marcum - Portland, OR
Brian L. Mcginnis - Gastonia, NC
Stacey L. McIntosh - Tomball, TX
Judith A. Miller - La Grange, IL
Claire A. Moulden - Westminster, CO
Debra Mussen - Keeseville, NY
Faith M. Neal - Duncansville, PA
Sandra L. Nunn - Albuquerque, NM
Brenda S. Olson - Topeka, KS
Indra D. Osi - Oklahoma City, OK
David G. Parks - Omaha, NE
Warren F. Parlee - Alkinson, NH
Roxanne C. Parrella - Red Hook, NY
Kimberly S. Patton - Rolling Prairie, IN
Peggy A. Presbyla - Cicero, NY
Wendy J. Reynolds - Yorktown, VA
Laurie A. Rinehart-Thompson - Columbus, OH
Kimberly A. Roberts - Fowlerville, MI
April D. Robertson - San Francisco, CA
Elizabeth Rodriguez - Dover, DE
Harry B. Rhodes - Chicago, IL
Michael S. Sager - Sequim, WA
Mary A. Storm - Frankenmuth, MI
Barbara A. Seitz - Homer, AK
Rita R. Silverberg - New York, NY
Christina A. Smith - Ebensburg, PA
Stanley Spack - Daphne, AL
Marie Stangl - New Castle, CO
Michael S. Stearns - Chandler, AZ
Rosalind C. Steiner - Long Beach, CA
Mary A. Storm - Frankenmuth, MI
Tony W. Taylor - Hendersonville, TN
Tricia E. Truscott - Urbana, IL
Mariela T. Twigg - Melairne, IA
Adriana E. van der Graaf - Los Angeles, CA
Dana H. Williams - Keene, NH
Benita Zahn - Woodbury, NJ
Lin Zhang - Palo Alto, CA

Charles E. Butterfield - Alexandria, LA
Jeffrey A. Cash - Cedar Rapids, IA
Sonia DaSilva - Lyndhurst, NJ
Michael S. Dethak - Port Orchard, WA
Linda S. Fletcher - Beech Grove, IN
Stephan A. Giesecke - Olympia, WA
Deborah C. Hawkins - Denver, CO
Ross C. Hughes - Elkridge, MD
Robert F. Jackowick - Kearney, NE
Richard A. King - Fairmont, WV
Paul Merrywell - Fort Smith, AR
Vincent P. Mullford - Fremont, MI
John F. Pascente - Englewood, CO
Guy Paterson - Saskatoon, Saskatchewan, Canada
Alan L. Poe - Bellevue, NE
Michael S. Ruano - Rockton, IL
Daniel Sedano - Fresno, CA
Anis Siddiqy - Branford, CT
Mary Ellen Skeens - Duluth, GA
Kendall R. Stanley - Saugerties, NY
Monica C. Summers - Dallas, TX
George R. Vasquez - Fresno, CA
James R. Wagner - Iowa City, IA
Jon Wunderlich - Walnut Creek, CA

CHS

Bonnie M. Altus - McMinnville, OR
Margaret K. Amata-yakul - Schaumburg, IL
Solomon I. Appavu - Chicago, IL
April E. Barnard - Portland, OR
John H. Daniels - Dayton, OH
George H. Evans - West Columbia, SC
Kane R. Francetic - Moscow, ID
John A. Gildersleeve - Hershey, PA
Joe David Kirby - Durham, NC
Kevin E. Kujawa - San Diego, CA
Gary L. Kurtz - Danville, PA
Edward D. Ricks - Elizabeth City, NC
Richard C. Stansfield - Ormond Beach, FL
J. William Woloszyn - Oklahoma City, OK
Nichole M. Yost - Sand Diego, CA

Join this elite group. Go to www.himss.org to find out more about the certification program.
To see a full listing of certificants go to http://www.himss.org/asp/certification_chs_chps.asp.
THE PHYSICIAN PERSPECTIVE

Life After Go-Live
Part 4: Preventing Error with an EMR

Eric Rose, MD

This column is the last in a four-part series providing observations and insights from the author’s experiences with ambulatory electronic medical record (EMR) implementation. It is intended to provide a glimpse “behind the veil” of an EMR-based care environment, with a particular focus on issues that have hitherto received little attention in the literature.

The Rationale for Decision Support

The causes of medical errors are many (and the subject of considerable controversy). Although poor judgment and lack of knowledge are popularly thought of as the main causes, it is clear from recent research that insufficient access to, or management of, information plays a substantial role.

Numerous studies have shown that physicians often fail to adhere to well-substantiated principles of good medical care (such as prescribing aspirin for patients after a heart attack or avoiding use of beta-blockers in patients with asthma), even though those same physicians are highly familiar with those principles. The nature of human cognition is such that physicians will rarely recall all the standards of care that might apply to a particular patient, especially in a time-limited encounter focused on a particular complaint.

Fortunately, where human brains fall short, computers excel. The automated cross-checking of patient information against formally expressed “rules,” and the provision of feedback to the user of an EMR, is a rapidly developing area in medical informatics. It has been given the rather confusing name of “automated decision support” (DS).

DS tools within an EMR can take many forms. They vary in their degree of intrusiveness — from tools that the user must actively access without any prompting from the software, to “pop-up” style alerts that require some action on the part of the user before the user can return to what he or she was doing. DS tools may be contact-dependent, where the user will only see the alert when he or she accesses a patient’s record, or contact-independent, where the alert is delivered to the provider (e.g., through a virtual “in basket”) regardless of whether the patient’s record is accessed. Many commercial EMRs offer DS tools at various levels of intrusiveness and in contact-dependent and contact-independent forms.

EMR vendors usually leave it to the client institution to program DS tools with the medical “rules” they feel appropriate. However, commercial databases are available for certain types of DS tools, such as databases that drive alerts for drug-drug interactions in EMRs that incorporate medication order entry.

The Challenges of Decision Support

In our organization, we have made extensive use of the DS tools within our EMR. We believe these to be valuable for ensuring high-quality care and preventing medical errors. However, we also find they pose certain challenges.

The most significant problem with DS tools we have encountered is that they add to the information that the provider must deal with (see also the spring issue’s column, “So Good It’s Bad” Information Management”). At best, this slows down the provider; at worst, it distracts him or her from the patient’s immediate problem. Our providers have described a resulting phenomenon, which we term “pop-up fatigue,” where, after receiving a number of alerts on a given patient or on a given day, providers simply stop paying attention to them.

Another difficulty with DS tools is the problem of false-positive alerts, i.e., alerts that appear but, for some reason, do not apply to a particular patient. This might occur, for instance, with an alert suggesting an intervention (like a vaccine), which the patient has received outside our organization. Our EMR allows users to record data on care delivered elsewhere in ways that can be “seen” by its DS components.

It is important to select the rules on which DS tools will be based with great care, and to obtain organizational consensus before turning them on.”

“...”
appropriate section of the patient record. The result, of course, is a false-positive alert the next time the record is accessed. Other causes of false-positive alerts include a patient’s prior informed refusal of a recommended intervention, clinical inappropriateness of a recommended intervention (e.g., routine cholesterol screening for a terminally ill patient), or any situation in which the logical rule driving the alert is not adequate to incorporate all the relevant aspects of the patient’s situation.

The underlying rules driving DS tools require ongoing maintenance. As we implement more and more DS reminders and alerts, this work has grown substantially. One aspect of this involves maintaining the clinical appropriateness of the rules, so that they remain consistent with the most current evidence-based standards of care. In addition, any changes in the standardized terminology systems, which we use for the structured data on which these rules operate (e.g., ICD-9-CM and CPT), must be reviewed, so that pertinent new entries from these terminology systems are incorporated into the DS rules.

For instance, recent updates in CPT added new codes for certain types of hysterectomy procedures. Since we allow our users to make entries on patients’ “surgical history” records using the most current CPT codes, and patients who have had a hysterectomy do not (in general) require pap smears, these new CPT codes had to be added to the list of codes that would prevent the pap smear alert from appearing.

The implementation of DS tools also requires careful attention to organizational politics. It is important to select the rules on which DS tools will be based with great care, and to obtain organizational consensus before turning them on. In our organization, we have used three criteria in this selection process:

• The rule is supported by an unassailable foundation of evidence
• The rule is intended to promote good clinical outcomes (rather than, for instance, cost considerations)
• There exists structured data in the EMR sufficient to support a high level of accuracy in performance of the DS tool (in particular, a low rate of false-positives)

We also take pains to inform our providers as to what patient data drives the application and what the underlying rules are, and to train them in how to interact with the DS tool, e.g., to order the recommended intervention. With this approach, we have seen a high degree of acceptance on the part of our providers.

What Lies Ahead
DS tools, as they exist in most commercial EMRs, are an evolving technology, and will likely grow in flexibility and usefulness. At present, they rarely go beyond a binary indicator (alert applies/does not apply) based on simple Boolean manipulation of structured patient data.

In some cases, linkage to the EMR’s order-entry functionality enables the

THE PHYSICIAN PERSPECTIVE

With a clinical data repository at its core, Oacis helps to streamline workflow and reduce the cost of care delivery.

Over 75,000 clinicians worldwide use the Oacis EMR to provide their patient populations better care.

Need an **EMR** that doctors will actually use

With a clinical data repository at its core, **Oacis** helps to **streamline** workflow and reduce the cost of care delivery.

Over **75,000 clinicians** worldwide use the Oacis EMR to provide their patient populations better care.

**Oacis**

A DINMAR SOLUTION

Contact us – we can help

info@oacis.com 707.658.5100

www.oacis.com

**DINMAR (U.S.), Inc.**

**Need an **EMR** that doctors will actually use**

With a clinical data repository at its core, **Oacis** helps to **streamline** workflow and reduce the cost of care delivery.

Over **75,000 clinicians** worldwide use the Oacis EMR to provide their patient populations better care.

**Oacis**

A DINMAR SOLUTION

Contact us – we can help

info@oacis.com 707.658.5100

www.oacis.com

**DINMAR (U.S.), Inc.**
provider to respond immediately to a DS alert by placing an order for the recommended intervention. Our EMR also enables some user-level customization, such as the ability for providers to adjust the drug-drug interaction warning system so that only warnings above a specified level of “seriousness” appear. A growing trend is for DS tools to be more “transparent,” i.e., to display (or link to) the specific patient data that triggered the alert, the underlying rule, and/or extensive background information, along with the recommended action.

There are several ways that present DS functionality could be enhanced. For instance, broader user-level customization might be useful, e.g., allowing a provider to choose whether he or she receives a particular alert in a contact-dependent or contact-independent context.

In addition, DS tools should provide a simple way, when displaying an alert, for providers to specify that a particular alert does not apply to a particular patient, thus suppressing the alert (either temporarily or permanently, as warranted). There is also a need for DS tools to enable direct feedback from providers to system administrators if they feel an alert is not based on the best available evidence.

Another major advance in DS will hopefully occur with the emergence of systems for standardized representation of clinical practice guidelines. Such systems (GLIF, ProForma, Ashbru, and others) have mushroomed in recent years. They offer the promise of DS tools that will base recommendations not on simple rules, but on an overarching plan of care that, among other subtleties, recognizes complex time relationships between events.

About the Author

Mr. Groper is the President and CEO of DINMAR, a leading North American healthcare IT solutions company. In November 2000, after DINMAR’s successful five-year track record as a certified Oacis implementation partner, it acquired Oacis Healthcare Systems Inc., which included the Oacis EMR product suite.
Ms. Arlotto has strengths in bridging the gap between the business strategies of the organization and the solutions offered by information technology departments and vendors. As a founding partner of Chrysalis Health Strategies, she is combining her extensive experience in strategic planning, organization design, and process transformation with information technology expertise to create a firm with a unique focus on IT value improvement.

She is a past president and fellow of the Healthcare Information and Management Systems Society; a founder and former chairman of the Center for Healthcare Information Management; a board member of the Dumpee Center of Entrepreneurship at Georgia Tech; and a former faculty member in the healthcare informatics program at University of Alabama at Birmingham. She has been featured on National Public Radio and the Wall Street Journal and has co-authored the HIMSS publication Return on Investment: Maximizing the Value of Healthcare Information Technology.

The interview was conducted by Richard D. Lang, EdD, editor, Journal of Healthcare Information Management, and principal, KnowPower, LLC in Glenside, Pennsylvania.

INDUSTRY LEADERS

Pam Arlotto, Healthcare IT Strategist, Shares Insight on the ROI Process and IT

What are the “high impact” critical success factors for organizations that want to do a great job at assessing the ROI of IT investments?

We like to zero in on four major components:

Strategic Alignment — Are the investments aligned with the clinical and business strategies of the organization? Does the organization have a solid prioritization or decision-making model for this?

Customer Relationship Management — Does IT have executive-level sponsorship and buy-in for key initiatives?

IT Internal Processes and Practices — Does IT use best practices in developing its own performance, and do they have a scorecard for tracking desired improvements?

Future Capabilities — Does a future vision exist and is it supported by the right skill sets, applications, infrastructure, etc.?

What are the major barriers or obstacles that hinder effective use of ROI in IT prioritization and justification?

The major barrier is often communications. If the conversation is focused on “technology for technology’s sake,” then goals, expectations, and approaches aren’t shared effectively. This typically includes lack of business thinking on the part of CIOs, and a limited focus on the “big picture.” ROI is achieved when IT enables change or accomplishment of business results. IT leadership must focus on clinical and business strategy, and help executive teams understand how problems can be solved and strategies accomplished through technology.

Are there ROI techniques or processes that seem to provide the greatest leverage?

We have found that ROI is typically calculated at a tactical level (e.g., FTEs saved). Most boards are skeptical of these promises, and would prefer an emphasis at the process/programmatic level. Ultimately, enterprise-level strategies should be the focus of the IT portfolio (key projects grouped to achieve specific strategies). In our book, we cover both the financial analyses (e.g., NPV, IRR, and Payback period) and the intangible benefits. We also focus a great deal of our discussion on hard and soft costs, as well as the risks associated with the project.

How should organizations deal with the ROI questions that surround IT infrastructure, e.g., networks and servers?

If IT investments are rolled into an overall portfolio, and grouped according to business strategies, ROI can be tied to the overall accomplishment of the IT portfolio, not just individual infrastructure projects. Certain investments, like desktop refresh, can be treated as routine property plant and equipment — just like beds on a nursing unit.

How can organizations “quantify” IT investments that typically yield intangible benefits, e.g., clinical systems?

Process metrics are useful in identifying intangible benefits. In addition, focus groups, Delphi techniques, and other quantification methodologies are useful. Strategic benefits that are often available but challenging to quantify include brand advantage, competitive advantage, improved management information, “catch-up” to standard practice, and improved stakeholder satisfaction. We rarely find anything so “soft” that it refuses to be quantified.

What is a reasonable time frame for an ROI — 3 years, 5, 7? Why?

Many institutions already have prescribed time frames or “hurdle rates” in place. If you use measures such as
IRR, NPV, and Payback to quantify ROI, the appropriate number of years should appear obvious. Given the rapidity with which healthcare changes, coupled with the change in HIT, a seven year (or even a five year) time frame may be excessive, as technology and the environment may both be obsolete. What is more important is that the IT ROI time frames correspond with those for other strategic capital investments (e.g., new program development), so that all can be compared on the same “level playing field.” The underlying (or hurdle) payback period may be different, but the difference should correspond to the fluidity of the underlying business environment for that particular investment opportunity.

What can a CIO do to hold departments accountable for delivering forecasted savings and improvements in the ROI?

Ultimately, it isn’t the CIO’s job to hold other organizations accountable. The key lies in joint development of a “Life Cycle Success Plan” for integrating process, technology, organization design, and change management throughout the life cycle of the project. It is essential that you plan not only for one-time costs associated with the acquisition and implementation of the project, but that you plan for ongoing operations that will maximize the benefits you hope to gain.

In your opinion, who is the best person to present the ROI for a major IT investment to senior management: (1) the CIO, or (2) the project sponsor/business unit executive?

In order to achieve and maintain credibility, IT must entrust the project “sale” to user departments and, more importantly, the executive sponsors for projects. Clearly, the message that a member of the senior management team endorses and sees a particular IT investment as “mission critical” is a far more compelling argument than the CIO presenting his/her shopping list. Of course, the CIO should have the proper prioritization process in place to ensure that only those investments that are critical to the overall portfolio and impact the strategic plan are presented.

Other comments on ROI?

Traditionally, return on investment analysis for healthcare information technology has been conducted to justify commitment of operating and capital funds as part of the annual budgeting process conducted by many hospitals and health systems, or to substantiate expenditures during the year. As many know, these “best guess” analyses often include some padding for the inevitable negotiation to streamline initial requests and are driven by IT’s “wish list” of new acquisitions.

“W e rarely find anything so ‘soft’ that it refuses to be quantified.”

“wish list” of new acquisitions.

During recent years, the financial outlook for many not-for-profit health systems has become grim. Challenged with lower margins, many organizations have implemented aggressive revenue, cash, and expense management initiatives. At a time when the demand for capital is high, many health systems are finding it difficult to borrow. According to Standard & Poor’s over 40 percent of U.S. hospitals have credit ratings below A — the standard for reasonable borrowing rates.

In order to be deemed credit worthy, many healthcare systems will have to redesign their approaches to managing operations and capital. A new culture of financial discipline will be essential — one more similar to that of corporate America. Since information technology accounts for one quarter to one third of the capital budgets, it will be crucial to redesign the way IT “justifies” its annual funding.

Health systems are developing new tools to balance required profitability, cash, debt, and capital spending. In this environment, we propose that IT move from documenting ROI for individual applications and projects to a portfolio management model that evaluates the value of initiatives as they support the strategic and financial priorities of the organization. We define value as the degree of change in the business as compared to the investment required to accomplish the change.

Rather than proposing a separate budget for IT, we suggest that strategic initiatives, as driven by the organization’s strategic and financial plans, drive prioritization of IT initiatives. Within each initiative, the component projects or applications should be identified and analyzed. For example, one client we worked with identified CPOE as a key initiative to support the business initiative of medical error reduction. The overall business strategy was directed by the executive sponsor, or chief medical officer. The chief information officer and her staff worked to identify the complete portfolio of projects that enable CPOE. A more complex model is required to calculate the specific tangible and intangible costs and benefits of the complete portfolio of technology initiatives as they support the business strategies of the organization. We suggest calculations of NPV, Risk-Adjusted NPV, IRR, and Cash Flow Analyses as critical components. In addition, we work with our clients to move beyond “best guess” estimates to conduct simulation analyses to improve their ability to manage uncertainty and the risks associated with these investments. We work under the parameters of the financial strategy to identify specific hurdle rates and payback periods.
Finding Value from IT Investments: Exploring the Elusive ROI in Healthcare

Abstract

This article explores the historical IT value research, discusses its applicability to IT investments in healthcare, and highlights how it is challenged by several factors unique to the healthcare industry. The integration of historical IT value research with healthcare industry attributes provides an important context for understanding why the IT value proposition in healthcare has been so elusive. The article also poses a set of guidelines, which, based on the IT value research outside of healthcare, may assist in alleviating some of the current frustration with determining the value of healthcare IT investments.

Lynn H. Vogel, PhD

There is much about healthcare that is unique. As Jeff Goldsmith has observed: Healthcare services are not only the prototypical knowledge business, but also are perhaps the most complex product of our economy. More variability and uncertainty at the point of service exists in healthcare than in any other service in our economy.1 With such “variability and uncertainty” in the healthcare business, it is not surprising that identifying a return on investment (ROI) from healthcare IT presents special challenges. Whether labeled as the search for an ROI, “benefits realization,” or “benefit/cost analysis,” the task is essentially similar: we need to understand better where we can identify and measure the value from our information technology investments.

Keywords

Value Return on investment (ROI) Healthcare IT investments
In recent years the combination of new types of IT investments (e.g., computerized physician order entry) and increasingly constrained sources of revenue (e.g., the Balanced Budget Act) have conspired to place information technology investments under a scrutiny they have historically avoided. While the Y2K phenomenon and what many have regarded retrospectively as its excessive IT spending certainly accelerated the process, the search for returns from IT investments has become an ongoing and inescapable challenge. But we need to differentiate what is “uniquely healthcare” and what is inherent in the nature of IT itself that makes valuation difficult.

The search for business value from IT investments is not new, and in fact has been an ongoing preoccupation of economic and management research outside of healthcare for almost a half century — at the macroeconomic level, across industries, and, more recently, at the level of the individual firm. Many recent discussions about ROI for healthcare IT have typically ignored this historical context and often conclude that finding value from healthcare IT investments is uniquely difficult and frustrating, without discussing why this might be the case, or what to do about it. Placing healthcare ROI discussions within the context of the historical search for IT value can minimize this frustration and hopefully enable us to develop a more fruitful approach to healthcare IT investments generally.

**Brief Overview of Historical IT Investments in Healthcare**

Investments in information technology in healthcare can be characterized by a series of phases, beginning in the 1960s with investments in financial systems — billing, general ledger, and payroll — which support the organization’s financial accounting and reporting. During this phase, IT investments were generally viewed as substitutions for labor costs, a fairly common initial stage for IT investments in a number of industries. Determining the value of these types of investments was clear and straightforward: if investing a dollar in information technology permits one to save more than a dollar in labor costs (e.g., through the elimination of clerical positions), then the investment is deemed to be “worth it.” The value to the organization stems from the fact that the financial resources invested in IT generated a return in the form of labor cost savings that were greater than the initial investment.

A second phase, starting in the late 1960s and carrying over into the 1970s, saw major initiatives by clinical departments to invest in systems that supported their internal activities — departmental systems for radiology, clinical laboratories, and pharmacy are important examples here. While the substitution of IT for labor continued to be important, the primary emphasis shifted to more efficient processing of patients and specimens, extending the ability of technical and professional staff to work more efficiently and effectively, and the ability to more easily generate clinical and management reports from data that was increasingly stored electronically.

Management reports were particularly important, since at that time hospitals were reimbursed for the services they provided on the basis of their costs. Departmental systems, with their ability to capture charges that were then sent to billing systems, produced the data that, through standardized “cost to charge ratios,” could generate the required cost reports.

In response to the shift in financial risk from payers to providers that occurred with introduction of DRGs, per diem reimbursement, and managed care in the 1980s, financial systems again became prominent with major investments in cost accounting and materials management systems. It was apparent that simply adding to the labor pool would not meet the challenge of developing and generating reports on the cost of doing business nor meet the task of managing expanding supply inventories.

In this second phase, information technology investments became mechanisms to permit the organization to engage in activities that it simply could not do by relying on staff with paper, pencils, or even calculators. Healthcare organizations had by this point passed from a simple labor substitution model into a model that focused more on enhancing the productivity of the labor force and on generating more accurate and focused data on the costs of doing business.

Entering the 1990s, attention turned to enterprise-wide clinical systems, including clinical data repositories and visions of a fully computerized electronic patient medical record. In this third phase, healthcare provider organizations were now challenged to make IT investments that were no longer labor substitution mechanisms, nor even primarily productivity enhancements for their employees. Rather, the focus became efforts to improve the quality of the product being delivered — attempting to meet goals of higher patient and provider satisfaction, increasing the safety of patient care, and reducing the risk and the cost of liability for medical errors. The end of the decade was highlighted by the publication of The Institute of Medicine’s
landmark report, *To Err Is Human*, which contained a number of references to the need for information technology investments to meet these new goals.

Each successive phase of IT investment in healthcare has produced both greater expectations and more complex systems environments into which IT investments are being made — probably none more so that the current phase with its potential (and real) impact on the provision of clinical care. With the added complication of significantly reduced reimbursement for care from both public and private payers, the pressure on healthcare industry managers to justify their information technology investments has increased significantly.

In comparison to other investments that healthcare leaders make, such as new facilities and medical equipment, the questions about which information technology to purchase and implement seem particularly challenging. New and remodeled buildings bring almost immediate results — more capacity to deliver more care to more patients, higher satisfaction from physicians and patients because of “updated” or “more modern” facilities, and even the possibility of a greater revenue stream from more or new types of patient services or perhaps rental income. The “value” of these investments is relatively clear, even if the measurement of the value accruing specifically to the investing organization is not.

“Value” in these examples is quite simply the justification for expending the resources. In the healthcare industry, the value that is returned from an investment can be described as supporting the attainment of at least two basic goals:

- To help sick people get well and minimize the possibility that well people will get sick
- To accomplish the first goal in a manner that sustains the organizational contexts through which the objectives of that first goal are carried out (e.g., hospitals, physician practices, long-term care facilities, etc.)

These goals are certainly much less measurable than the goals that exist in other industries, namely financial profits and returns to shareholders. Nevertheless, in most cases the value from investments made by healthcare managers can be described primarily in terms of these two goals.

To the extent that investments in information technology support the attainment of these goals, then we can say that these investments return value to the healthcare organization. But the measurement of information technology’s contribution to the attainment of these goals is elusive, in part because there are at least three different basic measures or “return on investment” measures that are commonly used in financial models to determine value:

- Will this investment generate specific and direct reductions in labor cost or increases in revenue for the organization? (Phase 1 Investments)
- Will this investment result in an increase in the productivity of the organization’s labor pool, which may either enable the organization to perform the same amount of work with less labor or, to avoid future cost increases, enable a constant level of staff to perform a larger volume or more complex tasks? Further, will this investment enable the organization to generate more accurate and timely management reports? (Phase 2 Investments)
- Will this investment result in an improvement in the quality of the product or service being offered, an increase in the satisfaction of the organization’s constituents (either internal, such as employees, or external, such as customers) or a reduction in the liability or risk of producing a defective product or service (the “error reduction” strategy)? (Phase 3 Investments)

Figure 1 provides a graphical representation of these different types of investments and the relative ease with which the return on investment can be measured.

The measurement of information technology’s value within each of these phases has been systematically explored outside of healthcare, as other industries have experienced similar IT investment phases as well as similar pressures to measure the value of their IT investments. A brief review of each of these measures of value provides an important perspective on those facing these challenges within healthcare. However, it is important to look at information technology investments more generally first, since IT investments create an organizational asset that is, in some ways, fundamentally different from the assets created by other types of investment.

**IT Investments Create a Different Kind of Asset**

Firms in every industry make investments to create assets, which in turn generate revenue streams back to the firm, enabling it not only to sustain itself, but hopefully to grow and to provide financial returns to owners or shareholders. Firms in the healthcare industry are no exception to this process. Hospitals, long-term care organizations, physicians (whether incorporated as individual entrepreneurs or as groups) each seek to make investments, which will maintain revenue streams and sustain their organizations over time.
When this process creates new facilities, adds equipment, or substitutes computer hardware and software for manual processes, the value generated is relatively clear and easy to understand. But when an organization invests in information technology to enhance quality or convenience, the value is more difficult not only to identify, but to measure as well. In large part this is due to the fact that investments in information technology create an asset that is truly different from other assets (e.g., buildings and equipment) that organizations have traditionally created and understood.

Moody and Walsh, in their exploration of the value of information, developed a set of general principles that govern the behavior of information as an “economic good,” and in fact distinguish information assets from other more traditional types of assets. Their approach is particularly helpful to our discussion of IT valuation in healthcare since it highlights why comparing the value from information technology investments with the value of other investments is difficult — in any industry. And since these IT assets are different in important ways, determining returns from IT investments can be a more elusive process. Two of Moody and Walsh’s more important principles, with particular relevance to healthcare, are:

- Information is (infinitely) sharable, in that “it can be shared between any number of people . . . without consequent loss of value to each party.” Most assets lose value when shared among several parties, since the total value of the asset is allocated in some proportion to each party.
- The value of information increases with use, in contrast to most assets, which actually exhibit “decreasing returns to use,” i.e., they decrease in value the more they are used. The depreciation of buildings, for example, is the accounting mechanism designed to capture this decrease in value.

Within the healthcare industry, much of the motivation for electronic databases or medical records for clinical data resides in the fact that paper records simply cannot be shared easily among the increasing numbers of people who appropriately need to see and use the data. Information technology investments enable an increase in the availability of medical records to multiple users, and therefore enhance their value for diagnosis, treatment, and in some cases, research. This virtually infinite “sharability” of electronic medical records is a key component of the value that information technology brings to healthcare.

On the other hand, as Moody and Walsh note, information assets do behave in at least two ways that make them similar to other organizational assets:

- Information is perishable in that its value tends to decrease over time; information on recent events, for example, is typically more valuable than that which relates to events in the distant past — except of course for historians.
- The value of one set of information increases when combined with other sets of information, since comparisons and combinations of information can provide insights that a single set of information, viewed on its own, cannot.

Information in the healthcare industry exhibits these principles to a great extent. Recent clinical information on a patient is generally more valuable in determining the state of the patient’s health than information that is several years old, except in situations in which the physician is looking for historical comparisons or patterns. In addition, clinical data from individual patients can be combined in various
FOCUS: RETURN ON INVESTMENT

ways to enhance its value. For example, we can learn more about diseases by grouping patients by type (inpatient vs. outpatient), location, and diagnosis (if interested in patterns for particular types of illness), type of medications prescribed, and in relation to diagnosis, treatment protocols, and outcomes, differentials among physicians in terms of therapeutic interventions for similar diagnoses, and so on.

To Moody and Walsh's work, however, we would add one other principle that is perhaps unique to healthcare information technology, particularly with regard to individual clinical data. In most industries, investments are intended to create assets that are controlled by the organization. Control in this context means "the capability of the organization to benefit from the asset, to deny or regulate the access of others to that benefit." In organizations outside of healthcare, this test of information as an asset is usually met. Organizations create databases on themselves, their employees, their operations, their customers, and their competition that is considered proprietary to the organization itself.

However, healthcare is different in that clinical data collected by healthcare organizations, for example, does not legally belong to the organization. As clinical data collection, storage, and use become a primary focus of healthcare IT investment, this "lack of control" becomes a complicating factor in our assessments of value. In this case, information technology investments are creating assets that do not belong to the organization that made the initial investment, so the value of the investment to some extent resides outside the organizational boundaries. This is truly at variance with how financial professionals typically think about asset creation.

In summary, information technology assets are infinitely sharable, increase in value with use, decrease in value over time, increase when multiple data sets can be combined, and increasingly contain content that is owned by someone other than the organization that created the asset. With these principles in mind, we next turn to a review of the important contributions of IT valuation outside of healthcare.

IT Valuation Outside of Healthcare

From Thomas J. Watson’s now famous comment in the late 1940s in which he projected that it was likely that he could only sell "3 or 4 computers," to Robert Solow’s observation that "we see computers everywhere except in the productivity statistics," — a comment that became known as the “productivity paradox” — many notable businessmen, economists, and others have wondered about the value of making investments in computers or in information technology more broadly.

The phases of IT investment that we identified earlier for healthcare IT investments, from labor substitution to productivity improvements to enhancements in product quality and service, parallel the types and sequence of IT investments made in other industries. While labor substitution has been of historical interest, some of the most extensive work in IT valuation has been done in productivity assessments.

This is due to the historical assumption that the real rationale behind IT investments has generally been the desire to improve productivity, which over the longer run is a major contributor to economic growth.

Phase 1 Investments: The Substitution of Information Technology for Labor. In the earliest stages of information technology investments, the most common type of investment is one which substitutes computing capability for manual labor.

Most industries, including healthcare, have followed this model. A number of routine activities, including the processing of transactions (e.g., patient bills), and the storing and retrieving of data, can be performed using electronic technology and, in the process, literally replace large numbers of file and accounting clerks.

While most organizations have already passed through this phase of IT investment, healthcare is still finding opportunities for labor substitution in areas such as clinical laboratories (with the introduction of robotics systems that substitute for medical technicians) and will probably do so in the future as imaging systems replace both medical records clerks and film file libraries.

Of all types of IT investments, measuring the value of those that substitute IT for labor is probably easiest and best understood.

Phase 2 Investments: Enhancement of Labor Productivity. In the 1980s and early 1990s, economists became interested in the potential contributions of information technology investment to labor productivity. This was due in large measure to two observations: (1) A decrease in the average rate of growth in U.S. labor productivity beginning in the early 1970s, and (2) An increasing awareness that companies were beginning to make significant investments in information technology, especially with IBM’s introduction of its desktop personal computer in 1981.
Economists observed that the growth in U.S. labor productivity averaged almost 5 percent per year over the entire period from the end of World War II until the early 1970s. At that point, however, productivity across the U.S. economy began to stagnate, averaging about 1.4 percent per year. During the period 1974-1995, economists determined that productivity growth was only increasing at an average rate of 1.4 percent per year, rebounding somewhat to an average rate of 2.5 percent between 1996 and 2000.20

In the same general time frame, as noted in recent research by McKinsey and Company, “the rate of nominal business investment in information technology surged to 17 percent per year, from its 1987-1995 rate of 9 percent.”21 From this data, it was assumed that even with new and increasing investments in information technology, for some unexplained reason productivity was not only not keeping pace, but had actually decreased from previous levels — hence Solow’s “productivity paradox.” Measuring productivity increases due to IT investment, however, is much more difficult than measuring IT investment as a substitute for labor dollars. We are no longer a manufacturing-based economy, and measurement tools developed in and applicable to that era are simply not adequate for measuring productivity in a services-based information world.

But with the surge in IT spending and the economy-wide productivity rebound after 1995, there was hope that the paradox had been resolved and that at last economists could conclude that IT investment was in fact contributing to productivity. As one economist noted:

Analysis of the industry-level data reveals that a broad productivity resurgence took place after 1995, with all principal sectors and a majority of industries posting productivity gains. The analysis also shows that the industries experiencing the largest productivity acceleration in the late 1990s were the producers and most intensive users of IT — a finding that provides direct evidence of information technology’s role in the U.S. productivity revival.22

Other research has supported these conclusions and emphasized the importance of understanding both the lag effects of IT technology investment and the importance of adapting organizational workflow to take advantage of IT investments.23

Simply investing in IT does not on its own, however, produce gains in employee productivity. Other “intervening” factors seemed to be operating that were difficult to identify from strictly quantitative data. While McKinsey’s research confirmed the contribution of IT investment to productivity, they identified another important contributor to value IT investment value:

In short, IT does matter, but its ability to impact productivity depends upon how it is employed. When tailored to sector-specific business processes, deployed in an appropriate sequence, and co-evolved with managerial innovation, its impact on productivity and, in some cases, profitability, can be large.24

Simply making an investment in IT, therefore, is not sufficient to achieve value. Organizations must change their underlying business processes in order to see gains not only in productivity, but also in their IT investments in general. IT investment therefore serves as an “enabler” for value, but on its own cannot be expected to create the kind of value that can come from combining it with changes in an organization’s underlying business processes.

Phase 3 Investments: IT Investments to Improve Quality of Service and Product. In addition to the realization that the value generated by IT investments is really obtained when IT is viewed as an “enabler,” we are also realizing that the measurement of this value is very difficult. As Brynjolfsson and Hitt have noted, “In today’s economy, value depends increasingly on product quality, timeliness, customization, convenience, variety, and other intangibles.”25 IT investments in general, across industries (but particularly in the services industries), have a difficult time with value measurement due to their dual nature of being “enabling” and attempting to measure an impact on “quality, timeliness, customization, etc.” — each of which can represent a new dimension to either current or new products or services.

In part this is due to the fact that information technology investments are part of a broad category of investments economists have called “general purpose technologies,” technologies whose value comes not directly from the investment itself, but instead from opening up “new opportunities”26 and from facilitating “complementary innovations.”27 In many cases, when we think we can recognize the presence or absence of these “intangibles,” we generally consider them to be valuable attributes, and even recognize that IT investments can enable them to occur. But it is also evident that, in this third phase, the dynamics of value and measurement are very different from the previous phases.

While investments made in Internet tools and capabilities (e.g., the proliferation of hospital and payer web sites and patient and health-focused portals) are considered by some as almost revolutionary, what is most interesting about Internet investments is their role as yet another IT “enabler,” albeit one that can potentially have an impact spreading across all three IT value dimensions:

- As labor substitute, as when patients or plan members utilize a web site or a personal portal to access either their own or the organization’s data, thus diminishing the
need for staff to answer phone calls or letters.

- As productivity enhancement, providing physicians with remote access to patient data, or having patients enter demographic or financial data prior to a visit.
- As an enabler, improving the “quality, timeliness, customization, convenience, variety” of healthcare products and services by providing web-based access to schedules, health information, and even one’s own personal health-related data.

As if the difficulties of measuring the value from IT investments regardless of industry were not sufficiently challenging, we next turn to a set of attributes unique to the healthcare industry that add even more complexity to the process.

Healthcare Industry Attributes That Challenge IT Valuation

The valuation of IT in the healthcare industry is confronted by two significant attributes that distinguish it from other industries: (1) the industry’s historical structure and governance process, and (2) the mechanisms through which customers pay for services.

Organizational Structure and Governance. In the corporate world generally, those who decide what products and services to produce and deliver, those who actually manage the production and/or delivery process, and those who market the products and services typically work within the same corporate structure. Over 20 years ago, Michael Porter described this set of processes as a “value chain,” in which each step of the process from the acquisition of raw materials to the final production and distribution is carried out within the same governance structure. Even when a corporation decides to outsource some portion of its value chain, presumably to add value to a particular part of the chain, the decisions about what is produced, who is to produce it, how it is marketed, and how it is to be distributed remain within a single governance structure.

The healthcare industry, however, is fundamentally different. Using Porter’s value chain approach, it is evident that significant portions of healthcare’s value chain are provided by fundamentally different governance structures whose interrelationships and financial incentives seem strangely out of sync. Figure 2 illustrates those four structures:

1. a provider facility with its staff of caregivers,
2. physicians,
3. the payer(s), and
4. the patient (not strictly a “governance structure,” but distinguished clearly as an entity separate from the other three).

Each of the three major governance structures (facilities, physicians, and payers) has distinct histories and cultures that have shaped not only their role within healthcare’s “value chain,” but more significantly their historical sense of independence from each other. Indeed efforts in recent years to merge these entities under one form of corporate structure or another (e.g., hospitals purchasing physician practices, hospitals becoming payers, and payers employing physicians) have, with few exceptions, been singularly unsuccessful.

In no other industry does one find a value chain in which the major components are both necessarily integrated to produce the final product or service, yet separate organizationally, culturally, and even in terms of financial incentives. In healthcare, those with the expertise to deliver the industry’s product or service are separated from the setting(s) in which the product or service is typically delivered and are, in turn, separate from those who purchase the product or service, and finally, separate as well from those who pay for the service.

Paying for Healthcare Services. In most economic transactions, the customer who receives the benefit of the goods and/or services purchased is expected to provide payment for receiving them. Whether purchasing a car, a house, a piece of furniture, or toothpaste, the basic model...
underlying the economic transaction is the same. In healthcare, however, the basic economic model underlying the payment for care is fundamentally different, with a “third party” reimbursement structure that is unparalleled in any other industry.

Nowhere else do customers receive high-quality service for which they pay only a marginal portion of the cost (through copays and deductibles). The current reimbursement structure linking payers, providers (both physicians and hospitals), and patients (see figure 2) permits those who receive the value of IT investments (particularly improvements in the quality of service) to avoid in large measure making any direct payments for those benefits.

Another challenge beyond value measurement is the fact that many times the value of improved service and product quality, which might be enabled by IT investments, does not in healthcare accrue to the investing organization. In most industries, companies seek to recoup their investment through price differentiation. In other words, if a company makes an IT investment that enables an improved product or service, they would expect to charge a higher price than the competition and, in this way, recognize the value of their investment.

The problem in healthcare is that, while IT investments may improve the quality of products or services, the value accrues not to the investing organization (e.g., a hospital) but to the patient (who in many cases is only paying a marginal amount for the service) or to the payer organization (who might see shorter patient stays, fewer illnesses to pay for, etc.). Using the model from a recent report on the business case for healthcare quality, we can conclude that, while there is a social and economic rationale for making IT investments to improve the quality of healthcare services or products, the business case, using customary ROI methodologies, is not only more difficult, but may in fact be impossible to make. As the study notes, “It is striking that in all cases where the investing organization is a provider, and even when the innovation is effective for patient care, the business case is unfavorable.” If we cannot make a business case for improvements in the quality of care provided by a provider organization, it will surely be difficult to make the business case for making IT investments intended to achieve that same objective.

Guidelines for IT Decision Makers in Healthcare

Decision makers in the healthcare industry face difficult choices when confronted with the myriad of investment opportunities presented by operations managers, physicians, nurses, IT professionals, finance professionals, and even board members. In the absence of sufficient funding to make every investment (and there seldom is), decision makers look to “rules of thumb” or summary measures in their attempts to sort out the best investments from the simply better investments, never mind the bad ones. Return on investment (ROI) calculations can provide a convenient, common denominator for comparing investment opportunities—provided the returns can be quantified, the investment resources fully estimated, and even the investments themselves amenable to comparison in similar terms.

The conclusions we draw from our research help us understand why such ROI efforts in healthcare have to date been so elusive:

1. Information technology investments produce assets that are fundamentally different from other types of assets.
2. The nature of the investments themselves, particularly as Phase 3 investments, focusing primarily on improvements in service and product quality and customer satisfaction, are more complex and their value therefore less measurable that what hospitals have been able to do in earlier phases.
3. The valuation of “Phase 3” IT investments even outside of healthcare is also challenging due to the nature of the investment itself, unrelated to the particular industry in which the investment is being made.
4. The organization, structure, and payment mechanisms currently in place in the healthcare industry add even more complexity to the valuation of IT investments.

With these conclusions in mind, we have developed a set of guidelines to aid not only in the education of the decision makers about information technology investments, but to assist in the process of comparing IT investment opportunities.

1. Recognize information technology investments as “general purpose technologies,” in which the investment itself must be complemented by changes in organizational processes in order to deliver the greatest value.
2. Recognize that, even though investments in information technology create new assets for the organization, the nature of the IT asset is fundamentally different from most other assets organizations invest in, and we need to adjust our investment thinking to account for these differences.
3. Recognize that, under the current reimbursement process, the benefits of information technology investments in healthcare do not accrue only, or in some cases even significantly, to the entity that makes the investments. If physicians, patients, and payers benefit from these investments, we need a mechanism for them to contribute to the investment at the outset or subsequently through different reimbursement or payment models.
4. It is not that you cannot find or calculate a return from an IT investment that is most important; it is that these...
types of investments have clear and definable value and that the terms of that value must be understood in the context of how IT investments create value more generally (even outside of healthcare), and the unique challenges of finding this value are not only the province of the healthcare industry, but of other industries seeking value from similar types of IT investments.

About the Author
Lynn Harold Vogel, PhD, (lynn.vogel@healthlinkinc.com) is vice president, Healthlink, Inc., Houston, Texas, and also serves as adjunct assistant professor, Department of Biomedical Informatics, Columbia University, New York.

References
7At one time, these goals were thought to be the only acceptable goals in the industry, since much of the care provided was done within the context of nonprofit organizations (e.g., hospitals). Although individual physicians and nursing homes were early adopters of for-profit models, only in recent years has the for-profit model been extended to hospitals.
9See reference 8, p. 4.
10See reference 8, p. 5.
11See reference 8, p. 6.
12See reference 8, p. 8.
13See reference 8, p. 5.
14While patients do sign waivers to permit their data to be shared with payers, for example, their clinical data residing in providers’ databases remains under the patient’s legal control. Recent HIPAA regulations have in reinforced the sense of a patient’s ownership over his/her medical records.
16See reference 4.
17As noted in Steindel, C., and Stiroh, K. J. “Productivity: What Is It, and Why Do We Care About It?” Federal Reserve Bank of New York Research Paper, April 12, 2001, “If labor productivity were to grow at 1.5% (the average rate from 1973 to 1995), output per hour would rise by 35% after 20 years. Growth of 2.7% (the average for 1995-1999) implies that it would be 70% higher after 20 years. Clearly, the rate of productivity growth can have an enormous effect on real output and living standards . . . and can serve as a good proxy for growth in per capita income and rising living standards.” p. 1.
18See reference 4.
21See reference 20.
22See reference 19.
23For an excellent summary of this issue, see Brynjolfsson, E., and Hitt, L. M. “Beyond the Productivity Paradox: Computers are the Catalyst for Bigger Change.” Communications of the ACM, August 1998, 41, 8.
25See reference 23.
WHO’S COUNTING NOW? ROI FOR PATIENT SAFETY IT INITIATIVES

ABSTRACT

The impact and expectation of cost-justifying patient safety IT initiatives using a traditional ROI must evolve to focus beyond the financial benefit. It must encompass overall patient safety, patient satisfaction, and employee and physician satisfaction benefit categories. Computerized physician order entry (CPOE) and bar code medication administration (BCMA) systems are two particular clinical point-of-care products that will play a key role in addressing patient safety objectives. Integrating the two technologies can bring both financial and clinical benefits.

Lucy Mancini Newell, MBA, and Doug Christensen, RN

In February 2003, the 14th Annual HIMSS Leadership Survey indicated that information technology (IT) executives increasingly believe that information technology must be implemented to reduce medical errors and promote patient safety. Given this trend, and the continued, intense pressure to reduce costs, improve operations, and justify large capital expenditures, what are the implications for developing and documenting an appropriate return on investment (ROI) approach?

Does this positively or negatively impact the cost-justification of any and all clinical and/or patient safety initiatives through traditional ROI methods? Has the focus truly changed, or has it simply been reinterpreted in our current, healthcare IT climate?

We believe that, not only has the focus and impact changed, the expectation that patient safety IT initiatives must have their cost justification evolve its focus beyond a solely financially based benefits model (i.e., traditional ROI model and analysis) toward a comprehensive ROI model has also changed.

This new model must encompass a variety of measurable elements that will parallel the areas of improvement and have an impact that will be realized when deploying a patient safety initiative. These elements include, but are not

KEYWORDS

Return on investment (ROI)  Computerized physician order entry (CPOE)  Bar code medication administration (BCMA)
limited to, overall patient safety impact, clinical outcomes, physician and clinician satisfaction, patient satisfaction, etc. In other words, the benefits realization model that will be reflected in a tailored ROI model will be far more comprehensive and broad than comparable IT initiatives to date, and the final outcome will be influenced by many factors including strategy, selection and implementation sequencing, and ultimately physician and clinician competency and compliance.

Because new patient safety initiatives are far reaching and impact a variety of healthcare professionals who will now automate their patient care workflow processes, technology selection strategies will be more tightly coupled to an ROI approach than ever before. We know today that the task for identifying the best possible avenue to pursue clinical IT initiatives has not gotten any simpler; it’s become more complex.

Computerized physician order entry (CPOE) and bar code medication administration (BCMA) systems are two clinical point-of-care products that will play a key role in addressing patient safety objectives, but they typically come at a high cost. Each product is specifically focused to improve a segment of the patient care delivery process. One without the other, however, will not ensure the ultimate financial and clinical benefits that would be achieved by integrating the products.

Industry Perspective

Patient safety initiatives, both operational and IT, have been at the forefront of consideration by large and small healthcare systems. How best to define patient safety measures for an organization based on its current operational and IT environment is the single greatest challenge.

The identification of all patient safety initiatives, will lead executive, medical, and clinical decision makers to find the best path to implement these solutions. Unlike other types of initiatives, patient safety solutions do not actually “plug and play” like other niche clinical products. Rather, there is a level of complexity in translating the requirements for an automated patient safety solution and the actual model that represents how the implemented solution will integrate and co-exist with other existing strategies for technology and systems.

In the hope of swiftly yielding a dramatic and tangible patient safety impact, the greatest area of attention and focus has been on two specific IT initiatives: CPOE and BCMA systems. While we recognize that there are still great strides that can be achieved even in a clinical environment that is primarily manual, we acknowledge that the industry’s discussions and attention are firmly fixed on technology as the self-evident approach to delivering the desired level of patient safety to mitigate any existing risks in the delivery of patient care.

Roadmap to Patient Safety Technology Initiatives: Where Do We Start?

1. Definition of patient safety
2. Identification of the types of initiatives that deliver patient safety outcomes
3. Validation of the patient safety initiatives that have been identified either at a strategic organizational level (annual and five-year strategic business plan), or at a constituency level (medical and clinical staff across specialties and services)
4. Confirmation as to whether the desired patient safety initiative is achieved via workflow redesign, information technology (one or several components), or a combination of the two
5. Mapping of desired patient safety initiative(s) to existing IT strategic plan
6. Determining the order of magnitude of the actual impact to implement the identified patient safety initiative (there may be more than meets the eye; an initiative may require a fairly extensive number of tasks to be planned for and completed across multiple-disciplines)

Historical perspective of meeting patient safety needs with and without technology: To date, healthcare organizations have focused on a variety of operational and, to some degree, IT methods to achieve patient safety benefits. Some of these methods include, but are not limited to the following:

- Clinical documentation standardization
- Competency testing
- Unit-dose medication packaging and dispensing
- Limited bar coding within pharmacy
- Traditional quality control and improvement initiatives within each department to improve policies and procedures

Until the Institute of Medicine Study in 1999 and the advent of The Leapfrog Group, IT was not considered a significant patient safety tool. Over the past decade, healthcare IT has continued to evolve to further encourage some level of adoption that would promote automation in clinical areas. Steady and incremental progress has been made in software application development (e.g., web-enabled, point-and-click, touch, etc.), end-user devices (e.g., laptop, tablet PC, PDA, etc.), intelligent medication-dispensing machines, embedded workflow engines within applications, and advancements in wireless communications and standards. All of these technology initiatives have made the overall use of technology as a patient safety enabler more of a reality.

While progress continues to be evident by the growing adoption rates of these technologies, there has been a continuous challenge to secure universal acceptance and widespread usage of CPOE for several decades. Issues regarding technology and user device limitations and the lack of an
intuitive, interactive presentation layer, knowledge databases, clinical decision support, and workflow engines have stymied the level of physician commitment and acceptance to early and current products. Beyond the adoption rate of CPOE is also the raw, economic reality of investing in this type of initiative to yield only a limited number of users based on the total number of potential physician users per healthcare organizations. So while strides are being made in the outpatient segment of healthcare, the rate of progress is still slow, and decision makers are executing caution as to whether this should be the initiative to dominate the IT landscape in support of strategic business goals.

Today, we have an interesting landscape with much improved healthcare IT solution options (software, hardware, and technology components), shifting priorities to allocate capital expenditures toward clinically focused solutions, and a growing level of end-user acceptance of technology as a valid patient care tool. This has also served to fuel many organizations in their zeal to undertake and fund major, IT-related, patient safety initiatives. Where to start, however, has been an issue.

As part of the process of determining how best to undertake such a patient safety initiative, healthcare organizations are re-thinking the importance of ROI. If the need is imminent and the focus is on patient care and patient safety initiatives, is a traditional ROI required? Doubtful. Does the focus on the ROI for any healthcare IT investment in support of patient care and patient safety need to be based on improved clinical outcomes? Absolutely.

This change toward a more strategic viewpoint and focus can and will create a cultural shift in how clinical IT decisions are traditionally made so as to move beyond the previous, strongly cost-based model. To complicate matters further, this shift leads us toward an area that has been difficult to implement successfully and measure corresponding benefits. Therefore, it is important to develop an accurate measurement of ROI for patient safety initiatives in support of advancing these approaches to enhancing the delivery of patient care.

How does this approach resonate for your organization? Where in the spectrum of change are you today and how is that road of change being developed to encourage success? Is your culture ready to re-focus its attention to a “beyond-cost-only” approach to patient safety ROI metrics?

It is clear that without a sound ROI strategy that is integral to patient safety initiatives we will continue to experience a wide degree of successes and failures in planning, funding, selecting, adopting, implementing, and complying with clinical solutions related to patient safety. Because of this historic precedence, current patient safety solution initiatives are at risk for success.

Parallel to what healthcare organizations are confronting and experiencing with patient safety initiatives, the vendor community that provides patient safety technology solutions has been aggressively trying to develop and deploy solutions that meet a part of, or many facets of, the patient safety continuum as possible, including CPOE and BCMA. And, similar to patterns in the early to mid-1990s, vendors have taken a number of tracks in vying for this niche in the market.

Depending on the vendor strategy, and depending on an organization’s overall IT and clinical technology strategy, it has been difficult to find isolated, compatible CPOE and BCMA solutions that can tightly integrate with an organization’s existing IT environment.

The past three to four years have seen a number of interesting developments specific to vendors of CPOE and BCMA solutions for patient safety initiatives. Categories of vendors currently presenting solutions include: pharmaceutical companies, healthcare software development vendors, medication-dispensing vendors, and technology vendors. While each vendor may provide one or some components of a patient safety equation, it is usually up to the healthcare organization to determine what components are required and how they will integrate with its current IT environment.

Perhaps one of the most critical elements of evaluating any of the potential patient safety solutions is to consider the multiple dependencies and interdependencies that will impact the implementation and delivery of this initiative. It is critical to understand these dependencies and interdependencies prior to making any selection (see table 1).

Recent Trends
While a variety of clinical information systems are required to collect and manage valuable patient information, the current spotlight is shining brightly on CPOE and BCMA solutions. If we specifically take CPOE and BCMA as examples of core patient safety solutions, we need to
understand the differences in strategies, expectations, and outcomes that each can satisfy.

CPOE, which is specifically physician-focused, has the patient safety outcome directed at incurring fewer medication transcription and ordering errors. This is based on the use of a point-of-care, decision support tool that will assist the physician in selecting the correct medication and other testing (i.e., therapies) based on real-time clinical information, as well as ordering the correct medication, dose, route, and time for each patient.

BCMA, which is nursing-focused, has the patient safety outcome that fewer medication administration errors occur with the use of a point-of-care, bar-code driven, clinical documentation and decision support tools. This solution will assist the clinician in meeting the five rights of medication administration (medication, dose, route, time, and patient).

With the increasing pressure to select and implement patient safety solutions, many providers face the following struggles:

- Matching the correct solution to the specific patient safety problem
- Determining how to select the appropriate solution
- Justifying the cost for a solution

All three of these issues, which are related to finding the right solution and implementing it to meet the desired patient safety goals, must be closely coordinated, and the process always begins with the appropriate planning phase.

**Selection Considerations**

As important as selecting the optimal solution for patient safety is the need for a comprehensive planning process. This process should include six elements:

- Definition of the patient safety initiative
- Development of patient safety goals
- Identification of the organizational and IT readiness to undertake the patient safety initiative(s)
- Alignment of organizational patient safety goals with those of the user community
- Confirmation that the current operational and IT environments can support the proposed patient safety initiative(s)
- Selection criteria, dependencies, and interdependencies that may impact solution selection

**Definition.** It is most important to note that each healthcare organization must create its own definition of patient safety initiatives that should be identified at both the strategic and tactical level of the organization. Ownership and execution may be widespread across multiple constituencies.

**Goals.** The healthcare organization must understand its patient safety goals, how it expects to achieve those goals, and what problems it will solve through achieving those goals.

**Readiness.** What defines the readiness to ensure that any such patient safety initiative can be successfully deployed?
How does the organization rank itself regarding readiness for CPOE and/or BCMA? Who will evaluate these findings and place them in the required context for appropriate decision making? Findings of the readiness assessment alone could stop or significantly delay a patient safety initiative.

Alignment. The organization must understand how it plans to get to the end goal of patient safety and how this aligns with the overall goals of the organization and the user community. Is the board involved? Are physicians and clinicians involved? Are patients involved? Is short-term and long-term funding available to guarantee the project through completion? How does the organization plan to involve the board and where does patient safety coincide with the broader clinical or computer-based patient record (CPR) strategy? The intent is to avoid the fragmentation of initiatives and/or strategies related to the overarching business/IT goals.

Current state. The healthcare organization must understand all of its current foundational components of technology (i.e., hardware, network, staff resources, etc.) and what impact BCMA and CPOE implementation will have on those technologies.

Selection. Dependencies and inter-dependencies of each patient safety component must be understood, i.e., the pros and cons of selecting a niche versus enterprise clinical solution, selecting BCMA associated with pharmacy or medication-dispensing vendors, selecting BCMA before CPOE or visa versa, understanding the interface or integration implications of selecting one with or without the other, etc.

The end-user device decision can and will impact the success of implementing BCMA and CPOE. The implications related to PC versus laptop, wireless versus hard-wired, etc., are many. In addition, the issue of having multiple applications on one end-user device needs to be researched during the selection process. If the CPOE or BCMA solution is not part of a larger clinical solution or healthcare information system (HIS), compatibility issues related to operating the systems on one end-user device can arise, leading to many implementation and cost issues.

To mitigate potential risks associated with pursuing a patient safety initiative, the healthcare organization should conduct a readiness assessment of the operational and IT environment to discover any areas that may constitute a risk. See table 2 for a representative segment of a readiness assessment that is specific to BCMA.

Return on Investment (ROI)

Each healthcare organization must define the ROI components that will be used for all major initiatives (the format varies greatly by organization yet generally encompasses all the actual, measurable components). In the case of either CPOE or BCMA, we suggest that the format for ROI be enhanced to include a number of metrics that are not strictly financial in nature but will translate into a financial impact over time once the appropriate analysis is completed.

Since CPOE and/or BCMA will impact multiple operational areas, it is helpful to create a graphical representation of all the “touch points” targeted for benefits. Each touch point can be labeled and identified as an area that will be tracked over the life of the initiative and post implementation to assess the level of direct or indirect impact achieved. Some of these categories might include, but are not limited to, the following:

- Reduced medication errors
- Increased patient satisfaction
- Increased staff satisfaction (physician and other clinicians)
- Increased staff productivity (physician and other clinicians)
- Improved operational processes and workflow (e.g., elimination of paper processes, redundant processes, etc.)
- Improved clinician and physician communication (e.g., greater accuracy, timeliness to access, etc.)

In reviewing these categories, it is important to define each one so that it specifically reflects the quality initiatives or other related initiatives that are currently in place to measure impact and progress of the delivery of patient care. The standardized definitions should be reviewed by a multidisciplinary committee (this could be a working subgroup of the patient safety committee or an IT steering committee) so that all information gathered from the inception of this initiative can be leveraged whether the reviewer of the information is an executive in administration, a chief financial officer, a chief of medical staff, a chief nursing officer, or other related decision makers.

In addition to defining the categories, it would be beneficial to determine whether tracking the desired information will constitute a quantifiable, tangible measurement or whether it is more qualitative in nature with some level of interpretation required.

Benchmarks should be established prior to implementation in order to measure specific outcomes representing the percentage of errors that have been prevented at any given point in time:

- Percent ordering errors
- Percent transcription errors
- Percent administration errors
- Percent calculation errors, etc.

This data is sometimes readily available if an organization has a current patient safety initiative underway regarding medication error reduction and a corresponding tracking tool developed to capture current metrics.

There is an additional perspective from which your healthcare organization might track the various cost savings and operational efficiencies to be included in a comprehensive ROI scorecard. Two of these components are (1) reduction of paper documents that previously supported...
these clinical processes that have been converted to an electronic format, and (2) reduction in administrative support across various clinical disciplines to complete the medication management loop.

Each of these areas will benefit from labor savings or the reallocation/transfer of labor to focus on other functions within a department or organization; for example, unit clerks are no longer transcribing orders or medication administration records (MARs)—this is all done electronically. If specifically focusing on future cost savings by avoiding lawsuits based on medication errors, this figure could be estimated on either state or national figures as well as the average lawsuit costs reductions that may be realized annually based on the organization’s own experience.

When reviewing all the various approaches to collecting ROI information for CPOE and/or BCMA, it is unwise to promote their implementation as patient safety solutions with a significant labor savings impact. Fully automating all BCMA tasks is more complex in terms of potential IT costs because this can require multiple system replacements or additions to reach a state of an automated medication management process.

For example, a healthcare organization might need to invest in related medication management components such as robotics, medication-dispensing units, enhanced network capacity, applications and/or other technologies, etc. The actual costs of this initiative will then be greater initially, but these costs can be recovered over time by the full impact of automating the medication management process. Certainly, the overall ROI and its benefits may take longer to realize.

In planning for CPOE and/or BCMA, it is far easier to evaluate products or technologies as the solution to current patient safety concerns. However, it is a bit more difficult to be clear about planning out each detail from inception to implementation well in advance of selecting a solution. The ROI can never be reached without the thorough analysis of interrelated aspects of this initiative. Thorough analysis includes, but is not limited to, the following:

1. Define and be clear on the categories of benefits that are targeted and expected to be achieved.
2. Identify a realistic timeframe in which these benefits may be achieved (balance operational and IT timelines when developing the timeframe).
3. Assess the overall IT impact of achieving the goal and identify any unexpected costs that must be factored in to actually delivering CPOE and/or BCMA.
4. Develop achievable benchmarks for ROI.
5. Establish physician and clinician competency and compliance requirements once the patient safety automation is fully implemented.

By far the most controversial and elusive aspect is the need for physician and clinician competency and compliance requirements. CPOE and/or BCMA will have a limited impact if utilized effectively and consistently by only a small subset of physicians and/or clinicians. Given the multiple millions of dollars in potential investment to achieve these patient safety technology initiatives, it will require that competency and compliance definitions and commitments be secured well in advance of a planning phase so that it can be integrated into the final, tailored ROI model requiring accountability by all participants to reach the intended ROI and patient safety levels of automation.

To this day, healthcare organizations have completed limited ROI studies that might serve as a model for others. In addition, too many variables that can impact the many categories of analysis that can create a comprehensive ROI model exist.

So while we will be unable to agree on a standardized ROI model that fits all situations, we believe that each orga-
FOCUS: RETURN ON INVESTMENT

Organization can leverage the many aspects of value and impact in order to realize the benefits and impact on patient safety through CPOE and/or BCMA initiatives. The customization of this ROI model will certainly provide not only the discipline to assess and measure the impacts of invested dollars but also educate all participants across the organization to be accountable and productive in delivering their patient safety initiative.

The customization on a ROI should include a strong balance of qualitative, quantitative, and financial benefits based on some of the examples provided. Above all, it is important to remember that the following elements will impact the ultimate outcome of the ROI:

- Readiness of the organization to take on these initiatives (i.e., change management as well as capacity and probability of successful introduction)
- Linkage of both patient safety business and clinical outcomes with the organization’s IT strategy
- Sequencing of initiatives that comprise the overall patient safety solution
- Physician and clinician commitment and policies regarding competency and compliance once the patient safety initiative has been implemented

If this information is not evaluated and weighed within the broader context of implementation and support of this type of initiative, the ultimate outcome of the initiative is in doubt.

About the Authors
Lucy Mancini Newell, MBA, is healthcare provider consulting leader at Perot Systems Corporation.
Doug Christensen, RN, is senior management consultant for Perot Systems Corporation.

Reference
The Leapfrog Group (www.leapfroggroup.org) has determined that the criteria for POE compliance have only been met by 29 U.S. healthcare organizations as of its 2002 survey. The criteria that qualify a healthcare organization as being compliant are two-fold: (1) at least 75 percent of patient orders are placed through a CPOE system, and (2) the healthcare organization is able to demonstrate that its system intercepts at least 50 percent of common, serious prescribing errors.
FOCUS: RETURN ON INVESTMENT

Clinical ROI: Not Just Costs Versus Benefits

ABSTRACT

Although sophisticated economic modeling can be used to quantify intangible benefits, ROI calculations for clinical information systems are driven more by the values and strategic direction of an organization than by any other considerations. But investing in clinical information tools to ensure quality and patient safety is, in reality, required as a cost of doing business and functioning as a safe hospital.

Barry P. Chaiken, MD, MPH

Return on investment calculations provide organizations with critical information on which to base capital decisions. A recent survey from the Medical Records Institute (Fifth Annual Medical Records Institute’s Survey of Electronic Health Record Trends and Usage) indicated that survey respondents view funding as the greatest challenge to implementing an electronic health record.

Although payers, including the government, have expressed interest in increasing reimbursement to organizations that invest in technology that improves patient safety, for example, little evidence exists that widespread programs such as these are about to emerge. In contrast, budget problems at both the federal and state levels probably indicate smaller reimbursement payments rather than increases in the future. In addition, the recent trend in healthcare premiums is up rather than down. Healthcare costs are now increasing at close to double-digit levels, frightening some analysts to think the days of rampant inflation in healthcare, like that which occurred in the 1980s, are ahead of the industry.

Industry

Increased competition, rising costs, and limited budgets are not unique to healthcare. All industries, when faced with these challenges, must make difficult decisions on where and how to invest their limited capital.

Over the past 25 years, Federal Express (FedEx) became synonymous with guaranteed overnight delivery. Some consider FedEx to be the inventor of the entire overnight package delivery business. Although others such as the United States Postal Service, United Parcel Service, and Airborne compete aggressively head-to-head with FedEx, none are able to seriously erode market share.

In the face of strong business competition, changing market dynamics, and shifting economic fortune, FedEx continually makes capital investments in its business. Clearly, its success must be based upon solid business practices such as the performance of return on investment (ROI) studies for all major capital allocations. It would be impossible for any organization to be successful over the long term without measuring what they are managing.

Keywords

Return on investment  Composite index  Tangible benefits
Intangible benefits  Length of stay (LOS)  Investment
Nevertheless, common sense suggests that FedEx does not
do an ROI study on every investment they make. It is not
practical to do so given the volume of decisions that are
made each day in an organization of its size.

For example, every overnight package requires a truck
for delivery. The truck needs to be in working order, reli-
able, and of appropriate size and functionality to satisfy its
mission. Buying trucks, upgrading trucks, and replacing
trucks are part of the cost of doing business. Without this
investment, FedEx would not exist. Of course, the company
“runs the numbers” on the number and types of trucks to
buy, when to upgrade, and when to repair, but FedEx cannot
afford to not buy trucks. Without trucks, FedEx cannot
deliver packages.

The same concept is true in healthcare. No mod-
ern hospital can exist without patient rooms, a
laboratory, or even easy access to CT and
MRI imaging devices. The recent emphasis
on patient safety, supported by
Institute of Medicine reports, The
Leapfrog Group, and government ini-
tiatives such as those by the Agency
for Healthcare Research and Quality,
presents hospitals with further pres-
sures to expend capital on technolo-
gy, particularly clinical information
technology that can enhance and
ensure patient safety.

In some respects patient safety-related
clinical information technology is synonymous
to trucks for FedEx — a required investment and
an item for conducting business. ROI, therefore, is becom-
ing not a means to decide on making an investment, but
rather an analysis to choose the right investment for an
organization. This change places a new burden on hospital
senior management as they now have less flexibility in
delaying many of their investment choices.

CPI and Value of Healthcare

The Bureau of Labor Statistics uses the years 1982-1984
as the baseline for comparing consumer prices, with the
value 100 used as a reference point. This measure is used
to monitor changes in prices of a standard basket of good
and services. In 1982 the annual year-over-year percent
change in the consumer price index (CPI) was about 8 per-
cent. Today it is close to 2 percent. Similar calculations are
made for a basket of healthcare services.

In contrast to the general CPI, the medical CPI year-over-
year changes exceed the general CPI changes in almost
every year since 1982. Today, the medical CPI is higher
than the general CPI, and it is predicted that this will con-
tinue for the next several years. One could conclude from
this data that healthcare costs are increasing at a faster rate
than other goods that make up the CPI. In fact, that might
not be the case if other facts are considered.

To illustrate this point, let us first consider automobiles.
No one would argue that automobiles are more expensive
today than they were 20 years ago. Also, let us assume that
automobiles cost twice as much today as they did in 1982.
Does that mean that the inflation rate over this 20-year peri-

d for automobiles was 100 percent? Such a conclusion
assumes that an automobile today is identical to an auto-
mobile of 1982. One can easily argue that automobiles
today are safer, less polluting, more reliable, and more
comfortable. If the quality and utility of an automobile
today exceeds that of 20 years ago, then the inflation rate
of 100 percent is not really accurate. Why? We receive
much more value for the higher price we pay for an
automobile today.

The same applies to healthcare. Today, patients of equal mor-
bidity are generally brought to a state of wellness with bet-
ter outcomes (e.g., functionality, less
discomfort, etc.) much more quickly
than 20 years ago. This is especially
true over the past decade due to the
introduction of very powerful and
effective medications, which replaced
invasive therapies that delivered lesser
outcomes. Therefore, what we pay for
healthcare today, although higher than
20 years ago, is not really comparable to
what we “purchased” 20 years ago. The value
of care today exceeds what we received in the
past. It is open to much debate how much greater that
value is, although almost everyone would agree that there
is greater value.

Scitovsky, Barzel, and Feldstein

More than 40 years ago, economist Anne Scitovsky rec-
ognized that all inputs in healthcare were not equal and
that calculating healthcare costs by adding up the costs of
the inputs (e.g., hospital days, physician visits, drugs, etc.)
did not take into account the fluctuating number of illnes-
esses that occurred each year and how those illnesses were
treated. Inherently, some illnesses cost more money to
treat than others. Scitovsky proposed the development of
separate indexes of the treatment costs for specific illnesses,
and the combining of those indexes into a composite
index. The composite index would be constructed by
weighting each illness’s specific index using a base year for
the weighting. This process is similar to that which is used
to construct the CPI.

Assuming a base year, this approach also takes into
account changes in the quality of inputs. To illustrate, let us
consider the average inpatient cost of treating a disease.

“ROI is becoming not a means to decide on
making an investment, but
rather an analysis to choose the
right investment for an
organization.”
This is simply calculated by multiplying the average lengths of stay (LOS) by the average cost per inpatient day. With advances in treatment and technology, a disease may have its average LOS decrease by, for example, 10 percent. If at the same time the cost per average inpatient day increases by 25 percent, traditional calculation of medical care inflation would report an inflation rate of 25 percent, ignoring the savings that accrue from a decrease in the average LOS for that disease. Said another way, we would see that the total cost for those inpatient days increased even though the total number of inpatient days decreased.

The quality of inputs, in this case advancement in treatment that makes the patient healthy faster, does not factor into these traditional inflation calculations even though it does impact total costs for treating the disease. In contrast, Scitovsky’s composite index better reflects changes in quality and subsequent decreasing LOS as it takes into account new medical products and techniques.

Scitovsky also recognized that the index should reflect changes in output and those treatments that reduced morbidity and mortality must be factored into her index. She proposed that, for each index, a single objective indicator of quality be chosen, and that this indicator be used to adjust each illness index before calculation of the composite index.

Yoram Barzel built upon Scitovsky’s idea by suggesting that the prevention of disease must be calculated into the composite index as well. For example, expenditures on immunizations to prevent polio must be countered by the cost savings associated with preventing a case of polio. As the healthcare economist Paul Feldstein so simply stated: “The prevention of a case or illness clearly represents an output that is superior to the successful treatment of a similar case, but if we concentrate on the costs per case of treating specific illnesses when they occur, we ignore the influence of preventive medical care.”

Scitovsky, Barzel, and Feldstein all realized that there was more to evaluating healthcare expenditures than the raw numbers presented in spreadsheets documenting utilization and its associated costs.

Realities of ROI

While it might be useful as an academic exercise to explore the theories of healthcare inflation and the value of services, the realities of today’s actual care environment must be considered. Organizations grounded in the details of providing care, while managing budgets affected by reimbursement rates, must still make critical decisions that will assuredly impact the organization’s long-term viability. Morally they are driven by their belief in offering the highest quality of care possible to every patient. In addition to clinical tools such as MRI machines and completely outfitted critical care units, this means offering their clinical staff the best clinical information technology tools available.

They also must be attentive to the marketplace. Organizations are driven by the requirements of payers and their representative groups such as the Leapfrog Group. In addition, the needs of their medical staff may cause organizations to implement systems just to “keep up with the Joneses.”

Lastly, financial considerations weigh heavily on organizations, dictating what initiatives they can and cannot afford to move forward. Taken together, organizations struggle mightily with these competing pressures to develop a practical plan for clinical information technology investment.

Although difficult, there are various measurements that can be used in determining a ROI on clinical information
technology solutions. Some of the measurements can be viewed as delivering hard, tangible monetary values, while others require a bit of finesse to truly measure the benefits in financial terms. Nevertheless, it is important to document both tangible and intangible benefits and use the results in the process of measuring or estimating the ROI on any clinical information system.

**Opportunities for ROI: Measurable Results**

A long-time measurement of ROI has been length of stay (LOS). Whether evaluating the introduction of a new therapeutic modality, modification of a clinical process, or employment of a standardized care plan, LOS can be easily measured in monetary terms through the use of widely deployed hospital information systems, and linked to a definitive impact on hospital costs. Even fractional reductions in LOS can deliver substantial financial benefits, through both the reduction in cost per case as well as an increase in hospital capacity. In the face of the growing shortage of hospital beds, benefits accrue from the greater utilization of fixed assets and costs (e.g., hospital plant and equipment and staffing expenses). The additional patients treated with the same assets then generate additional revenue, making the entire hospital more efficient.

Hospitals that can capture the increasing demand for services with existing infrastructure will obtain a significant financial advantage over competitors. Examples of clinical information systems that can help reduce LOS include computerized physician order entry/clinical decision support (CPOE/CDS) systems and physician portals (see figure 1). CPOE/CDS can facilitate putting patients on treatment regimens that are more likely to get them well quickly. Physician portals offer physicians accurate, up-to-date patient information via the web, allowing them to react to clinical data promptly even when not in the hospital.

Properly deployed clinical information systems provide staffing efficiencies that allow a fixed number of staff members to treat a greater number of patients. Efficiencies occur through improved communication of treatment plans with less time spent clarifying orders and the elimination of unnecessary efforts. For example, CPOE/CDS delivers to each care team member the exact assignments that require completion. Each staff member can then organize the workload to maximize efficiency. In addition, managers can structure the work environment to make the overall workflow more efficient and thereby obtain the greatest level of staff productivity. As efficient processes are more reliable processes, by-products of this effort include a reduction in medical errors, higher quality patient care, and enhanced patient safety.

The explosion in the introduction of effective but expensive new drugs challenges organizations to ensure the appropriate utilization of these new weapons against disease. Careful management of practice pattern changes, particularly in medication use, can dramatically decrease the cost of treatment. Several organizations successfully reduced antibiotic drug costs after deploying a CPOE/CDS system that uses evidence-based medicine guidelines at the point of care during the ordering process. Besides increasing compliance with the hospital formulary, organizations have been able to direct physicians to more appropriate, less expensive medications while preserving outcomes, with the added benefit of helping to reduce the development of “super bugs” resistant to the latest antibiotic formulations. Similar benefits from changes in physician behavior have accrued through the increased adherence to treatment plans that have proven to deliver better outcomes at lower costs (e.g., anticoagulation protocols) (see figure 2).

Clinical information systems can also assist in regulatory and accreditation reporting (e.g., CMS, JCAHO) by providing much of the required information through analysis of existing patient data sets (see figure 3). This can reduce staff time associated with pulling records and compiling disparate data elements. In addition, the recent announce-
ment by the Federal Department of Health and Human Services to embrace SNOMED Clinical Terms, a clinical vocabulary nomenclature, and direct the Institute of Medicine to develop a standard model for an electronic health record, provides a foundation on which systems can collect data elements. It is likely with this enriched potential for building a standardized clinical database and the expanded deployment of clinical information systems, regulatory and accreditation standards will take advantage of the available reporting capability.

Properly chosen and deployed clinical information systems help to improve medical staff relations by facilitating physician workflow and satisfying the information needs of the practicing clinician. By making it "easier" for the physician to deliver care within the hospital, the physician is motivated to refer more patients to the institution. This leads to higher occupancy rates and better utilization of fixed assets, culminating in improved hospital cash flow and net revenue.

Each clinical information system deployed has the potential of providing some or all of the tangible benefits noted above. The actual benefits and cost savings (or increased revenue) are determined by the choice of system and method of implementation. Therefore, actual ROI is greatly impacted by the clinical processes affected by the deployed systems.

Opportunities for ROI: Intangible Benefits

Healthcare economists have struggled for some time over the measurement of intangible benefits. Putting a financial value on morbidity or mortality is fraught with nuances, value judgments, and arguable errors. Nevertheless, these intangible benefits have value, even though it may be difficult for everyone to agree on the precise monetary amount.

Reduction in medical errors is the primary intangible benefit that accrues from the implementation of clinical information systems. Whether it is the reduction in the 98,000 annual deaths due to medical errors as estimated in the 1999 Institute of Medicine report *To Err Is Human*, or a reduction in the 7,000 deaths attributed to medication errors in the same report, significant and valuable savings can accrue from reduced patient morbidity and mortality.

It is even more difficult to measure errors that are prevented or morbidity and mortality that are avoided, due to real-time alerts, enhanced tracking of errors, and the incremental improvement of clinical processes that occur from the use of clinical information systems. Data elements, never before available, can be tracked and interventions made before serious problems appear in patient care. In addition, ordering patterns of physicians can be tied to patient outcomes to identify treatment plans that deliver the best results.

A culture of medical error reporting only exists in a few institutions. Current surveillance of clinical processes and potential medical errors is inefficient and often non-existent in hospitals without clinical information systems. Irrespective of the commitment to patient care, such organizations just do not have the readily available data elements in a format that can be analyzed to optimally monitor quality of care.

Lastly, goodwill provides the most difficult intangible benefit to measure. Hospitals exist to serve their community. Boards members, senior management, and clinical staff are committed to providing the highest quality and safest patient care possible to their neighbors and community.
FOCUS: RETURN ON INVESTMENT

they serve. These leaders struggle putting a monetary value on the goodwill benefits (e.g., community perceived quality of care, prestige, attraction of distinguished clinical staff) that many clinical information systems provide. Therefore, goodwill is often left off the ROI equation.

Conclusions
ROI calculations for clinical information systems are driven more by the values and strategic direction of an organization than by any other considerations. Those factors determine which ROI metrics are included and which are discounted as the organization works through the decision-making process. After implementation, organizations can then utilize those same metrics to evaluate their chosen projects. Some of the available metrics are noted in this article.

Every investment decision carries an opportunity cost with it. It is important for organizations to understand both the tangible and intangible costs and lost benefits when appropriating resources in one area versus another.

Therefore, decisions to invest in clinical information systems should not be driven solely by ROI calculations, but by broader determinations on what investment best appropriates resources to meet the goals of the organization. As resources vary greatly among organizations, program funding will reflect this reality. For example, some organizations with tight budgets may choose to continue to provide indigent care rather than make an investment in IT, while others, with greater institutional endowments, will have the luxury to do both.

Nevertheless, investing in clinical information tools to ensure quality and patient safety is, in reality, required as a cost of doing business, of functioning as a safe hospital. The real question is how resources will be mobilized to pay for the necessary systems, and what will be the timelines to make those investments. Creative senior management will work with their boards, administrative managers, and clinical leaders to build their own unique roadmap to bring the necessary systems into their institution as they continually work to address the needs of their community.

About the Author
Barry P. Chaiken, MD, MPH, vice president, medical affairs, McKesson Corporation, has over 17 years experience in medical research, epidemiology, quality improvement, and public health. He can be reached at bchaiken@docsnetwork.com.

References

“Putting a financial value on morbidity or mortality is fraught with nuances, value judgments, and arguable errors.”


FOCUS: RETURN ON INVESTMENT

The New England Healthcare EDI Network

ABSTRACT

The New England Healthcare EDI Network (NEHEN) is a collaborative of providers and payers in eastern Massachusetts that created, manages, and operates a shared insurance EDI infrastructure. NEHEN currently has 12 provider and three payer members, and supports over 1,000,000 insurance EDI transactions per month. This paper describes the philosophies that define the NEHEN business model and discusses its governance structure, technology, operational issues associated with its implementation, and its current status, along with lessons learned from the NEHEN undertaking.

John P. Glaser, PhD, Greg DeBor, and Laurance Stuntz

The implementation of computer-based support of payer-provider transactions offers significant cost reduction, revenue capture, and service gains for the participants in the healthcare industry. These systems support transactions such as eligibility determination, referral request, claims status inquiry, and claims submission.

By replacing the use of paper, phone calls, and faxes to carry out these transactions with systems based on electronic data interchange (EDI) or Internet technologies, payers and providers can reduce the cost of each transaction. Improvements in the “real-time-ness” of the transactions can assist providers in reducing claim denials and associated lost revenue. Reducing transaction errors improves the level of service provided by the payer to patients/subscribers and physicians.

Recognizing the significance of these gains to the healthcare system, the Health Insurance Portability and Accountability Act of 1996 (HIPAA) mandated the industry’s movement to insurance EDI by October 2003 and defined the transaction standards to be used, ANSI X12.

This paper describes the New England Healthcare EDI Network (NEHEN), a collaborative of providers and payers in eastern Massachusetts that created, manages, and operates a shared insurance EDI infrastructure. Figure 1 provides a high-level schematic of NEHEN.

1This paper will use the term insurance electronic data interchange (EDI) to refer to a range of technologies to support payer-provider transactions. This range includes traditional EDI, the use of the Internet as a transport mechanism between two legacy applications, and Internet-based communication between fully web-capable payer and provider applications.

KEYWORDS

Electronic data interchange (EDI)        Insurance EDI
HIPAA electronic transactions        Architecture and technology
NEHEN Overview and Objectives

NEHEN is a not-for-profit, limited liability corporation formed (in 1998) and owned by a collaboration of providers and payers in eastern Massachusetts. Since its inception, NEHEN has worked with Computer Sciences Corporation (CSC) to develop and manage NEHEN. NEHEN has several objectives:

- Create a common technology platform to exchange insurance transactions between regional providers and payers
- Develop a common set of guidelines for implementing the transactions (e.g., mapping payer-specific transaction fields to the X12 standard)
- Develop a common set of policies that govern the use of the developed network (e.g., security guidelines)
- Manage the network, including technology upgrades and technology problem resolution
- Coordinate member implementation plans
- Share implementation experiences between NEHEN members

NEHEN Philosophies and Business Model

The NEHEN business model is based on several principles, premises, and observations.

Leverage good working relationships. The Affiliated Health Information Networks of New England (AHINE) was formed by the Massachusetts Health Data Consortium (MHDC) in 1994. AHINE was established as a result of an MHDC strategy to advance the application of information technology to improving the health status of the citizens of Massachusetts. AHINE served as a forum for the IT leadership of regional providers and payers and members of the healthcare IT service and product community to discuss common issues, share experiences and sponsor conferences and the development of white papers on current topics.

AHINE enabled the regional IT leadership to develop close and effective working relationships, a critical contributor to the willingness of that leadership to engage in the mutual development of NEHEN.

Shared gain. Providers and payers are both under pressure to reduce the costs of the administrative processes associated with providing care. In the struggle to reduce those costs, insurance EDI is a tide that raises all boats. Some aspects of the value proposition favor providers (e.g., improved revenue capture), some favor payers (reduced service center costs), and some favor health plan members and patients themselves (e.g., improved service and fewer hassles with forms, phone calls, and incorrect bills).

High degrees of interdependency in achieving gain. Neither providers nor payers can achieve this value without the full participation of each other. The problem is akin to being the first user of a fax machine. You need other users to make the tool effective. To achieve gains from insurance EDI, the payers need the providers to participate and vice versa. Moreover, the payers need as many providers as possible across as many transactions as possible to achieve the maximum value and vice versa. Providers and payers have
a shared interest in achieving comprehensive regional use of insurance EDI. An effort on the part of a payer and provider to “go it alone” hinders their ability to achieve regional scale and optimal value.

**Insurance EDI as a commodity.** NEHEN members viewed insurance EDI as unlikely to be a basis of competition. Payers would compete with each other on the basis of their insurance products. Providers would compete with each other on the basis of the quality of their care. But providers would not compete with each other on the basis of their EDI capabilities and neither would payers compete with each other on that basis.

In effect, EDI capabilities were viewed as a commodity capability, like dial tone. All participants need the capability and derive value from it, but the capability provides no more competitive advantage than automated teller machines today provide competitive advantage to a bank.

Several industries have discovered, years into an effort, that their efforts to create a competitive advantage have turned into the redundant development of commodity capabilities (e.g., automated teller machines and credit card swipe boxes). The result is a capability that distinguished no participant but, because of redundant development, is unnecessarily expensive to support.

Once an organization gets beyond incorrectly thinking of a capability as a competitive differentiator, the opportunity presents itself to engage in a shared conversation to develop a commodity capability. And one can design, at inception, a capability that has the desired characteristics of a commodity, e.g., inexpensive and reliable.

**Minimally invasive approach.** Members agreed that NEHEN could be implemented in a manner that required minimal diversion of member strategies, technology commitments, and plans. All members had interest in implementing EDI capabilities. Since insurance EDI was part of everyone’s IT strategy, the creation of NEHEN required no organization to significantly alter its IT strategy.

Furthermore, NEHEN could be implemented such that it interfaced with existing systems at each member organization. No provider or payer had to replace an application or change vendors in order to take advantage of NEHEN.

NEHEN, as will be seen in the section on technology, has “nothing in the middle.” There is no central database or central network. This minimizes the need for participants to redirect scarce capital to create the “middle” or dedicate scarce staff to supporting an infrastructure “in the middle.”

NEHEN integration at any member organization is done according to that member’s individually defined schedule. CSC coordinates schedules and maintains a master schedule, but NEHEN does not require a specific implementation timetable. Hence, if a participant had internal need to delay implementation of a transaction or alter the pace of implementation, it could do so. Also, if a member organization chose or required a partner to assist in the integration of their legacy systems with NEHEN, the choice of that partner was entirely at the discretion (and expense) of that organization.

**Collaboration efficiencies.** Collaboration provided several advantages in the development of a commodity capability. The cost of developing implementation guides and policies could be done once rather than redundantly done by each organization. NEHEN technologies could be developed once, with the costs shared, rather than be redundantly developed.

Managing a regional implementation schedule could be done by one organization (CSC), rather than by each of the members trying to assemble its own version of a master schedule. Implementation lessons learned (technical and operational) could be gathered by one organization and broadly shared across the NEHEN membership.

**Keep it simple.** NEHEN adopted a “keep it simple” mantra throughout all of its discussions and decisions. This orientation was apparent in several decisions.

- No member would be charged a transaction fee. A transaction fee adds to, rather than subtracts from, the desire to reduce transaction costs. The lack of a transaction fee recognizes that the value to NEHEN members comes from reduced costs of handling transactions and not from transaction revenues. Moreover, transaction fees would have required the establishment of a billing operation.
- NEHEN members would be charged a flat fee ($72,000 per year for larger organizations, $48,000 for smaller ones) for membership. This approach eliminates the need to discuss an approach to a more elaborate sliding or tiered fee structure.
- Intellectual property developed by NEHEN (e.g., transaction switches and implementation guides) would be equally owned by all members and could be used by all members to support their business activities. Members

---

*Affiliate members serve several purposes. First, they are able to amortize the NEHEN fee across their customers, e.g., the small physician practice. This enables participation in NEHEN by organizations that might be too small to pay the fee. Second, by having one agent represent many smaller organizations, the NEHEN meetings can reduce the need to be held in an auditorium. Third, for-profit pursuit of the insurance EDI services market is inevitable and desirable to promote innovation and competitive economics. The affiliate member category enables participation by these firms. Fourth, several organizations use a vendor to establish EDI integration with their legacy systems (e.g., HDX provides integration with Siemens Medical Systems hospital information systems). These vendors can join NEHEN and provide their local customers with NEHEN connectivity.*
who joined later than the founding members would have the same ownership rights and share as the founding members. This approach enabled NEHEN to avoid potentially interminable discussions of intellectual property ownership.

- NEHEN agreements would be subservient to current and future contract agreements between providers and payers. NEHEN is intended to support operations and not “get in the way” of the contract discussions that occur between providers and payers.

The “keep it simple” philosophy and other philosophies in this section are largely intended to reduce, as much as possible, any barriers to joining NEHEN and remaining a NEHEN member. Barrier reduction is essential to quickly achieving regional scale.

**NEHEN Roles and Governance**

NEHEN is governed by a steering committee of its members. Members must be a provider or a payer based in the region. The members elect a chair that manages the committee meetings and represents NEHEN, as needed, in a variety of external discussions and forums.

**NEHEN governance.** NEHEN has developed documents that define its objectives and describe needed operating principles and mechanisms for making decisions, e.g., process for approving the budget, frequency of meetings, and the authority of NEHEN members.

NEHEN is owned by its members, each of which has an equal share of NEHEN and an equal vote in its direction and management. The members are represented at the steering committee by a manager appointed by the member. Generally, these managers are the CIOs, CFOs, or key directors for the member organization. Vendors, if they provide insurance EDI services to payers or providers, can become affiliate members for NEHEN. These vendors are agents in that they represent the interests of their payer and provider customers. Affiliate members cannot vote and hold no shares of NEHEN or its intellectual property.

**Member roles.** The members of NEHEN have several responsibilities and roles. Members are:

- Expected to nominate a representative who will attend the NEHEN meetings and vote, as needed, on issues that obligate the member, as well as the addition of new members to NEHEN, the annual NEHEN budget, and any proposed changes to the NEHEN governance documents and the scope of the work of the program manager.
- Required to pay an annual fee to NEHEN to fund the overall program management and ongoing development of NEHEN. Members are responsible for their own network fees and NEHEN implementation and integration costs.
- Responsible for the quality of the data sent to other members.
- Responsible for maintaining security according to the standards developed by NEHEN in accordance with HIPAA and other generally accepted industry practices.
- Expected to effect Chain of Trust Agreements between each other using a standard developed by NEHEN.
- Expected to be able to send and receive HIPAA-compliant transactions.
- Required to review and approve NEHEN’s program management agreement and monitor the performance of the program manager.

**Program manager roles.** NEHEN appoints a program manager to carry out a range of activities need to advance the strategies and day-to-day operational needs of NEHEN. Since the inception of NEHEN, CSC has served as program manager. The program manager has the following roles:

- Work with the steering committee to establish NEHEN strategy and direction
- Organize and support member meetings and discussions
- Develop and pilot core technology
- Coordinate implementation plans
- Resolve implementation issues
- Recruit new members
- Develop needed policies and procedures
- Provide impetus and momentum to NEHEN activities (often referred to as “herding cats”)

**Governance documents.** There are three major NEHEN governance documents:

- The NEHEN Memorandum of Understanding (MOU) describes the organizational status, purpose, and objectives of NEHEN, and the philosophies that guided its formation and continue to guide its deliberations. This document is parsimonious covering the essentials needed in order for NEHEN to exist as a corporation.
- The NEHEN Operating Agreement is NEHEN’s incorporation document, describing the roles and responsibilities of members and the program manager, and the processes to be used by NEHEN to make a range of budget, membership, and legal decisions.
- The Program Manager Scope of Work Document defines the focus and tasks of the program manager. This document is reviewed annually and becomes the NEHEN business plan for the year.

**NEHEN Architecture and Technology**

In addition to their Program Management responsibilities, CSC is responsible for designing the NEHEN architecture and for developing much of the NEHEN technology.

**NEHEN architecture.** The guiding principle for the NEHEN architecture is that members exchange information using standard, asynchronous transactions over secure connections between enterprises. All of the components are
engineered to run under the commonly available and inexpensive Windows NT-based operating systems and do not use any Microsoft-specific software components in order to increase potential portability. Figure 2 shows the architecture from the perspective of a member hospital. This example is repeated for each connection in the NEHEN network.

**NEHEN technology.** Originally developed by CSC for Partners HealthCare, many of the core components were then licensed to NEHEN for other members' use. Since this original donation, other members have donated components, and the NEHEN program has developed software that extends the core infrastructure.

There are three main subgroups of the NEHEN software:

- **Routing software.** The eGateway is the main routing engine for the NEHEN network. It runs as a multi-threaded NT service listening on a known port for valid ANSI X12 EDI transactions. Designed specifically for routing the HIPAA EDI transactions, it is optimized for speed and reliability of transmission. The eGateway also supports queuing, validation of each transaction, and batch transmission for large transactions that don't require near real-time processing.

While the NEHEN architecture is predicated on exchanging HIPAA or other industry standard transactions, not all payers support these transaction formats. In order to allow providers to communicate with payers who cannot yet support the industry-standard formats, NEHEN provides software that translates, for example, between the standard eligibility request/response transactions and the payers' legacy eligibility systems.

- **User interface components.** For most workflows, the optimal value to the provider or payer is created when the standard transactions are sent and received by the core processing systems. However, not all core systems can yet support the HIPAA transactions, and some workflows have an ad hoc nature that is ideally suited to a flexible inquiry tool.

For these reasons, NEHEN created the NEHENLite user interface for submitting certain EDI transactions from a provider to a payer and displaying the results in a consistent manner. NEHENLite is a combination of HTML web pages and CGI programs written using Microsoft Visual...
C++, running under Microsoft Internet Information Server and using an ODBC data source to keep track of sent and received transactions.

NEHENLite currently supports:
- Eligibility inquiry
- Specialty care referral requests
- Authorization and pre-certification requests
- Referral and authorization inquiry
- Claim status inquiry

Core components. All of the above components use common objects and code written using Microsoft Visual C++. The major groupings of objects implemented by this code are:
- EDI objects. These implement creation of generic, well-formed ANSI EDI objects. There are also specific implementations for the ANSI X12 4010 version of the 270, 271, 276, 277, and 278.
- Communications objects. These implement all of the capabilities needed to do network communications, including direct, FTP, and command communications. These include automatic queuing of transactions when a transmission method is “down.”
- NT service objects. These implement all of the features of an NT service, including security, registry access, and generally “playing nice” with the operating system.
- Utility objects. These implement features such as database connection, decoding of comma-separated files, creation of dynamic HTML pages, and logging of error messages.

Current Status
As of July 1, 2002, the following providers, which are composed of 36 hospitals and over 10,000 physicians, were members of NEHEN:
- Partners HealthCare System
- CareGroup Health Care System
- Lifespan
- Boston Medical Center
- Children’s Hospital Boston
- Dana Farber Cancer Institute
- University of Massachusetts Memorial Medical Center
- Lahey Clinic
- Southcoast Health System
- Northeast Health System
- Massachusetts Eye and Ear Infirmary
- Caritas Christi

The payer members, which have collectively over 2,000,000 members, are:
- Tufts Health Plan
- Harvard Pilgrim Health Care
- Neighborhood Health Plan

In addition, NEHEN has implemented the eligibility transactions with several payers that are not currently members: Blue Cross Blue Shield of Massachusetts, Medicaid, and Medicare.

NEHEN has established a category of affiliate members. Affiliate members are service providers that provide insurance transaction services to healthcare organizations such as physician groups.

MedUnite has contracted with NEHEN as the newest of these affiliates. MedUnite is an insurance EDI service vendor formed by a national consortium of commercial health plans, e.g., Aetna, CIGNA, and Oxford. MedUnite augments NEHEN capabilities by providing regional providers with EDI access to the commercial plans. These plans have subscribers in the region but are not based in the region. Athenahealth.com and HDX join MedUnite as affiliate members.

The monthly volume of transactions supported by the NEHEN infrastructure has grown dramatically over the years, as depicted in figure 3. Volumes have reached over 1 million transactions per month in 2002.

In an effort to improve the effectiveness of NEHEN implementation, a series of discussions and forums have been established, which gather department managers of member operations (e.g., accounts receivable, claims processing, and registration) together to discuss implementation issues and lessons learned.

In the next six months, NEHEN will:
- Develop the implementation guides for the claims transactions
- Initiate pilot versions of the claim transactions
- Initiate a pilot for the remittance transaction
- Explore the use of Virtual Private Networks as a network transport alternative

The Value of NEHEN
The value of any insurance EDI solution is simple to understand:
- It helps trading participants to control or reduce transaction labor and non-labor costs.
- Technology can improve core business processes and administrative workflow, so that even the same number
of people doing the job can find better job satisfaction and devote more of their working day to direct patient or customer service.

- **Patient, member, and provider service** can be improved by reducing the hassle factor and delays that result from fragmented, manual processes and broken workflow.
- **The better data** produced and accessible in electronic form can help payers and providers find and account for money in the reimbursement or revenue cycle.
- **It helps organizations comply with and take advantage of HIPAA.**

On the provider side, members can develop custom interface capabilities or purchase application vendor modules fully integrated with their day-to-day scheduling, registration, admitting, and billing workflow; use the standalone web browser-based NEHENLite; or extract data from their legacy applications and send it to their payers offline, in the background. For the payer, NEHEN technology can be integrated, either in batch or real-time, with core membership and claims systems and with their portal solutions.

Furthermore, when a common and comprehensive tool such as NEHEN is in place among trading partners, performance can be examined, targeted, and communicated on a payer-by-payer, provider-by-provider, or transaction-specific basis. Part of the recommended (but optional) NEHEN implementation methodology at each participant involves modeling the return on investment (ROI) associated with specific implementation projects.

### Case Studies

Organizations are increasingly looking to justify their investment in information technology with a formal assessment of a technology or project’s expected return on investment (ROI). The ROI for insurance EDI, unlike that for many clinical systems investments, is relatively straightforward to quantify. Insurance results are already generally well documented in monetary terms and many in the industry are well aware of measures related to measuring revenue cycle (provider) or administrative cost (payer) performance.

While no NEHEN member to date has established a formal baseline of their performance in these areas and measured and reported progress against it, several have studied the technology’s impact on processing results prospectively, or measured it retrospectively.

One NEHEN member hospital estimated that for an initial investment of $250,000 in eligibility interface development and rollout effort, plus one year’s program management subscription of $72,000, they could achieve ongoing annual savings of approximately $485,000. The largest portions of the hospital’s expected savings resulted from improved collections ($90,000) and reduced labor costs ($395,000) related to claim error rework attributable to eligibility problems. This return equates to a positive ROI in year one, and two-and-a-half to three times ROI over three years.

Similar benefits are available to payers. NEHEN’s payer members frequently cite the avoidance of clearinghouse costs as a benefit of developing direct connection capabilities with their provider network. Even before initial claim submission charges are reduced, cleaner submission as a result of upfront eligibility verification and referral matching can eliminate much of the 10 percent of volume typically estimated to be resubmissions.

Insurance EDI also eliminates phone calls to the health plans’ provider and member call centers and reduces paper claim processing in their service centers. As an example, one NEHEN member plan has estimated that they process over 30,000 claims per month that, on their face value, do not belong to them. Many of these result in resubmission or calls to their provider service center, and ultimately, to frustrated providers and health plan members.
The same plan receives 600 eligibility verification calls on an average day. Besides eliminating the calls related to rework and resubmission, an insurance EDI solution like NEHEN reduces the volume and labor costs associated with initial eligibility calls by letting machines talk to each other in the background or off-hours. By virtue of its efficient technology, NEHEN is also providing these answers in approximately two seconds per query, as compared with one minute for older dial-up alternatives, and three minutes or more (plus labor costs at both ends) for “human” calls.

**Operational Issues**

The degree to which NEHEN (or any insurance EDI capability) delivers organizational value is highly dependent upon the extent to which electronic transactions have replaced manual transactions, the effectiveness of user training, and the quality of any necessary process reengineering. Successful implementation of NEHEN requires addressing four major areas.

**Information systems.** NEHEN technology must ideally be integrated with existing legacy applications. For a provider, these applications include registration, scheduling, and patient accounting applications. The integration efforts may need to support real-time and batch transmission of data. The vendors of these applications can have varying ability and willingness to support the integration effort.

The integration of NEHEN with legacy systems has generated several issues. For example:

- **NEHEN organizations must determine the degree to which the information received from a transaction is to override existing information.** For instance, if the eligibility response from a payer indicates a change in the spelling of a patient’s name, should that spelling replace the spelling in the registration system?
- **Organizations must develop plans to deal with instances in which a trading partner’s applications are offline or exhibiting very slow response times.**
- **NEHEN use can expose a variety of payer and provider application system and information systems operations issues.** For example, eligibility and claims may query different payer databases leading to inconsistent responses.

**Communication, organizational alignment, and accountability.** NEHEN is a tool. To ensure effective use of the tool, the organization must communicate its capabilities, the implementation plan, and the “fit” of that tool with the overall organizational information technology strategy and direction. For example, what is the role of NEHEN versus the service portals offered by payers directly to support insurance transactions?

The use of NEHEN must be part of an overall organizational initiative that addresses revenue enhancement (as a provider) and/or service improvement (as a payer). These initiatives must be organized and the team and person responsible for NEHEN implementation must be identified and appropriately empowered. The organization’s HIPAA preparedness efforts must be aligned with the plans for NEHEN implementation.

As implementation occurs, enhancements and changes in operations will be identified. Forums, committees, and individuals must be created or identified to prioritize, implement, and monitor these improvement requests.

**Performance measures and evaluation systems.** The organization will need to monitor:

- The progress of NEHEN implementation
- The status of efforts to improve revenue capture, transaction cost reduction, and/or service improvements
- Transaction characteristics, e.g., percent of claims denied, percent of visits that had eligibility checked, and percent of referrals that lacked a referral number

These reports and analyses enable the organization to track the degree to which NEHEN use is occurring and ensure that progress toward organizational goals is being achieved. These reports can be used to identify areas that require management attention.

**Jobs, skills, staffing, and training.** Organizations will need to identify and disseminate best practices. These practices will address ways, for example, to integrate NEHEN into legacy systems and clinic workflow. These practices will vary by the type of user setting (e.g., provider vs. payer and large health center vs. small physician office). NEHEN has established forums for organizations to share best practices with each other and organizations will need to establish mechanisms to share practices internally.

Staff will need to be trained in the use of NEHEN and the procedures for addressing a range of NEHEN responses. For example, what should a registration clerk do if the eligibility query indicates that the patient is not covered but
the patient believes otherwise? Registration clerks will also need to understand downstream billing consequences if they fail to adequately determine eligibility.

**Lessons Learned**

NEHEN is a remarkable accomplishment. Regional providers and payers were able to leave their competitive swords and histories of periodic antagonisms at the door and work together to create and manage a shared insurance EDI infrastructure.

Why did this work? Several factors have been critical to the success of NEHEN:

- The NEHEN business model philosophies have been an essential framework for the development and ongoing operation of NEHEN. For example, in more than one NEHEN meeting, a manager will remind the committee of the need to “keep it simple.” Had these philosophies not been as thoughtful, NEHEN might have had to address issues too difficult to overcome.
- The MHDC AHINE project created an environment for regional healthcare CIOs to develop very effective working relationships. This “team building” and mutual respect served NEHEN very well during its early years of discussing complex topics.
- The NEHEN participants understood that the creation and management of NEHEN was largely a political and management challenge. While NEHEN confronted (and still confronts) challenging technology issues, the larger and more complex issues involve areas such as mobilizing several independent organizations, coordinating implementation plans and priorities, and developing consensus on strategies, technologies, implementation guides, and governance. In addition to understanding the nature of the challenge, NEHEN has been fortunate in having NEHEN members and program management staff who were skilled political and management players.
- HIPAA has been a significant catalyst for and contributor to NEHEN. HIPAA “defined” the transaction standards, identified a timetable for effecting insurance EDI, and required regional participants to face this challenge.
- NEHEN members have been very willing to share technologies, innovations, and implementation lessons with each other. While NEHEN is often referred to as a technology infrastructure, it is actually an organization that continuously fosters the regional development of insurance EDI.
- NEHEN has focused on the business case for insurance EDI. This focus has involved identifying, through case studies and measurement, the actual business value of the technology. This focus has led to the formation of business owner meetings and working groups to discuss operational issues and workflow changes.
- NEHEN was formed at a time when few of the regional payers and providers had insurance EDI portals or machine-to-machine initiatives underway or in place. As a result, NEHEN did not conflict with a significant set of extant organizational investments.

NEHEN filled a void and NEHEN discussions did not require that an organization scrap an infrastructure. The one regional exception to this has been Blue Cross Blue Shield of Massachusetts, which had an early generation of connectivity implemented throughout the region. As a result, Blue Cross Blue Shield has been hesitant to join NEHEN.

**Conclusion**

The New England Healthcare EDI Network has been remarkably successful. NEHEN demonstrates the business value of insurance EDI. NEHEN also presents an approach to a regional collaboration between providers and payers to develop the insurance EDI infrastructure.

**About the Authors**

John Glaser, PhD, is the vice president and CIO for Partners Healthcare System.

Greg DeBor is a Boston-based partner for Computer Sciences Corporation.

Laurance Stuntz is a principal healthcare consultant with Computer Sciences Corporation and the technical architect and program manager for NEHEN.
Analyzing Computer-based Patient Records: A Review of Literature

Tricia L. Erstad, MSN, RN

Abstract

A wide-ranging literature review of computer-based patient record (CPR) implementation over the past decade reveals that clinical, workflow, administrative, and revenue enhancement benefits of the CPR outweigh barriers and challenges — but only if healthcare organizations redesign certain work processes. Among other key efforts, organizations must train and motivate users to navigate CPR systems, as well as develop a common structured language. Clinicians who used CPRs found that electronic access to clinical information saves time and provides a thorough and efficient way to manage patient information.

Keywords

Computer-based patient record (CPR)
Electronic medical record (EMR)
Electronic patient record (EPR)
Clinical decision making
Workflow
CPR standards

Note: The terms Computer-based Patient Record (CPR), Electronic Medical Record (EMR), and Electronic Patient Record (EPR) are used synonymously in this discussion, and are used as they are referenced in each work.

In 1991, the IOM published a report recommending the implementation of the CPR by 2001 to improve the care of patients and to reduce waste. The Computer-based Patient Record Institute (CPRI) stated, if providers continue with their current paper systems, they will lack the tools needed to manage the quality and costs of healthcare, the scientific basis for healthcare will continue to be undermined, and healthcare reform will be impeded. Therefore, administrators and other people involved in allocating resources and selecting CPR systems need to be educated about the benefits and complexities of CPR systems.

Ten years after the initial report, CPRs are still under review for cost justification. A survey by Lenhart, Honness, Covington, and Johnson found that only 55 of 329 family practice residency programs (17 percent) were currently using a CPR. Similarly, only 13 percent of HIMSS 2002 Leadership Survey respondents reported having a fully operational CPR system. Tang and Hammond stated that implementing an expansive, robust system is daunting, but the option of operating an integrated delivery system on paper is increasingly becoming a nonviable alternative.

Definition of a CPR System

The CPR is an integration of patient information systems that captures and stores demographic, financial, and medical information from ancillary services such as registration, billing, lab, radiology, pathology, pharmacy, and transcription. The CPR also includes the network that links these systems, databases, interfaces, physician order entry, electronic communication systems, and the clinical workstations. CPR systems are
not simply automated forms of today’s paper charts. Instead CPRs contain patient information, decision support, reference material, and payer information.² ⁵

To reap the full benefits of a CPR, organizations must redesign current workflows and practices to evolve into efficient providers of care. CPR systems are developed to meet the following goals: improve quality of care, reduce organizational expense, and produce a data stream for electronic billing.⁵ ⁶ The CPR meets these goals through workflow automation, connectivity, and data mining.⁸

The CPR’s definition concurred with the other researchers, but added that the CPR provides protection of patient and provider confidentiality, has a defined vocabulary and standardized coding, produces documentation as a by-product of patient care, connects local and remote systems, and provides electronic support for secondary users (payers, policymakers, researchers).¹ Unfortunately, most CPR systems are unable to offer all of the components defined by the CPRI because “the technology is too complex and too expensive, doctors won’t use computers, and standards don’t exist.”⁹ The problems associated with CPR definitions are discussed in the barriers and challenges section of this discussion.

**Benefits**

The advantages associated with implementing CPRs are well documented and are straightforward. The difficulty comes with placing a dollar figure to these advantages; consequently, few organizations have published studies describing the actual costs and benefits attained from implementing CPRs.¹⁰ ¹¹ The benefits associated with CPRs are organized into four categories: clinical, workflow, administrative, and revenue enhancement. Renner¹² states that measuring all the benefits associated with CPRs is virtually impossible, and that it is probably safe to select those that can make the greatest financial difference, and incorporate them into a financial model.

*Clinical benefits.* Clinical benefits seen after implementing a CPR include: better access to the chart, improved clinical decision making and disease management, enhanced documentation, simplified patient education, and increased free time to spend with patients, accompanied by improved perception of care and quality of work life. These benefits ultimately result in better delivery of patient care.⁷ ¹⁰ ¹³-¹⁵

First of all, implementing CPR systems improved access to the patient chart. CPRs give staff access to the medical record, and eliminated the need for providers to locate and pull paper charts for patient information to answer questions or return telephone calls.¹ ³ ¹⁵ ¹⁸ Electronic chart access was invaluable for telephone triage personnel and chart auditors, and eliminated problems associated with “the lost chart” because it was available from any workstation.¹¹ ¹⁹

To reap the full benefits of a CPR, organizations must redesign current workflows and practices to evolve into efficient providers of care. CPR systems are developed to meet the following goals: improve quality of care, reduce organizational expense, and produce a data stream for electronic billing.⁵ ⁶ The CPR meets these goals through workflow automation, connectivity, and data mining.⁸

The CPR’s definition concurred with the other researchers, but added that the CPR provides protection of patient and provider confidentiality, has a defined vocabulary and standardized coding, produces documentation as a by-product of patient care, connects local and remote systems, and provides electronic support for secondary users (payers, policymakers, researchers).¹ Unfortunately, most CPR systems are unable to offer all of the components defined by the CPRI because “the technology is too complex and too expensive, doctors won’t use computers, and standards don’t exist.”⁹ The problems associated with CPR definitions are discussed in the barriers and challenges section of this discussion.

**Clinical benefits.** Clinical benefits seen after implementing a CPR include: better access to the chart, improved clinical decision making and disease management, enhanced documentation, simplified patient education, and increased free time to spend with patients, accompanied by improved perception of care and quality of work life. These benefits ultimately result in better delivery of patient care.⁷ ¹⁰ ¹³-¹⁵

First of all, implementing CPR systems improved access to the patient chart. CPRs give staff access to the medical record, and eliminated the need for providers to locate and pull paper charts for patient information to answer questions or return telephone calls.¹ ³ ¹⁵ ¹⁸ Electronic chart access was invaluable for telephone triage personnel and chart auditors, and eliminated problems associated with “the lost chart” because it was available from any workstation.¹¹ ¹⁹

**“CPRs improved clinical decision making and disease management through enhanced integration of treatment outcomes and reminders.”**

Second, CPRs improved clinical decision making and disease management through enhanced integration of treatment outcomes and reminders. Siwicki²⁰ stated that physicians are required to retain an unmanageable amount of knowledge to deliver consistent care to patients.

Tierney, Overhage, and McDonald²¹ found that variations in treatment that cannot be explained by differences in patients have encouraged the wider use of practice guidelines in an attempt to reduce variation, increase healthcare quality, and lower the costs of care.

Khoury²² and Tierney et al²³ suggested that the EMR might be the only practical way to apply practice guidelines while documenting consistent to the level of service provided, and eliminating problems associated with “the lost chart” because it was available from any workstation.²⁴ ²⁵

Third, CPR tools ensured each note was complete, helped standardize chart quality, and minimized errors. Charts were legible and organized, visits were documented consistent to the level of service provided, and signing was more convenient when providers were able to view and sign from any workstation.²⁶ ²⁷

Fourth, patient education was simplified because providers didn’t need to
Slowinski reported a reduction in nurse availability for providers. Dassenko and forms in different office settings. The information again and again on paper frustrated by having to record the same ing the CPR, patients were no longer drug recalls.

Workflow benefits resulting from CPR implementation include improved data intake, reduced transcription costs, reduced labor costs, and improved communication and better management of referrals, lab results, prescriptions, and drug recalls.

The first workflow benefit was improved data intake. After implementing the CPR, patients were no longer frustrated by having to record the same information again and again on paper forms in different office settings. The CPR had all of that information readily available for providers. Dassenko and Słowski reported a reduction in nurse intake time from 35 minutes to 20 minutes for initial office visits and from 35 minutes to 15 minutes for return visits at University of Wisconsin Hospital and Clinics. They attributed this greater efficiency to eliminating collection of redundant information, and enhancing documentation with assessment screens that display a patient’s history, vital signs, weight, and medical problems.

Renner cited a study from Duke University Medical Center where the time for one office visit was reduced by 13 percent for physicians and one minute for each pre-exam interview for the nurses. The time saving was found in documentation and was attributed to faster pre-encounter chart reviews and post-encounter recording of data in the chart. The physician’s time with the patients stayed the same.

Second, when clinicians completed their documentation at the point of care, there was no need for transcription at the end of the day. Mildon and Cohen valued this as an estimated savings of $300 to $1,000 per month, per physician. For example, in a six-provider practice, transcription took 150 hours per week with a turnaround time of seven days before implementation of a CPR. After implementation of a CPR, transcription time decreased by one-third, turnaround time decreased to one day, and the practice was able to add two providers.

Fourth, CPRs have a built-in e-mail system, which results in improved communication by allowing staff the ability to message each other from any workstation. The CPR coordinated workflow communication in the business office and patient care departments. For example, the business office e-mailed the physicians when payers needed certification and justification for therapies, and physicians responded in a timelier manner.

Finally, CPRs improve managing referrals, lab results, prescriptions, and drug recalls. Referrals that are submitted electronically extract the essential data from the CPR, eliminating the need for staff to manually summarize patient data to file with the recommendation. MedicalLogic clients reduced their turnaround time for referrals from one day to less than one hour. They also reduced their turnaround time for posting lab results from an aver-
**Original Contributions**

Dassenko and Slowinski, Davis, Marietti, and Renner also found that claims processing was more efficient and complete with CPRs because of improved access to the chart and structured and encoded data. This resulted in quicker and less expensive bill production, and ultimately facilitated cash flow because bills were paid quicker when they were issued sooner. Timeliness in issuing bills also avoided penalties. Dassenko and Slowinski1 and MedicaLogic2 reported that in the past, substantial charges were written off because a bill was not submitted to a secondary payer on time. Before the CPR was implemented, a bill requiring information from an off-site folder might have waited two to three weeks for completion; in contrast, online information access allowed the bill to be in the mail within two or three days.

Another claims processing advantage cited by Dassenko and Slowinski and MedicaLogic was improved cash flow as a result of more complete billing. With the CPR, account representatives were able to view an organized chart and search the entire chart by a key word. From their workstations, patient accounting representatives accessed and printed such detailed information as physician notes and operative notes required by payers. Before the CPR, patient accounting representatives had to call each department for a photocopy of such information, and if too much time had elapsed, the patient accounting representative was instructed to submit the bill without the necessary information. If the payer denied the payment, the department that failed to provide the documentation was sent a copy of the denial, and asked to send the required document.3

Finally, Dassenko and Slowinski found that customer service was enhanced because patient accounting representatives were more available for questions and because questions were answered more completely and easily with online access to patient files. Most patient calls are very basic, and do not require the expertise of a patient accounting representative. If the information is organized and available online, other staff can handle these questions while patient accounting representatives can handle the more complicated problems.

**Revenue enhancement.** Milden and Cohen stated, “There is more to money than saving it. CPRs also can enhance revenue.” CPRs increase revenue through effective management of information at the point of care and in the billing office. Revenue enhancement depends on factors such as more effective health maintenance programs, better accuracy of coding, and improved administrative and workflow functions.

CPR systems enhanced revenue by increasing health maintenance visits. CPR systems provided tools and generated reminders based on patient age, gender, diagnosis, or procedures, and each time a chart was accessed, the CPR alerted the provider about overdue health maintenance issues.21 In fee-for-service environments, health maintenance functions offer the potential of increasing the volume of services while ensuring better care for patients.23 Renner cited a study that found that the annual cost of all patient care was far lower for patients assigned to a CPR group ($943) than those assigned to a paper chart group ($1,539). The researchers credited better preventive care and health maintenance given to the group whose records were kept electronically.

CPR systems also generated revenue through improved coding. According to industry estimates, the amount of money lost by inaccurate coding ranges from 3 percent to 15 percent of total practice revenue.20 Clinicians are conservative about coding due to the additional documentation burden and fear of an audit. CPRs assisted in recapturing this lost income by making it easier for providers to document visits and by helping them to code at the appropriate level.20 21

**Medical Economics** magazine estimated a $40,000 to $50,000 annual loss to physicians who routinely down-code one “E and M” (Evaluation and Management) level. CPRs helped with “E and M” coding and enabled providers to code correctly, with full supporting documentation. Mohr found that the use of dictation templates improved revenue capture.
by ensuring that documentation was adequate for associated charges.

Finally, many of the process improvements made with CPRs in administration and workflow discussed in the previous sections ultimately produce revenue enhancement. Benefits included improved claims processing, greater customer service that resulted in increased market share, and efficiencies that allowed practices to grow without increasing staff.

Barriers and Challenges

Despite all of these benefits, testimonies, and recommendations, CPRs are not a standard in today’s healthcare systems. Even though the IOM’s recommendation to implement CPRs is over 10 years old, it is evident that CPR technology is still a hot topic for discussion when browsing through current healthcare technology and management journals. The following barriers have kept healthcare leaders discussing CPR technology instead of adopting it: cost, leadership, ROI, vendors keeping up with users’ needs, and deficits in the following categories: public policy, standards, security, and a true definition.

First of all, cost has kept organizations from implementing CPR systems. These costs can be organized into the following categories: software, hardware, infrastructure development and maintenance, implementation, education, planning, and administration. Software costs include development or purchase of workstations. Infrastructure development and maintenance costs include servers, interfaces, workstations, network cables, network maintenance, and help desk operations. Planning costs include development of an implementation plan, identifying measurable outcomes, and choosing meaningful metrics and goals, while implementation costs include training, overtime associated with entering patient data, business disruption during transition, employee resistance to change, and lost productivity. Administrative costs include time and commitment to make the project succeed and ensuring that the CPR product meets credentialing requirements.

When compared with other sectors of the economy, the healthcare industry is not committed to interactive information exchange. Drazen suggested that leadership was probably a more significant barrier than cost because, in the past, healthcare leaders have raised capital for essential business initiatives such as major building programs, acquiring a physician network, or starting up a managed care organization. This amount of capital is on the same scale as an EMR. The 13th Annual HIMSS Leadership Survey sponsored by Superior Consulting reported that CPR implementation came in seventh of eight top IT priorities for 2002.

In addition, institutions have not been able to produce the ROI promised by vendors. Many factors that have been figured in vendors’ ROI are dependent on difficult-to-change processes like point-of-care nursing documentation, physician order entry, and structured physician progress notes. For example, physician order entry is essential for decision support and medication management, and structured progress notes are necessary for transcription elimination and database building. ROI is difficult to calculate because each organization has its own business objectives and many of the benefits are qualitative rather than quantitative. It is also difficult to establish the baseline costs of doing business manually to compare to the post-CPR implementation data.

Another challenge is that vendors have not kept up with organizations’ needs for growth. Vicki Bosch, project leader of clinical informatics at MeritCare Health Center in Fargo, North Dakota, stated that, as users became more comfortable with the EPR, they started identifying ways to improve and refine the tools for clinical guidelines and health maintenance. Their primary EPR vendor didn’t have solutions for these improvements, but a secondary vendor had put resources into refining the tools for an additional expense. Organizations that have implemented EPR systems and have contacts with specific vendors want to see product improvement without an increase in costs (personal communication, April 12, 2002).

Next, Drazen stated that a lack of government support is a major issue holding up CPR implementation. The recommendation in the IOM report was to establish the CPRI and to fund it as a public/private partnership. Unfortunately, the federal government did not contribute financially to CPR implementation projects. In addition, the federal government has never addressed the issue of CPR standardization. Without standards and structured data definitions, computer systems are not guaranteed to interface easily with each other, and databases are not easily developed. Most individual departments within a healthcare system have already invested in computerized patient information systems; however, these systems are isolated and do not communicate well with one another. Getting these systems to interface is one challenge facing EMRs. Because of this, McDonald suggested focusing on interfacing solutions in the form of standards (i.e., IP, HL7, ASTM, DICOM, LOINC, SNOMED) rather than EMR solutions to accelerate EMR deployment. The work required to interface with the many different island systems and regularize their data has been more than most can afford, and no individual CPR supplier, healthcare enterprise, or payer has the ability to create national standards at this time.

Data security continues to be an ongoing challenge. Bergman found that politicians, consumer advocates, and the general public have voiced concerns about risks to the privacy and confidentiality of patient information. However,
when compared with the security of the paper chart, the EMR's electronic audit trails and passwords actually improved internal security.

Dassenko and Slowinski\(^6\) stated that each EMR's subsystem contains a user profile defining the organization, user name, title, job function, and work area. This information is used to determine what information can be accessed and for what patient populations an individual is authorized. In addition, Dassenko and Slowinski\(^6\) reported that detailed records were created each time a user accesses certain categories of patient data, and that these access logs became part of a patient's permanent computer-based record, thus ensuring a reasonable level of confidentiality and discouraging inappropriate use. The security system not only creates access trails, but also documents patient chart movement and print requests.\(^5\)

The EMR may be more secure for internal breaches of confidentiality, but must also be protected from external breaches such as hackers, who could potentially enter the EMR from an off-site location and download volumes of confidential information. Firewalls and encryption software are methods used to protect patient data from these violators.\(^9\)

Finally, a universal definition of the CPR has not yet been developed.\(^4, 8, 32\) Conflicting visions from CPR vendors, the clinical informatics community, the CPRI, the IOM, and the healthcare community have kept these individual groups from agreeing on an accepted definition and a mutual goal. As a result, Tang and Hammond\(^4\) stated that CPR implementation has been impeded because vendors do not know exactly what to supply and users have had a difficult time selecting a system that meets their needs.

Gailliot\(^8\) suggested redefining the CPRI's vision by scaling down and aiming for a less perfect CPR, thereby increasing implementation rates. Then organizations could focus on implementing the easier components such as transcription, lab results, patient schedules, and ICD-9 capture. By eliminating difficult-to-implement features such as structured data and decision support, organizations can aim for 100 percent provider participation, and will meet the multiple access goals for sharing information.

Drazen\(^6\) suggested focusing on supporting care processes that produce clear and valuable benefits rather than focusing on a theoretical ideal.

**Conclusion**

Clinicians who used CPRs recognized two axioms: First, electronic access to clinical information saves time. Second, electronic access provides a thorough and efficient way to manage patient information. With CPR systems, comprehensive information can be located and presented in a way that is relevant to the task at hand.\(^5\)

"**When compared with the security of the paper chart, the EMR’s electronic audit trails and passwords actually improved internal security.”**

The obstacles identified in the barriers and challenges section have thus far been insurmountable, but the considerable achievements identified in the benefits section of this discussion suggest that the advantages are well worth the effort. As Lenhart et al state, “Success comes at the price of considerable effort, persistence, and optimism, as well as dedicated leadership.”\(^9\) (p. 114) Some organizations that invested in early CPR systems are struggling to show the qualitative benefits promised by vendors because an electronic version of current work processes is not cost effective.\(^8, 15, 24\) “If the ROI were a function of the information tool itself, the financial benefits would be experienced universally.”\(^23\) To get the most value out of a CPR, healthcare organizations must reengineer the following work processes to make full use of the system:

- Healthcare organizations must first train and motivate their users on how to navigate and operate the CPR tools. To optimally use the CPR it must be implemented from registration through billing, thus allowing the organization to realize full potential benefits across the delivery system. These benefits include clear, concise, and comprehensive documentation, greater efficiency, care consistent with best practice guidelines, and improved claims processing.
- When providers begin to function more efficiently, they will be able to spend more free time with their patients and increase their clientele. Spending more time with patients could improve customer satisfaction and boost market share, while seeing more patients could increase revenue.
- Organizations must come to an agreement on a new CPR and identify methods to reduce organizational waste. For example, malpractice carriers could be asked for reductions in premiums due to improved quality of care secondary to decision support tools. Administrators also must restructure jobs eliminated by the improved access and workflow benefits, and reduce or eliminate transcription services if encounter forms are working well.

It is difficult to measure the economic value associated with less tangible benefits such as higher quality of care, patient service, provider and employee satisfaction, and competitive advantage. It is even more difficult to allocate necessary resources and commit to institutional change when the paper chart is “getting the job done,” even if it is not in the most efficient style.

However, Carlon\(^40\) suggests that all providers should embrace the EMR to deliver safe medical care. This is an important topic after the IOM\(^4\) released
its widely debated report on medical errors in 2000. The information in the CPR can reduce medical errors to avoid dangerous, sometimes lethal, mistakes. If organizations can’t show that CPRs have a positive ROI, they may decide that the CPR is just another expense of running a business. The expense is to improve patient safety and reduce medical errors and is rooted in the most basic and ancient obligation of the medical arts: First, do no harm. The CPR contributes to the ultimate goal of delivering effective care while improving patient safety.

About the Author
Tricia L. Erstad, MSN, RN, is a registered nurse with a master’s degree in nursing informatics.

References


30Medical Economics, August 24, 1998.


Advancing the State of Data Integration in Healthcare

Joyce Sensmeier MS, RN, BC, CPHIMS

ABSTRACT
There is growing consensus that clinical information systems will provide the bridge to advancing the integration of information systems in healthcare. In spite of developments in technology that have enabled some organizations to integrate clinical information with care delivery in ways that can promote safer, more efficient patient care, the majority of healthcare has yet to achieve this goal. Why aren’t we there yet?

KEYWORDS
Computer-based patient record (CPR)
Data integration
National health information infrastructure (NHII)
Patient safety

More than a decade ago, the Committee on Improving the Patient Record, convened by the Institute of Medicine, set a goal to make the computer-based patient record (CPR) a standard technology in healthcare by 2001. The committee defined the CPR as "an electronic patient record that resides in a system specifically designed to support users by providing accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to medical knowledge, and other aids." To date, this goal remains a vision as the information revolution has eluded much of the U.S. healthcare system, and the high expectations of these visionaries remain largely unfulfilled. A decade-long study of integration in leading Integrated Delivery Networks (IDN) across the nation reports that information systems continue to be inadequate in the critical function of physician and clinical integration. Study authors encourage IDNs of the future to expand the focus of their information systems from business processes to clinical care and quality management.

An update to the original IOM report in 1997 concluded that computer-based patient records are an essential technology for healthcare and that electronic records should be the standard for all healthcare records. However, few comprehensive information systems and products exist that integrate information across the entire continuum of healthcare delivery.

In spite of developments in technology that have enabled some organizations to integrate clinical information with care delivery in ways that can promote safer, more efficient patient care, the majority of healthcare has yet to achieve this goal. Most healthcare information system vendors are working to extend their products to cover the needs of integrated delivery systems. Yet, information systems in many organizations are a patchwork of applications on disparate platforms that have evolved over time — not a single, seamless, integrated application.

Current Market
It is clear that while there is a great deal of progress to be made regarding the current status of data integration, momentum is certainly building. According to the 13th Annual HIMSS Leadership Survey,
which reports the opinions of IT executives from healthcare provider and vendor organization across the U.S., the second highest information technology priority for vendors is integrating systems in a multi-vendor environment.7

Respondents also identified the CPR as the second most important application area to healthcare clients over the next two years. The percentage of CPR implementations over the past three years has grown to 13.5 percent, and more than half of senior executives reported that CPRs were important to their facilities, up from 45 percent in 2001. Study results as to the status of current installations demonstrate that 32 percent of providers are planning to install CPRs this year and 23 percent are developing a plan (figure 1). More rapid growth is evidenced by recent statistics, which describe the acute care installation rate for CPR vendors at 35 percent of the market, with sub-acute care settings slightly ahead at 36 percent.8

Why aren’t we there yet? How is it that something of such importance, which has captured the attention of industry leaders, is not more widely available? One key issue is the lack of integrated systems. Islands of data exist within specialties such as radiology, cardiology, and pharmacy, and their unique requirements are difficult to connect.9 For example, radiology is dependent on imaging as a diagnostic tool, and typical healthcare information systems cannot support integration between digital images and other structured data formats. Cardiology data includes three-dimensional waveforms, which are accessible only via stand-alone systems. Pharmacy systems are being connected with medication management systems, but the implications for workflow and the lack of standardization for this type of documentation cause integration to be a difficult challenge.

Lack of standardization is another key issue. In the banking industry, stakeholders agreed upon standards that would support a seamless system of data and information that can be accessed via automated teller machines worldwide. While many standards exist in healthcare, there is frequently lack of agreement on use of those standards. The United States still lacks national standards “for the protection of health data and the capture, storage, communication, processing, and presentation of health information.”10 Additionally, lack of a unique patient identifier limits our ability to access a patient’s records across different providers and care settings, thereby limiting caregivers’ knowledge of the patient’s health history.

Progress is being made, however, in the development of multidisciplinary language infrastructure. Through collaboration that crosses boundaries of disciplines, work settings, organizations, nations, and languages, nursing terminology standards have made enormous progress since the first Nursing Terminology Summit in 1999. The mission of this Summit is to promote and support the development, evaluation, and use of a reference terminology for nursing and its integration with healthcare applications and other healthcare terminological systems.

A number of ongoing initiatives promise to contribute to the development, evaluation, and use of standardized terminology. These include work by the Systematized Nomenclature of Medicine (SNOMED), Health Level 7 (HL7), Logical Observations Identifiers Names and Codes (LOINC), the International Classification of Nursing Practice (ICNP), and others.11

The impact of HL7 communication, American Society for Testing and Materials (ASTM), SNOMED, and International Organization for Standardization (ISO) standards are far reaching. Utilization of existing standards such as HL7 and Digital Imaging and Communications in Medicine (DICOM) has enabled initiatives, such as Integrating the Healthcare Enterprise (IHE), whose technical framework has successfully linked the radiology systems environment, to begin to deliver on the promise of true cross-system integration.12 The
availability of such national and international standards, combined with the policy and economic forces, results in a scenario that lays the groundwork for the future advancement of data integration.

Other key barriers to integration are the complexity of healthcare information systems and their cost. Both vendors and providers have identified lack of financial support as the most significant barrier to implementation of information technology.13 Competition for resources includes the recent implementation of Year 2000 modifications, upgrades, and systems replacements. Currently, HIPAA compliance is the number one priority for healthcare as the Health Insurance Portability and Accountability Act of 1996 nears its first implementation deadlines. Cost estimates for an electronic patient record can range from $25,000 for solo practitioners to millions of dollars for hospitals, and tens of millions for large healthcare delivery systems.14 In order to justify these costs, a compelling business case is needed.

The ability to provide evidence of return on investment (ROI) for information technology is becoming increasingly feasible with evidence that the “most wired” healthcare organizations have better control of expenses, higher productivity, and more efficient utilization management.15 In spite of these findings, it is noteworthy that not all of these technological advances have been truly leveraged by healthcare providers, information systems developers, and vendors. Compounding the problem is the fact that the typical healthcare organization spends approximately 2 percent of its capital budget on information technology, as compared with an average of 10 percent in other industries.16

Making It Happen

Many experts agree that to advance data integration, external forces such as government regulations are necessary, rather than the simple recognition that technology is inherently useful.17 One example of a mandate that is needed is the development of a national health information infrastructure (NHII). As defined by the National Committee on Vital and Health Statistics, this structure would consist of a “set of technologies, standards, applications, systems, values, and laws that support all facets of individual health, health care, and public health.”18

Just as the development of the U.S. highway system laid the foundation for interstate travel and commerce, the NHII will provide the “rules of the road” for the connection of distributed health data and integration of systems within the framework of a secure network.19 Successful implementation of an electronic patient record at two hospitals in the United Kingdom provides an opportunity to evaluate what went right. The following five critical success factors were evident at both sites:20

- **Clinical (not just medical) focus.** Clinicians and managers envisioned that true integration of all clinical data on a computer system was the ultimate goal. They believed that implementing a system that assists clinicians in their daily workflow would achieve far greater benefits than introducing a system that simply collects data.
- **Routine clinical use of the systems.** By involving clinicians from the outset and encouraging their input into each facet of system development, a high degree of “clinical ownership” was obtained. This process enabled clinicians to trust that the system was truly designed to meet their needs.
- **Executive leadership and sound management.** Not only were executives involved with weekly meetings at every stage, but members of the project team had direct access to the CEO and other senior executives throughout the implementation. Recognizing the disruptive impact that change would create, these leaders maintained the expectation that while this process wasn’t easy, the system would be installed and used. They didn’t hesitate to make the difficult decisions that required people to change their ways.
- **Nurturing of a new culture.** Both organizations created a culture of improvement that encouraged clinicians to use the system’s expanding knowledge base to evaluate the effec-
tiveness of their care delivery. Understanding how important it is for clinicians to accurately and efficiently deliver patient care, the organizations provided new tools and methods to enable them to take full advantage of the system’s capabilities.

- **Stability and a mature management-clinical partnership.** The length of employment of key executive leaders and project champions provided the continuity and stability necessary for long-term success of the project. As a result, the implementation benefited from their organizational insight and guidance.

Another opportunity for advancing data integration is leveraging technology to enhance patient safety. One mechanism for achieving the goal of error reduction is by use of a CPR.21 According to Gartner Inc., CPR systems can be defined by five separate generations based on their progressive capabilities. In order to estimate the error reduction potential of different CPR generations, the types of errors reported in the 1999 IOM report were analyzed and combined with the minimal features required for each.22 As one progresses from Generation 1 CPRs, which include access to information in a clinical data repository from a single location, to Generation 5 CPRs, which include sophisticated clinical decision support systems that incorporate evidence-based practice, the basic infrastructure will be in place to address preventable errors (figure 2).

**Conclusion**

There is growing consensus that clinical information systems will provide the bridge to advancing the integration of information systems in healthcare. Clinical systems offer new opportunities to further improve the quality and safety of care by ensuring that the most recent information is available for clinical decision making, improving evidence-based practice, and enhancing communication among providers.

In the 2002 HIMSS Leadership Survey, clinical information systems were identified as the most important application area over the next two years by both provider and vendor respondents.20 Enabling access to relevant patient information from multiple settings and encounters at the point of care will have a significant positive impact on the quality, consistency, and timeliness of data and information. Incorporating the capability of decision support and access to knowledge resources will enable us to reap the benefits of the information revolution and attain the vision of optimal healthcare in the 21st century.

**About the Author**

Joyce Sensmeier MS, RN, BC, CPHIMS is director of professional services for the Healthcare Information and Management Systems Society.


---

**References**

2. Ibid.
5. Ibid.
17. Ibid.
The healthcare industry has experienced a broad spectrum of market influences in recent history. Among these are post-9/11 security concerns, continuing pressure to cut costs and consolidate infrastructures, and the need to integrate large disparate systems as mergers and acquisitions continue to move the market. Add to these looming HIPAA deadlines, ever increasing pressure from patients to access their records, partners demanding automated e-business integration, and the ever present need to reduce administration costs of IT infrastructure.

Enterprise architectures are heterogeneous environments where many applications often use different technologies and platforms. Many of these systems are constantly evolving, thus complicating implementation and maintenance of the integration solution. Managing this complexity is difficult and expensive, often leading to overly complicated solutions with lengthy implementations. Approaches to health data integration have traditionally ranged from simply making two disparate systems work together to trying to interconnect the vast sphere of health data in a magical "health web." The truth lies somewhere in between.

By combining several traditional approaches to integration (e.g., using industry standards, implementing hub-and-spoke methodology) with newer innovations, healthcare organizations in both the public and private sector are finding that problems such as HIPAA remediation and providing secure online access to patient records can be resolved by leveraging integration projects across the enterprise.

Health Data Integration is an Enterprise Problem

The number one problem with integration projects is escalating costs. Most integration projects are typically undertaken in order to provide specific solutions to specific problems. For example, HIPAA remediation projects, those that deal with taking information from legacy healthcare information systems and transforming that data into HIPAA-compliant data sets so that they may be transported to other HIPAA-compliant systems, is typically viewed as a single project.

In fact, there are a host of software vendors with Enterprise Application Integration (EAI) software that offer pre-built HIPAA solutions that combine software adapters for HIPAA-compliant data types, integration translators that use...
those adapters to translate data from legacy systems to HIPAA formats, visual modeling tools to help design the transformation process, and consulting services to implement the solution. Many healthcare organizations have already solved this particular problem by buying software and consulting services to extract, transform, and exchange information between internal and external systems in a HIPAA-compliant fashion.

The costs associated with this type of integration project vary greatly depending on the number of systems involved, the amount of information to be exchanged, and the frequency with which data exchange must take place. The hidden costs are exposed, however, when organizations realize that they haven’t considered additional systems, or when factions within the organization have purchased similar software from other vendors to handle a similar set of technical requirements in another area within the enterprise. In either case, initial costs represent a mere fraction of the total information technology costs, not to mention the human capital associated with such complex projects.

Some organizations have already discovered, however, that solving this challenge is no different than solving any other integration problem. Yet, many of these same organizations still face integration problems. Although they have met deadlines for HIPAA requirements for some systems, they have not been able to solve ongoing internal integration problems, the kind that mean real dollars to healthcare organizations, such as:

- Sharing information with billing systems and clinical systems
- Sharing data from legacy billing systems to new Enterprise Resource Planning (ERP) and financial packages
- Providing access for patients, doctors, and other healthcare professionals

In addition to traditional integration problems, as the threat of biological and chemical attacks becomes more ominous, the ability to quickly share information with other institutions about epidemics, symptomatic trends, and emergency response is also driving organizations to consider new strategies that not only integrate disparate systems, but do so faster than ever before.

The potential cost of tackling such challenges can be staggering to many organizations. In the end, the projects that get done are those that (1) can be justified by direct impact on additional revenue, (2) can show significant cost savings and extremely fast return on investment, and (3) meet regulatory requirements. Although traditional approaches such as EAI implementations can greatly reduce the time to complete integration projects, those approaches are still too costly and too slow to continue to meet emerging requirements.

**“Problems such as HIPAA remediation and providing secure online access to patient records can be resolved by leveraging integration projects across the enterprise.”**

**Federated Hubs and Healthcare Transaction Repositories**

The success of EAI software as well as Business-to-Business (B2B) integration has been largely due to the hub-and-spoke methodology. This approach to integration offers significant advantages over traditional point-to-point systems integration by providing a hub that offers three basic functions: (1) receiving data in a variety of formats, (2) transforming that data to a variety of other formats, and (3) sending data to other systems in a variety of formats.

The hub uses technologies such as Extensible Markup Language (XML) to describe data universally, allowing it to send data to virtually any system. Typically, the hub-and-spoke methodology relies on software adapters to access specific systems or to send information to specific systems. For example, an EAI hub might have adapters that access ERP systems from SAP or mainframe-based CICS applications, or the adapters might produce HIPAA-compliant XML data sets.

Typically, integration projects tend to have fewer, static application-to-application (A2A) integration points, B2B-driven integration must typically accommodate many-to-many integration among a potentially ever changing list of parties.

A federated hub approach is designed to provide a hub that accesses information across all potential integration points from within and outside an organization. Although underlying technologies are similar in both instances (transformation engines, visual modeling tools, messaging), other features are specific to either EAI (automated workflows of key business processes) or B2B (registration and management of trading partners).

Using a federated hub, organizations can expect to leverage a common integration platform across not only their internal integration projects, but to extend that platform to provide timely information sharing when needed, such as during a crisis. One of the keys of the federated hub is its ability to also integrate with other hubs. As information sharing becomes more prevalent, especially within the public sector, hub-to-hub communication will most certainly become a requirement.

Another emerging trend in health data integration is the concept of using operational repositories to consolidate information from multiple systems. In theory, these repositories would contain near real-time healthcare transactions that would provide health professionals with a single consolidated view of all information across the organization. Unlike a data warehouse, where vast amounts of data are collected over long periods of
time, or data marts, which tend to focus only on a single subject or knowledge area, the healthcare transaction repository is meant to provide a global view of information in near real time.

In practice, tracking an epidemic, locating available hospital beds in an emergency, or monitoring an outbreak after a bioterrorism event are all high-profile candidates for such systems. However, there are other more mundane uses, such as taking a snapshot of performance across a health system, looking into a supply chain in near real time, or monitoring claims processes on a daily basis.

Although the concept of an operational intelligence repository is not a new idea, it has met with limited success in the past. One of the primary reasons is that most implementations start with the goal of providing operational intelligence, but fall short and become failed data warehouses. The leading cause of failure can be attributed to faulty data population. Ultimately, the success or failure of the operational intelligence system depends on the validity and timeliness of the data.

The process for populating such systems usually mirrors that of traditional data warehousing projects. Using extract, transform, and transport (ETT) processes, organizations can access multiple systems and transform data to be placed into the operational repository. However, most ETT tools were designed with the data warehouse in mind and don’t take into consideration the dynamic nature of an operational repository.

Enter the federated hub or integration hub. In addition to providing both EAI and B2B integration, the third key to successful health data integration is using the federated hub not only as a means of facilitating system-to-system communications, but as a means of populating a healthcare transaction repository in near real time. Using technologies common to integration hubs, such as asynchronous messaging, transactions that pass through the hub can easily be applied to databases as well.

By adding this dimension to the federated integration hub, organizations can truly get a near real-time view of what is happening within their organization at any moment. Using this approach makes it possible to meet not only continuing integration requirements, but to provide up-to-date operational intelligence to stakeholders within the organization, and to key partners outside the organization across both the public and private sector.

### Technical Requirements for an Integration Hub

The technology to implement an integration hub that fully utilizes both cutting-edge integration facilities and an operational repository has existed for some time. In some ways, this makes the decision to implement such a system much easier. However, just as with any new investment in technology, a number of factors that must be weighed before

---

**“Ultimately, the success or failure of the operational intelligence system depends on the validity and timeliness of the data.”**

---

be complemented by process automation software.

- Business intelligence — Without the ability to populate an operational repository and access information, the solution is only partly successful.
- Management facilities — Tools to manage the complex hub environment should be mandatory as part of any solution.
- Security and privacy of data and communications — A top priority for any system that will handle sensitive data such as patient records must include stringent security evaluations for data in motion, as well as data at rest, in a repository.

The federated hub is the starting point for any good integration architecture. Supporting both internal application integration as well B2B integration is something many software products are quite capable of doing. Other factors that should be weighed, however, include performance, scalability, and portability. A successful hub will truly grow to support the entire enterprise. In a small organization that might mean thousands of transactions are coursing through the hub every day. But in mid-size to large organizations, the transaction loads handled by an integration hub could reach the tens of thousands or even millions per day.

Software that can grow to meet that demand, and perform to meet expectations, is important. Benchmarks are one way to ensure that vendor claims are accurate. However, it’s important to understand just what benchmarks are saying. It is important to focus an analysis of the software not only on the number of transactions that are moving through the hub, but also on the type of transactions. Evaluating whether or not those transactions are simple or complex will go a long way toward determining just how the hub is performing under real workloads. It will also help an organization compare their requirements to those being measured in the benchmark.

Another key to performance and scalability is the availability of multiple hardware platforms. Limitations on growth...
that are dictated by choice of hardware can drive integration costs up by forcing hardware upgrades either at the beginning of a project to account for future growth, or mid-way through a project due to poor planning or increased demands. In either case, lack of flexibility can drive the cost of the project past the return. By providing support for multiple operating systems, software vendors who support multiple environments let the healthcare organization make the ultimate decision about when to upgrade hardware. The choice to go with a small initial hardware purchase and add nodes to a cluster later, versus the decision to plan for growth or use existing enterprise-class hardware platforms should be left open to discussion based on the organization’s skill sets, budgets, and other factors.

Once a hub architecture has been evaluated, connectivity becomes the next decision point. Many vendors offer adapters to third-party software packages, such as SAP, Oracle, Peoplesoft, and others. Still other vendors offer connectivity adapters to mainframes and legacy systems. Some vendors have moved to support web services as their main integration technology. In any case, the decision to choose an integration software platform should include the ability to select from a wide variety of adapters that will meet the needs of the healthcare organization.

For example, a vendor that supports not only a federated hub, but provides multiple adapters such as HIPAA adapters, would have a decided advantage over vendors who do not offer such support. The success of the project will in large part be determined by how fast it can be operational. Leveraging pre-built adapters will help organizations meet their implementation goals much faster than those organizations relying on custom code.

The transformation process, the process for taking transactions from one system and transforming them so that another system can receive that transaction, is largely a manual process. This process must be designed so that transactions can be automated and passed from one system to the next.

The help of visual design tools is crucial during this step. These design tools should not only allow the designers to visualize how a transaction from one system will interact with the next, but they should also provide advanced functionality, such as error reporting and change repositories to keep track of the versions of various mappings. By using repository-based tools, it is possible to better manage the ever changing environment. It is also helpful that multiple users can see where one designer has left off and another has begun, leaving the guesswork out of this crucial stage of implementation. It also provides future staff a way to see just what has been done in the past, which helps to protect healthcare organizations from the impact of IT staff turnover.

The keys that will set vendors apart are unified management of all of the components within the integration hub to include: (1) the hub itself, (2) the repository database, (3) the reporting environment, and (4) administrative tasks such as party registration, user management, and security policies. In a disjoint-
ed solution, the potential exists for multiple software components, managed by multiple tools. A successful integration hub will have fewer moving parts and a single management interface. The cost of implementing an integration hub should not include the integration required to implement the hub software. Part of managing the integration hub environment is ensuring the protection of all data contained both inside repositories and host systems, as well as the data moving from system to system. Guaranteeing security and privacy of information, both at rest and in motion, is one of the most important aspects of any healthcare information system. There are several steps that should be taken to ensure that privacy and security are maintained:

- First, all software used in such a sensitive environment should be evaluated by independent bodies to ensure adherence to the strictest information assurance policies. For example, by investigating whether or not software has been evaluated under the Common Criteria, which evaluates software based on series best practices for information security, healthcare organizations can ensure that they have an added level of information assurance and do not need to rely on vendor claims or promises. One has only to read recent industry news to find a variety of stories about the results of security flaws in commercial software. By using only databases that are evaluated at the Common Criteria level EAL4, for example, healthcare organizations are able to not only say they are secure, they can prove it.

- Another security practice is to use network encryption techniques and standard data formats as defined by standards bodies to ensure the integrity of communications. In most cases, HIPAA-compliant adapters meet both the HL7 data format requirements as well as X.509 certificate requirements to send and receive secure communications.

- Finally, using secure technology alone won’t ensure complete safety. Good security practices are crucial when determining who, how, and when outsiders will access information in an integration hub. A thorough evaluation of the security process is necessary in addition to making sure that the software being used is inherently secure.

Guaranteeing security and privacy of information, both at rest and in motion, is one of the most important aspects of any healthcare information system.”

Enterprise Software Made By Enterprise Software Vendors

One final consideration is the actual vendors providing support. It is almost a foregone conclusion that integration hubs won’t be implemented alone. Partnerships with software and services vendors will be crucial to the success of any project. Some keys to success offered by industry analysts include the following:

1. Choose vendors who have experience in the market. Choosing a vendor for software alone can be a grave mistake. Integration projects have a track record of costing more than any other software project in IT. Choosing a vendor with experience and references is one way to avoid the hidden costs of inexperience — or buggy software.

2. Choose software vendors with solid financial foundations. Just as experience in the marketplace is important, it is equally important to choose those software vendors that you expect to be around for the long haul. Integration projects don’t last a year or two. They are typically strategic to the organization. An integration hub platform should be around for more than the short term. So should your software vendor.

3. Select products from one vendor where possible. It is been proven in studies time and time again that integrating best-of-breed software costs more than using software that was already designed to work together. Unlike ERP systems where business functionality is largely the main driver behind best-of-breed decisions, integration software decisions should be driven by time to implement. Cobbling multiple integration software components together will take away from real progress, and detract from the bottom line.

About the Author

James Donlon is a technologist with Oracle Corporation and has over 10 years experience in the information technology field. During that span, he has spent time working with customers in both the public and private sector and currently works with customers in the healthcare industry.
Antecedents to the Adoption of ASPs in Healthcare

Ebrahim Randeree, MBA, Susan P. Judd, MSHA, MBA, Rajiv Kishore, PhD, H. Raghav Rao, PhD

A B S T R A C T
The objective of this exploratory study was to identify drivers of adoption for a new form of information technology outsourcing — the ASP model — in the healthcare industry. Primary data were collected in January 2002 from a nationwide survey of senior-level healthcare information technology executives. Cost management (supplier presence, asset specificity, production costs, transaction costs, resource availability) and relative advantage (reliability, customizability, strategic alignment, and magnitude of potential loss) were found to have the largest influences on adoption behavior.

K E Y W O R D S
Technology adoption
Cost management
Application service provider (ASP)
Strategic alignment

With the finalization of HIPAA regulations, innovative IT applications and services are on the radar screens of many healthcare senior executives. An Application Service Provider (ASP) is an information technology innovation wherein a vendor manages and distributes software-based services and solutions to customers across a wide area network from a centralized location. This study developed an exploratory research model encompassing institutional and organizational factors to identify the antecedent drivers to adoption of the ASP model in the healthcare industry.

An innovation is defined as an idea, practice, or object that is perceived as new by an individual or other unit of adoption.¹ The adoption literature is replete with the diffusion of technology across organizations,² but there is a relative paucity of research on the antecedent drivers of adoption. IT outsourcing has special considerations relating to security, performance, and usability, as well as costs and contracting issue, but ASPs can be beneficial to hospitals for many reasons. ASPs can provide hospital IT departments with expertise at fixed costs, relieving the shortage of skilled IT staff and allowing internal IT departments to focus on implementing new applications. ASPs can also give hospitals access to high-end applications with reduced implementation time.

Research Objectives
The purpose of this study was to explore adoption drivers among health-care decision makers with respect to the ASP model. To accomplish this, an exploratory research model (figure 1a. ASP Construct Loadings) and hypotheses were developed.

In 1996 Congress passed the Healthcare Insurance Portability and Accountability Act (HIPAA), governing the transfer of electronic information and the security of patient records. The legislative impetus was to reduce the complexity of payment systems, improve the compatibility between various standards.
and protocols, and standardize third-party processing of health claims. Many healthcare organizations are struggling to comply with regulatory pressures in addition to the financial crisis that plagues healthcare. Government regulation alters the level of competition and the flow of resources in local markets.

**H1: Regulatory impacts** (the degree to which an organization is ready to comply with HIPAA regulations) will have a negative relationship with ASP model adoption.

Organizations with multiple information technology systems and various platforms are looking to external providers such as ASPs to streamline their operations and reduce non-compliance liability. The ASP model is a viable option to meet compliance standards; ASP providers can focus on meeting changing regulations since their efforts are concentrated and they serve multiple organizations that must follow similar guidelines.

If the organization is ready to meet HIPAA guidelines, they have invested in new technology and have created procedures to comply with privacy requirements and patient protections. Regulatory impacts (the level of readiness for HIPAA) would be related to the investigation of procedures that bring the organization in compliance. Government regulation and policy affects divergent change by increasing or decreasing the level of competition and the flow of resources in local markets.

If the organization is ready to meet HIPAA guidelines, they have invested in new technology and have created procedures to comply with privacy requirements and patient protections. Regulatory impacts (the degree to which an organization is ready to comply with HIPAA regulations) will have a negative relationship with ASP model adoption.

Competitive pressure has been identified in previous studies as an influential construct in innovation adoption. Organizations experiencing increased competitive pressure tend to use environmental scanning and boundary spanners to ensure they identify potential competitive advantages. Environmental hostility will make an organization search for innovations that may affect its competitive positioning and thus increases the probability of ASP adoption. External pressure to adopt may originate from industry or trading partners. A high degree of competition will also lead hospitals to strive to develop competitive advantage through adoption of innovations such as ASPs.

**H2: Environmental hostility** will positively influence ASP model adoption.

Competitive pressure has been identified in previous studies as an influential construct in innovation adoption. Organizations experiencing increased competitive pressure tend to use environmental scanning and boundary spanners to ensure they identify potential competitive advantages. Environmental hostility will make an organization search for innovations that may affect its competitive positioning and thus increases the probability of ASP adoption. External pressure to adopt may originate from industry or trading partners. A high degree of competition will also lead hospitals to strive to develop competitive advantage through adoption of innovations such as ASPs.

**H3a: Vendor trust** will positively influence ASP model adoption.

Vendor trust has previously been identified as an antecedent in exchange relationships that involves risks and vulnerabilities. Improper access refers to the protection of the data at the organization or at the ASP vendor site, and encompasses both technological constraints and organizational policy. Unauthorized secondary usage refers to the inappropriate use of stored information at the ASP vendor site. The usage is specific to external concerns over data disclosed to third parties other than those included in the contract. ASP models that protect against the unauthorized usage and the improper access of information will be more likely to positively influence adoption.

**H3b: Improper access protections** will positively influence ASP model adoption.

Issues of data security are of primary concern to all organizations, but are of particular importance to healthcare organizations. The protection of patient information is a key concern of healthcare security legislation and a vital part of the new HIPAA regulations. Data security can be viewed as a function of vendor trust, appropriate access, and proper secondary usage of information.

**H3c: Unauthorized secondary usage protections** will positively influence ASP model adoption.

Unauthorized secondary usage refers to the inappropriate use of stored information at the ASP vendor site. The usage is specific to external concerns over data disclosed to third parties other than those included in the contract. ASP models that protect against

**H4a: Higher production costs** will positively influence ASP model adoption.

**H4b: High transaction costs** will negatively influence ASP model adoption.

**H4c: High supplier presence** will positively influence ASP model adoption.

In the last two decades, the healthcare industry has experienced rising costs with shrinking revenue streams, leading hospitals to search for effective cost management solutions. Research in information technology outsourcing has shown that a primary reason for using external providers is the potential for cost savings.

APs have been projected to reduce production costs (of maintaining patient information and medical systems) in pure monetary terms for factors such as hardware, software, and personnel costs. As a nascent outsourcing model, ASP contractual agreements are still evolving to an industry standard. IT managers might be reluctant to enter into long-term contracts. The viability of the ASP model may dissuade potential adopters. The transaction costs involved in negotiating an ASP contract were hypothesized to negatively influence the adoption of the ASP model. Supplier presence reflects the paucity of available vendors in the marketplace. The availability of reputable and trustworthy external IT service providers in the market can also be a concern to hospitals seeking to adopt ASPs.

**H5a: High asset specificity** will positively influence ASP model adoption.

**H5b: Resource availability** (an abundance of capital-intensive resources) will positively influence ASP model adoption.

Asset specificity refers to the uniqueness and specificity of an organization’s information technology applications and assets. The level of investment in specialized equipment or the skills required to yield value from an asset can influence its adoption. ASPs may have the greatest potential for organizations that are logistically or geographically disparate and/or administratively complex.

The recent consolidations in the turbu-
lent hospital industry have created merged systems that contain redundant, legacy systems. Organizations with high asset specificity will seek to reduce their reliance on legacy systems and multiple platforms. ASPs will benefit from the need to streamline operations. Similarly, organizations with high resource availability may choose to investigate the ASP model through use of slack resources. When excess resources are available to the hospital, they will be more likely to adopt an ASP. The level of investment in specialized equipment or the skills required to yield value from an asset can influence its adoption. Thus, the abundance of capital resources will allow organizations to investigate new technology.

**H6a: Reliability of the ASP system** will positively influence ASP model adoption.

**H6b: Customizability of the ASP system** will positively influence ASP model adoption.

**H6c: Magnitude of potential loss** (risk aversion of the hospital) will negatively influence ASP model adoption.

Researchers have posited that users who perceive an innovation positively with regard to relative advantage over existing systems will be more likely to adopt that innovation; relative advantage is in part a function of reliability and customizability. Reliability refers to the dependability of the technology systems used by the ASP. Customizability refers to the ability of the technology systems used by the ASP to conform to specific needs of the user applications. The potential impact of the failure of the innovation post-adoption will significantly lower the attractiveness of the ASP model. Those seeking to lower the magnitude of potential loss (risk averse) will seek to adopt proven technologies; the nascent nature of the model will reduce adoption behavior.

**H7: Strategic alignment (goals)** will positively influence ASP model adoption.

Strategic alignment (goals) refers to the presence of organizational commitment to the importance of IT efforts. Strategic planning effectiveness is dependent on the internal co-alignment of various dimensions. The alignment of the ASP goals with those of the organization is important for success. Information sharing between the partners can create strategic competitive advantages and lead to synergistic relationships. The introduction of new technologies and processes within an organization signifies that management is committed to the adoption of innovations.

**Methodology**

A survey was developed based on innovation adoption and outsourcing literature; content validity was established by the use of previously validated variables and individual interviews with IT professionals in the hospital industry. A pilot test was conducted using a sample of 84 IT professionals resulting in 29 usable responses. The internal consistency (Cronbach’s alpha) for the pilot data was calculated with results ranging from 0.5903 to 0.9407. Cronbach’s alpha for survey data ranged from 0.6818 to 0.9521. Factor analysis was used to verify discriminant validity; items with a factor rating below 0.5 were dropped. In collaboration with the Healthcare Information and Management Systems Society (HIMSS), the final survey was distributed to 3,500 identified IT hospital executives (CEO, CIO, IT director) with the option to complete a Web survey (overall response rate 6 percent).

**Dependent and Control Variables**

Prior researchers have developed multiple-stage models to capture adoption. We used an adjusted seven-stage adoption model. This model was selected because all instances where the model would likely be adopted needed...
to be captured, even though the model may not have been yet contracted for or implemented in the organization, allowing inclusion of different adoption stages (awareness, interest, evaluation, trial and reject, commitment, limited deployment, or general deployment).

With respect to control variables, organizational size has been linked to adoption behavior. Size promotes adoption due to resources, up to a point where diminishing returns set in. Alternately, the larger the size the more likely any change would disrupt the structure of the organization, creating disincentives for change. Thus, size was applied as a control variable and measured using the number of licensed beds reported.

Results

There were 223 total surveys returned (50 with multiple variables missing data were eventually dropped). Of the 173 remaining, 84 surveys had indicated that they were aware of ASPs but were non-adopters and had stopped completing the survey at that point. In summary, we had 120 non-adopters and 53 adopters. Excluding incomplete surveys, we had 36 non-adopters and 53 adopters.

Due to the relatively small sample size (usable completed surveys, n=89), the results were analyzed using partial least squares (PLS) analysis under PLSGRAPH (version 3.00). PLS is appropriate due to the minimal demands on sample size and measurement scales, and is frequently used in exploratory analysis to suggest relationships. It also allows for optimal empirical assessment of the theoretical model. PLS is also suited to exploratory models without theory grounding where explaining the relationships among a set of constructs is desired.

The overall model (figure 1a. ASP Construct Loadings) encompassing the continuous variables (R2=0.533) showed that all the four constructs were significant. The influence of cost management and that of relative advantage persisted. On the variable loadings model (figure 1b. Variable Loadings), environmental competition (0.339, p<0.001) and the magnitude of potential loss (0.298, p<0.001) were highly significant (p<0.001) and positively affected adoption while transaction costs (-0.308, p<0.01) negatively influenced cost management and adoption. Vendor trust (0.222), unauthorized secondary usage (0.256), and strategic alignment (0.196) were also significant (p<0.05).

The R-Square and the factor loadings do not relate to how well the latent variables or item measures are predicted; the algorithm takes the model as true and attempts to find the best parameter estimates; standardized paths should be around 0.200 and ideally above 0.300 to be meaningful. While other control variables for size were investigated (annual gross revenue, total FTEs, IT FTEs, number of licensed beds), they correlated significantly with each other but not with adoption measures. The number of licensed beds was chosen in the PLS model.

Significance of Results and Relevance to Management

No support was shown for regulatory (HIPAA) impacts on adoption. Organizations could have been investigating internal processes prior to looking at new technology models. HIPAA readiness could also have been preliminary in most organizations during the survey period. Lack of support for improper access could imply that hospitals assume that access issues are not a primary concern as much as vendor trust is, and that access protections are implied in the contracts.

The strong support for the magnitude of potential loss was expected, but the direction was found to be opposite from predicted. Those with high risk aversion were predicted to not adopt ASPs. The
positive response could suggest that these organizations had previously investigated ASPs and were currently using them, lowering risk aversion. Organizations could also have more confidence in the ASPs than their own IT staff/capabilities.

Commitment to the nascent model is clouded by financial uncertainty and questions of cost benefits. IT outsourcing has implications for patient confidentiality. However, the relative newness of the ASP model and the inherent risks of outsourcing patient information did not significantly deter healthcare organizations from adopting an ASP. Additionally, the HIPAA regulations are forcing organizations to re-examine their IT functions and investigate new and better ways of doing things.

The final analysis of ASP adoption in healthcare is still evolving as ASP providers themselves transform to meet new demands. Hospitals are continuing to be plagued by financial crises, federal and state cutbacks, and post-9/11 funding shortfalls, the result being that the adoption of the ASP model has settled to a cautious, incremental approach. Hospitals should investigate the ASP model in context with other options to select the most cost-effective approach. Even though the nature of the healthcare environment has become very competitive, adoption of ASP to reduce costs and improve operations needs to be an incremental process that evaluates the transaction costs (contract negotiations) and the effect on the organization should the ASP system fail once adopted. In contrast, ASP providers need to promote the benefits of their businesses, as many respondents were aware of the model but have not yet seen the impetus for change. ASP vendors need to tap into the regulatory conundrums faced by hospital executives and design solutions that reduce uncertainty.

References


About the Authors

Ebrahim Randeree, MBA, is a graduate student in the School of Management at the State University of New York at Buffalo. Susan P. Judd, MSHA, MBA, is the Director of Strategy/Business Development at the Greater Baltimore Medical Center in Baltimore, Maryland.

Rajiv Kishore, PhD, is an Assistant Professor in the School of Management at the State University of New York at Buffalo. H. Raghav Rao, PhD, is a Professor in the School of Management at the State University of New York at Buffalo.

Acknowledgments

This research has been funded by the National Science Foundation, grant #990735. The authors would like to thank Stephen Shortell (UC Berkeley), Leonard Friedman (Oregon State University), Jennifer Horowitz (HIMSS), and participants at the 2002 Academy Health Meeting (D.C.) for their feedback on the paper.
Prescription drug costs are rising rapidly. Serious prescribing errors are widespread, although many are avoidable. Electronic prescribing (e-prescribing or eRx) promises to address such problems. Recent technological advances in handheld computing allow prescribing software to be installed on palmtop computers. This paper focuses on handheld eRx systems that are independent of more comprehensive, complex, and expensive electronic medical record (EMR) systems.

In theory, eRx devices enable physicians to manage multiple and competing formularies, prevent medication errors caused by illegible handwriting and overlooked drug interactions, promote increased use of generic drugs, enhance efficiency by producing error-free and electronically transmittable prescriptions, augment patient safety, and improve quality through provision of clinical guidelines.

Recent studies have demonstrated the benefits of e-prescribing tools in improving quality of care and reducing costs in inpatient settings. However, there is a dearth of published research on the use of e-prescribing in the outpatient arena, the workplace of 75 percent of America’s physicians. Available outpatient studies have been funded (and often carried out) by e-prescribing companies themselves, or others with financial stakes in the industry. Many such studies are proprietary and therefore unavailable to researchers, policymakers, and the public.

Despite evidence that physicians perceive eRx to be useful, and some evidence of exploratory initiatives by large organizations to use eRx at select sites, physicians working in outpatient settings are adopting eRx slowly. A recent survey by Medco Health Solutions, the nation’s largest pharmacy benefits manager (PBM), revealed that 13 percent of surveyed physicians used e-prescribing systems to write prescriptions in 2002. Key to the success of eRx is the participation (including financial investment) of eRx industry stakeholders — not only physicians, but also purchasers, health plans, PBMs, pharmacies, and drug companies. We conducted telephone and in-person interviews with managers from these key stakeholders to describe the benefits and costs of eRx as assessed by key industry stakeholders, identify the components of a needed electronic prescribing infrastructure and the barriers to its completion, and identify potential public and private policies and initiatives that could encourage the development of an EPI and hasten eRx adoption among stakeholders.
stakeholders groups to address the following questions:

- **eRx Core Capabilities**: What are the capabilities of eRx software and hardware as assessed by key stakeholders?
- **Existing and Needed Flow of Prescribing Information**: What is the existing model for the prescribing process? How does prescription information flow from one stakeholder to another? What electronic prescribing infrastructure (EPI) is needed for eRx to succeed and how might that be achieved?
- **Benefits of eRx**: What are the benefits of eRx adoption?
- **Barriers to eRx Success**: Why is eRx adoption so slow? What is being done to address those barriers?
- **Current Initiatives to Overcome the Barriers**: What initiatives are currently spurring eRx adoption?
- **Needed Initiatives to Overcome the Barriers**: What initiatives are needed to spur eRx adoption?

This study aims to describe the benefits and costs of eRx as assessed by key industry stakeholders, identify the components of a needed electronic prescribing infrastructure (EPI) and the barriers to its completion, and identify potential public and private policies and initiatives that could encourage the development of an EPI and hasten eRx adoption among stakeholders.

**Methods**

We selected a purposive sample of 45 organizations that, by design, varied widely (e.g., size, type of stakeholder, geographic location, etc.). Stakeholders from physician practices, eRx vendors, PBMs, pharmacies, drug companies, and purchasers participated. Data were obtained through semi-structured, in-depth, 90-minute interviews with 65 individuals at 35 organizations (Technical Appendix, “Interview Respondents”), including CEOs, medical/pharmacy directors, and staff physicians, to assess the impact of eRx on practice efficiency and to obtain data on organizational, financial, and technological factors facilitating or impeding adoption. Most questions permitted open-ended responses.

We used QSR Nvivo qualitative research data management and analysis software to create an interview database and to facilitate analysis of our data. This software package allowed us to code relevant sections of each transcribed interview to analysis categories that corresponded directly with the research questions listed above; the sub-categories provide more detail. For example, for the category “eRx Core Capabilities,” we coded transcribed text to the subcategories: “electronic prescription order capture,” “formularies,” “drug-interaction checking,” “connectivity,” and “other features.”

**Results**

**eRx Core Capabilities**

eRx users and vendors reported a variety of core eRx device capabilities, such as electronic prescription order capture, formulary information viewing, drug-interaction checking, connectivity (i.e., data exchange) with other software, patient education, and disease management programs.

**Electronic prescription order capture.**

Electronic prescription order capture is central to all eRx devices. The physician requests prescribing information (i.e., medication, dose, frequency, and duration), usually by using pull-down menus on the device’s touch-sensitive screen. The order is typically printed or faxed to the pharmacy.

**Formularies.**

Most eRx devices provide formulary information viewing, drug-interaction checking, connectivity (i.e., data exchange) with other software, patient education, and disease management programs.

**Drug-interaction checking.**

Electronic prescribing devices always include drug-interaction checking capability, which usually includes identifying potential problems with drug-drug interactions, and sometimes drug-allergy and drug-food interactions. However, the most effective drug-interaction checking depends, to a large extent, on obtaining information regarding the patient’s drug history, allergies, and other information that often is not available electronically.

**Connectivity.**

The connection between the physician’s eRx device, the pharma-
Completing the Electronic Prescribing Infrastructure

Figure 2. Needed Information Flow for Successful E-Prescribing: Completing the Electronic Prescribing Infrastructure

Physician-PBM link.
Existing: PBMs and physician offices currently communicate via telephone and fax.

Needed: This link does not yet exist. It would allow the physician to check patient eligibility and pharmacy benefits information electronically, in addition to providing critical formulary and patient prescribing history information. Major PBMs (Rx Hub) and pharmacy (SureScripts) initiatives, described later in this report, are designed to complete this link.

Pharmacy-PBM link.
Existing: A highly sophisticated system of electronic links and databases allows pharmacies to check with PBMs to verify patients’ eligibility for pharmacy benefits and formulary status of specific drugs; the response time to pharmacy requests for such information rivals that of Visa or MasterCard, often seen as the “gold standard” for electronic transactions. The existing link also allows the pharmacy to send claims data (for reimbursement) to the PBM.

Needed: The needed EPI link already exists.
This description suggests that the electronic prescribing infrastructure represents a more complete information flow than the existing one. However, a better understanding of the benefits of and barriers to eRx is necessary to confirm or refute the importance of the EPI.

Benefits of eRx and the EPI
Our interview data suggest that eRx and a completed EPI have substantial potential benefits for various stakeholders (see figure 3, “Potential Benefits of Electronic Prescribing Systems and the EPI”). Drug-interaction checking helps physicians to prescribe appropriately, which benefits patients, physicians, pharmacists, and, ultimately, purchasers of healthcare services. Real-time access to comprehensive patient prescription histories helps prevent drug-drug interactions and other drug-therapy problems.

Similarly, real-time access to formulary information encourages prescribing of current, on-formulary drugs, which reduces callbacks from pharmacists to physician offices — clearly benefiting...
Problem-solving. Finally, more time to clinical tasks such as prescription tasks. This assessment is congruent pharmacists to perform other, more clinical tasks. Reduced callbacks, in fact, could allow numerous stakeholders simultaneously.

PBMs also stand to gain from e-prescribing. PBMs manage pharmacy benefits for health plans by creating formularies that incentivize physicians to prescribe certain preferred (typically rebated) drugs. The eRx process could generate valuable prescribing data for PBMs that could improve formulary management, potentially increasing their rebates. Moreover, PBMs could reduce staffing at their physician callback centers if eRx devices could check drug authorization requirements directly at the point of prescribing.

While eRx systems currently provide some benefits to multiple stakeholders, existing e-prescribing systems have not yet fully lived up to their potential. As described in the next two sections, current efforts to span the gap have had some success. They have also encountered significant barriers.

**Barriers to eRx Success**

The key barrier to the success of eRx is the anticipated effect on physician time and costs. Physicians were unanimous in stating that, unless e-prescribing saves them time and/or money, physicians will continue to be slow in adopting eRx. Physicians’ concerns go beyond recouping any upfront or ongoing financial costs of the system: they also want to be paid for time costs involved in adapting to a new system and any ongoing time costs in using e-prescribing devices.

The survey identified the following factors affecting time, cost, quality, and patient safety.

**Lack of ease of use and limited eRx functionalities.** Ease of use is a critical issue for eRx success, since difficulties in using eRx add time to the physician’s prescribing process. Technological barriers such as erratic radio and infrared connections, limited battery life, and slow processor speeds limit the technology today, but may soon be resolved by expected technological gains. More significantly, small screen sizes prevent the normal chart-sized display of information that physicians are accustomed to seeing, although tablet computers may eventually remove this barrier.

E-prescribing packages have limited sensitivity and specificity to drug-interaction messaging. High false-positive rates are particularly vexing for busy physicians, and may decrease ease-of-use, increase physician time costs, impair patient safety, and disrupt quality by encouraging physicians to ignore potentially valuable drug-interaction messaging. Nearly all (8 of 10) vendors reported focusing heavily on removing ease-of-use barriers.

More than half (14 of 25) physician interviewees stated that they would be more likely to adopt an eRx system if the eRx process could generate valuable prescribing data for PBMs that could improve formulary management, potentially increasing their rebates. Moreover, PBMs could reduce staffing at their physician callback centers if eRx devices could check drug authorization requirements directly at the point of prescribing.

While eRx systems currently provide some benefits to multiple stakeholders, existing e-prescribing systems have not yet fully lived up to their potential. As described in the next two sections, current efforts to span the gap have had some success. They have also encountered significant barriers.

**Lack of integration with practice management systems.** Most eRx systems failed to interface with many of the dozens of other physicians’ practice management systems (which contain patient demographic, scheduling, billing, and insurance data) currently available, thus increasing the complexity or time currently required to write a prescription, physician adoption is likely to be slow. As one vendor observed, “There is a critical balance between ease-of-use and functionality,” that is, it is necessary to maximize the “power” of the eRx product without making the device too difficult and time-consuming for physicians and other prescribers to use.

**Limited functionality.** Two eRx companies built modular “suites” of functionality, in the hope of interesting physicians to expand functionality incrementally (e.g., by incorporating charge capture and refill features first, then e-prescribing, or vice versa) and attracting a broader base of physicians (to expand market share). Most (15 of 25) physician respondents stated that a modular approach to adopting information technology was preferable to attempting to adopt a complete EMR system at once. Physicians in smaller practices (4 of 10 physicians in small practices) stated that a modular approach would enable physician champions to garner support from more “technophobic” (and sometimes older and more influential) physicians in their practices. Whether either or both of these strategies succeed may depend on the ability of the vendors to develop products that successfully meet the unique needs of large or small practices.

**Lack of integration with practice management systems.** Most eRx systems failed to interface with many of the dozens of other physicians’ practice management systems (which contain patient demographic, scheduling, billing, and insurance data) currently available, thus increasing the complexity or time currently required to write a prescription, physician adoption is likely to be slow. As one vendor observed, “There is a critical balance between ease-of-use and functionality,” that is, it is necessary to maximize the “power” of the eRx product without making the device too difficult and time-consuming for physicians and other prescribers to use.

**Limited functionality.** Two eRx companies built modular “suites” of functionality, in the hope of interesting physicians to expand functionality incrementally (e.g., by incorporating charge capture and refill features first, then e-prescribing, or vice versa) and attracting a broader base of physicians (to expand market share). Most (15 of 25) physician respondents stated that a modular approach to adopting information technology was preferable to attempting to adopt a complete EMR system at once. Physicians in smaller practices (4 of 10 physicians in small practices) stated that a modular approach would enable physician champions to garner support from more “technophobic” (and sometimes older and more influential) physicians in their practices. Whether either or both of these strategies succeed may depend on the ability of the vendors to develop products that successfully meet the unique needs of large or small practices.

Financial costs to physicians. Several (9 of 25) physicians interviewed in this study were not convinced of the value of eRx because they were concerned about equipment costs and the time costs (which translate into financial costs) related to training and changes to workflow. Ultimately, these costs raise the financial burden to physicians, which, in turn, can slow eRx adoption.

Even though vendors nearly always provided free e-prescribing devices, surveyed physicians reported paying user-based licensing fees ranging from $80 to $400 per month. Physicians also reported that they had to invest in new or updated hardware, such as computer servers and networking infrastructure, to operate the e-prescribing system (the amount varied significantly by product). While all
when either (a) the device was used for less than a majority of patients, and/or (b) a minority of physicians in the practice used the devices, higher time costs accrued due to the inconvenience of switching back and forth between paper and electronic prescribing. This barrier was particularly evident when a physician practice used an eRx device from a vendor that had contracts to provide formulary information for only a small proportion of that practice’s health plans and PBMs.

**Lack of a comprehensive EPI.** There was universal agreement that, in order for eRx to be successful, all aspects of the system must be electronic (see figure 3). Without such electronic linkages, time costs to physicians in using eRx systems increase, decreasing the likelihood of adoption. For example, without electronic access to complete drug history and real-time formulary data, physicians would have to enter patient data manually. With electronic access, physicians can refill prescriptions in one or two quick steps (saving staff medical record retrieval time), obtain real-time feedback on patient-specific formulary coverage, and advise patients of copayment information, which would reduce callbacks for changed prescriptions from pharmacists. Further, without linkages providing patient history information, a physician might have difficulty seeing what other physicians had prescribed for a given patient, threatening the quality of the patient’s care.

**Conflicting stakeholder incentives.** Different stakeholders in the prescribing process — including physicians, pharmacists, health plans, PBMs, drug companies, and purchasers — have conflicting incentives with respect to eRx, which slows the completion of a comprehensive EPI. This impedes the provision of electronic data needed by physicians to use e-prescribing in a time-efficient manner, ultimately limiting the rate of eRx adoption.

Specifically, physicians depend on access to information — drug histories, accurate formulary data, copayment structure — typically controlled by PBMs, pharmacies, and health plans. In creating an EPI, PBMs face resistance.

physicians reported some willingness to invest the money to pay for these costs, 12 of 25 physicians objected to paying per-transaction costs charged by e-prescribing vendors and “connectivity organizations” (such as RxHub and SureScripts, described herein).

**Limits of small practice size.** The size of a physician practice can influence adoption. Four of five of the physicians in practices of 10 or fewer physicians stated that their groups lacked sufficient capital, information technology (IT) support, and expertise to facilitate optimal adoption of eRx technology. Further, as the market for eRx products matures, some (6 of 25) respondents expressed concern that products and vendors will disappear, leaving early adopters with technology that is no longer supported, a real disincentive for adoption of eRx in smaller practices with low levels of risk tolerance.

In fact, such vendor attrition did occur over the course of the study. Surviving vendors have responded by narrowing their market focus: some focus on large physician practices, while others focus on smaller, one-to-six-physician practices, but it remains to be seen whether such strategies will overcome barriers unique to small practice size.

### Figure 3. Potential Benefits of E-Prescribing Systems and the EPI

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Potential Benefits</th>
</tr>
</thead>
</table>
| **Patients**    | Legible prescriptions reduce medical errors (65 of 65)  
Prescriptions checked for drug interactions (drug-drug, drug-disease, drug-allergy, drug-food) to reduce medical errors (44 of 65)  
Patients’ pharmacy benefits checked before patient arrives at pharmacy (45 of 65)  
Reducing hassles for physician (see below) means more-satisfied patients (14 of 65)  
Possible ‘trickle-down’ savings to patients through immediate receipt of copayment information (17 of 65)  
Increased patient education about drug therapies (6 of 65)                                                                                               |
| **Physicians**  | Prescriptions checked for drug interactions (16 of 25)  
Fewer callbacks from pharmacies to clarify prescription and formulary issues (21 of 25)  
Possible ‘trickle-down’ savings to physician groups through formulary compliance (4 of 25)  
More-satisfied patients reduce stress and increase job satisfaction for physicians (11 of 25)                                                        |
| **Health Plans**| Legible prescriptions reduce medical errors (6 of 6)  
Drug interaction checking reduces medical errors (4 of 6)  
Fewer pharmacy callbacks mean increased efficiency/decreased costs (5 of 6)  
Formulary compliance decreases drug costs (through increased efficiency) (4 of 6)  
Greater convenience to patients means increased patient satisfaction (5 of 6)  
Prescribing data can improve medical and formulary management (3 of 6)                                                                                       |
| **PBM**         | Access to physician prescribing data improves formulary management (3 of 8)  
Formulary compliance increases cost savings to PBMs (8 of 8)                                                                                              |
| **Pharmacies**  | Pharmacists spend less time on phone with physicians clarifying legibility, drug-interaction, and formulary issues (3 of 3)  
Greater convenience to patients means more-satisfied patients, more-satisfied pharmacists (2 of 3)                                                        |
| **Drug Companies**| Access to physicians’ prescribing data facilitates better marketing planning (1 of 2)  
E-detailing enhances access to physicians and increases efficiency of sales force (2 of 2)                                                               |

Note: Benefits directly attributable to EPI in italics. Number of respondents agreeing with statement out of total number of respondents in parenthesis.
from pharmacies concerned that PBMs will route electronic prescriptions to the PBM’s mail-order pharmacies, thus reducing revenues for retail pharmacies. Representatives from chain pharmacies were reluctant to cede current pharmacist job responsibilities to an automated system, particularly one operated by a non-pharmacy stakeholder.

Conflicting incentives between drug companies and PBMs versus HMOs and purchasers also appear to slow investment in eRx and the completion of the EPI. Drug companies and PBMs are interested in using e-prescribing devices to influence physicians’ prescribing decisions at the point-of-care: drug companies described their desire to expand their drugs’ market share through advertising on eRx devices, and PBMs hoped to use the devices to increase physicians’ compliance with their formularies.

Some (three of six) health plan respondents reported that drug company and PBM influence may increase costs to healthcare purchasers, health plans, and, ultimately, to patients if physicians are encouraged to prescribe expensive, brand-name medications rather than generic and other cost-effective drug products. Further, they stated that drug companies and PBMs may promote device capabilities that increase their capacity to market drugs, which could influence the types of clinical decision-support envisioned for future e-prescribing products (e.g., the desire to market drugs, particularly expensive drugs, could take precedence over quality-improvement initiatives such as integration of evidence-based clinical guidelines into e-prescribing systems). HMO respondents reported that these conflicting incentives reduce their motivation to invest in eRx and the building of an electronic information infrastructure.

**Current Initiatives to Overcome the Barriers**

Despite these barriers, two key stakeholders — PBMs and pharmacies — are attempting to “jump start” the completion of the electronic prescribing infrastructure, in an effort to hasten physician adoption of eRx. In 2001, the three largest PBMs (Medco Health Solutions, Express Scripts, and Advance/PCS) jointly created RxHub, an electronic prescription order system that would virtually pool the PBMs’ extensive databases and establish real-time connectivity to physicians at the point of prescribing.14

According to PBM respondents, this system would enable physicians to view complete prescription histories, formulary eligibility status, and demographic data for almost all patients. Unlike existing formulary software, RxHub also promises to provide electronic access to frequently updated formularies at the point of prescribing, using its unparalleled access to its three PBMs’ massive formulary databases. PBM respondents asserted that access to such comprehensive and accurate formulary information would decrease PBM, physician, and pharmacy staff time required for processing new prescriptions and refill requests.

Shortly after RxHub’s entrance into the market, two major pharmacy organizations, the National Association of Chain Drug Stores and the National Community Pharmacists Association, formed SureScripts, considered by most stakeholders to be a rival to the RxHub initiative. Although some of the potential capabilities of the two systems are similar (until March 2003, RxHub also supported technology allowing physicians to send prescriptions electronically to pharmacies), SureScripts respondents emphasized SureScripts’ two-way communication links between pharmacies and physician practices — using its historical claims-processing links with PBMs (providing physicians and pharmacies with access to patient benefit information), it can respond efficiently to physicians’ electronic requests for formulary information.

Both RxHub and SureScripts are planning to implement a transaction-based revenue model that would charge users (primarily physicians, eRx vendors, pharmacies, and PBMs) a small fee per transaction. This would be part of a larger per-transaction fee eRx vendors are already planning to charge clients.

Both organizations are attempting to complete the electronic prescribing infrastructure by building on the highly sophisticated existing connectivity between pharmacies and PBMs. Whereas RxHub emphasizes the PBM-physician link, SureScripts promotes its instantaneous pharmacist-physician link, emphasizing the importance of the pharmacist-physician relationship in improving quality of prescribing and enhancing productivity of both physicians and pharmacists. Once operational, both organizations stated their business plan would be to charge transaction fees to recoup initial and ongoing investments. SureScripts recently announced that 10 retail chains nationwide would use SureScripts.15 Similarly, RxHub signed partnership agreements with four major eRx vendors.16

Survey respondents reported two significant barriers to successful implementation:

**Costs.** Due to the reluctance of other stakeholders to invest in eRx, PBMs, vendors, and pharmacies must bear the costs of creating the systems to support eRx and the eRx electronic infrastructure and thus must develop ways to defray these costs. Facing slim and decreasing profit margins, pharmacy respondents expressed reluctance to make the extensive IT investments required for purchasing and implementing eRx systems, impeding the completion of the electronic prescribing infrastructure. Such investment is especially burdensome for independent retail pharmacies, which can depend on fewer economies of scale to justify the investment.

**Rivalry.** Competition among PBMs and pharmacies has slowed the creation of a fully functional EPI. As described above, pharmacies are concerned that they may lose their role in the prescribing process with the potential rise of PBMs due to the RxHub initiative (especially given that PBMs operate their own mail-order pharmacies). Moreover, several HMO and physician respondents expressed doubts about whether the three major competing PBMs involved in RxHub could successfully collaborate over time on building an EPI.

Finally, rivalries regarding who will prevail and gain market share in developing a fully integrated electronic benefits data system may slow development.
of needed connectivity among physicians, pharmacies, and PBMs. PBM respondents expressed doubts about whether SureScripts would be able to provide physicians with accurate and timely formulary information, and speculated that, if RxHub could provide patient medication history functionality to physicians, it might be the more attractive solution. On the other hand, SureScripts respondents stated that that in completing the data link between physicians and pharmacies, pharmacies will be able to leverage an instantaneous electronic connection to physicians while also providing benefits and drug history information to physician practices (drug history information that, according to surveyed pharmacists, includes patient over-the-counter prescription information not available to PBMs.)

Discussion

Despite the potential advantages of eRx, uptake is slow and skepticism exists among key industry stakeholders. For some physician practices, EMRs may provide a comprehensive answer to problems of increasing drug costs and medication errors, while generating other benefits from additional functionality. However, several factors may support an incremental increase in IT capabilities, like eRx, for many practices. Compared to EMRs, its financial costs to physicians are relatively low and it requires less change to existing clinical workflow, thus easing the transition to greater technology use. Further, eRx requires less experience in the multi-step process of adopting a technology (e.g., device selection, training, and technological support).

Nevertheless, the future of eRx is unclear. Interview data suggest that to spur use of eRx beyond “early adopter” physicians, and to help address time, cost, and quality concerns, several important initiatives need to be considered.

Benefits information and refills.

Physicians need real-time access to patients’ medication histories, the ability to process medication refills efficiently, the ability to check a patient’s formulary, and access to specific prescription drug copayment information. This requires a viable, common electronic prescribing infrastructure to which physicians can easily connect with both pharmacies and PBMs. While PBMs and pharmacies are making strides in this area, eRx will be slowed further than it need be unless affiliated stakeholder organizations — RxHub and SureScripts — cooperate in their efforts, or unless one system prevails as the industry standard.

Technology.

While processor speed, memory, and robustness of the wireless connection currently limit physician adoption, the rate of technological advance will soon eliminate these concerns. However, vendors need to promote compatibility among applications and data transfer with physician practice management systems. While continued technological advances are likely to produce powerful tools for physicians in the near future, developers face the challenge of designing, and IT managers of selecting, e-prescribing packages that carefully balance the trade-off between functionality and ease-of-use. To be useful to physicians, eRx may have to be combined with additional electronic capabilities, but such increases in functionality cannot be accompanied by substantial decreases in ease-of-use.

Evidence-based medicine.

E-prescribing vendors’ attempts to improve quality of prescribing have largely been limited to producing legible prescriptions and drug-interaction checking alerts. However, a broader vision of e-prescribing — a vision incorporating evidence-based guidelines and accompanying decision-support — would be of significant benefit to the healthcare system. Many evidence-based clinical guidelines are not followed in practice, typically because physicians cannot easily access them (i.e., paper copies are difficult to keep track of) and lack of knowledge about the “best” current guidelines. Failure to adhere to these “best practices” leads to preventable mortality and morbidity.

For example, many patients who have suffered a heart attack are not prescribed beta-blockers and statins to lower cholesterol, despite rigorous evidence that such interventions improve survival. Similarly, in other chronic conditions such as asthma and congestive heart failure, patients may not be prescribed medications that improve clinical outcomes and have been recommended by evidence-based practice guidelines. By computerizing evidence-based guidelines, e-prescribing offers the potential to improve quality of care and enhance patient safety by prompting physicians to use recommended therapies.

Incentives.

Physicians need more incentives to change their current view of eRx costs and benefits. In understanding the potential benefits of e-health technologies for quality-of-care improvement, employers and other purchasers of health services are creating performance standards and incentives for wider adoption of health information technologies in inpatient settings.

For example, the Leapfrog Group, a coalition of large private purchasers of health services, recently identified computerized physician-order entry as critical to improving care and reducing medical errors. The coalition developed standards that it wants hospitals to meet. To encour-
age physicians to institute needed changes, Leapfrog is considering rating physicians based on their compliance with these quality measures, in a format that would be publicized to consumers.22, 23

Such initiatives should be extended to e-prescribing in outpatient settings. We suggest that a related approach is to encourage health plans to offer financial incentives to physicians based on selected quality and efficiency measures, including use of eRx. These incentives would hasten eRx adoption in office-based practices, especially in smaller physician groups typically having less capital to invest in IT. If these initiatives achieve a certain degree of success, a “tipping point”24 — the threshold beyond which small inputs can result in large changes — other purchasers may recognize the value of adoption and follow suit.

Conclusion
While many experts consider EMRs the “holy grail” of electronic information systems to improve quality of care, electronic prescribing may be an effective and manageable first step to a full-fledged EMR — some even suggest that it can be an effective stand-alone system.25 The stakes are high: two-thirds of physician visits end with a prescription.26 While technological advances may overcome some existing shortcomings, difficulty-of-use for physicians, conflicts among stakeholders, and as-yet-unproven value to each stakeholder slow the creation of a needed electronic prescribing information infrastructure and the widespread adoption of e-prescribing. The speed of e-prescribing implementation will increase rapidly only if the barriers to its adoption are faced head-on.

About the Authors
Helene L. Lipton, Ph.D., is professor of health policy and pharmacy in the Department of Clinical Pharmacy and Institute for Health Policy Studies, Schools of Pharmacy and Medicine, University of California at San Francisco.
Robert H. Miller, PhD, is associate professor of health economics in residence at the Institute for Health & Aging, University of California San Francisco.
Julian Wimbush, Sc.B., is a senior research associate at the Institute for Health Policy Studies at UCSF.

Acknowledgment. The authors are grateful to the Robert Wood Johnson Foundation for financial support of this research. Selected findings from this research were presented at the Annual Research Meeting of the Academy for Health Services Research and Health Policy in Washington, DC, in June 2001. The authors would like to acknowledge Bernard Lo, MD, Gordon Schiff, MD, David Gibson, MD, Harold Luft, PhD, and the Institute for Health Policy Studies’ Writing Seminar for their helpful critiques in reviewing earlier drafts of the manuscript.

References

Journal of Healthcare Information Management — Vol 17, No 4 79
CMS Ad
Full B/W
Page 80