Strategies for Successful Information System Development

Despite tight budgets and competing needs, many healthcare organizations are devoting larger percentages of their budgets to computers. In a survey of attendees at the 1993 Healthcare Information and Management Systems Society (HIMSS) conference in San Diego, more than 70 percent of respondents said their organizations plan to increase investments in information systems during the next two years. The trend suggests that healthcare providers no longer see information systems improvements as an option, but as a necessity.

HIMSS conference attendees cited the growing emphasis on managed care, outcomes management, and patient-focused care as major forces driving hospital investments in computer systems. But they said the two most important general forces were government and payer pressure to control costs and a growing need to connect to outside organizations. With healthcare reform on its way, comprehensive, reliable, and accessible information promises to become even more important.

But as providers' data requirements have grown, so has their understanding of the difficulty of implementing a system that adequately meets their needs. Today's information managers must be aware of current options and improvements in system architectures and design. At the same time, they must be thoroughly familiar with their organization's strategic plans and managerial priorities. Finally, in installing a system, they must address cultural and technical obstacles.

Gaining Physician Support

One of the biggest obstacles is ensuring that key personnel support the system and use it. The large-scale introduction of computers into daily operations inevitably forces people to learn new skills and change old work habits. In the process, it can create resistance among professionals who may question whether an electronic information system really enhances healthcare delivery.

To secure physician support of an electronic information system, involve them in selecting the vendor and in examining the issues and factors necessitating change in the work process, said Charles A. Gordon.

As a group, physicians have been among the most skeptical about the benefits of electronic information systems. Past experiences have convinced many physicians that computers get in the way of care delivery more than they enhance it and that system developers have little regard for physicians' needs.

Many facilities have adopted strategies to ensure medical staff backing for computerization. At Lehigh Valley Hospital, Allentown, PA, planners decided that the best way to head off potential problems was to include physicians in the development process from the beginning.

In 1988 personnel from Lehigh's information services staff developed an information systems strategic plan with the help of hospital managers and a consultant. According to Charles A. Gordon, MD, physician information services liaison at Lehigh Valley, the first step in approaching physicians was to involve them in selecting the vendor and in examining the issues and factors necessitating a change in the entire work process. "Physicians know the difference between titular participation and codevelopment," Gordon said. He emphasized that the opportunity for meaningful involvement at this stage was important to physicians and crucial to the success of the implementation process.

Early in the process an ad hoc medical staff committee, later known as the Information Services Physician Committee (ISPC), convened to examine various vendor possibilities and design requirements for the new data network. The ISPC reported directly to the Medical Executive Committee and, ultimately, to the entire medical staff.

Physician independence was one of the major obstacles the committee envisioned, Gordon noted. With more than 700 referring physicians, the sheer size of Lehigh's medical staff posed a potential problem. "Planners in a position similar to ours should be aware of the difficulty of bringing together 700-plus physicians who work in multiple small groups and have a native resistance

to bonding to any large corporate identity."

Physician Liaison Early meetings among committee members and other medical staff soon made it apparent that, with the right arrangement, the medical staff would endorse a model of mutual cooperation and participate in the development of a data network. To encourage such participation, the ISPC recommended that a physician information services liaison be appointed to represent medical staff interests and to convey hospital administrators' views to the medical staff.

Lehigh administrators and the medical staff agreed that the liaison would be chosen jointly by the hospital chief executive officer (CEO), the president of the medical staff, and the hospital chief information officer (CIO). In addition, they decided the hospital would provide the liaison with a written contract to compensate for the time and referrals lost in performing the position's duties. "The goodwill generated by this obvious commitment played an important role in getting many doctors to begin paying serious attention to the hospital's information systems plan," Gordon said.

He stressed that such a position requires someone who is perceived by both administrators and physicians as above all a patient advocate. In addition, an effective liaison must be able to negotiate win-win responses to key issues. Finally, the liaison must be unencumbered politically and able to advocate unpopular positions, Gordon said.

As the implementation process unfolded, it became clear that another important role for the liaison was to control the pace of negotiations. "We decided it would be important that he or she withhold endorsement of any proposal until there was general agreement from all constituencies as to the benefit of a particular situation," Gordon said.

An adequate power base, with support from persons at all levels of the organization, was also critical to the liaison's effectiveness, Gordon noted. He added that a successful liaison needs the endorsement of the formal medical staff leaders and department heads, as well as de facto medical staff leaders, including large admitters and credible, politically active physicians.

Nurse Physician Liaison The appointment of a physician liaison reassured medical staff that their interests would be represented at every stage of the vendor selection and system implementation process. But Lehigh planners realized they would also need to find out what physicians wanted from a system, what they needed to learn about computer use, and what kind of commitment they were willing to make to automate their offices and become more computer literate.

"Some physicians will be highly motivated to use an information system; others will be less enthusiastic. . . . You have to know who is who," Mary A. Sabo said.

A key person in this aspect of the hospital's efforts was Nurse Physician Liaison Mary A. Sabo. "My strategy was to show up everywhere that physicians were likely to meet," she said. Sabo emphasized that a critical element in approaching physicians was to get a clear idea of the makeup of the group she was dealing with. Identifying physicians' overall objectives and priorities was crucial, but it was not enough. "Some physicians will be highly motivated to use an information system; others will be less enthusiastic," Sabo said. "To approach them effectively, you have to know who is who."

Persons attempting to interest physicians in using an information system should avoid gravitating to those who are already committed to the system, Sabo warned. "Sometimes your best results come from listening carefully to those who resist the kind of change you are advocating," Sabo said.

She related how a colleague made a point of writing down every remark made by a particularly critical physician as he was practicing at a display terminal in the physician lounge. "Her impression while the physician was speaking was that he was just being negative," Sabo said. But when the nurses' committee reviewed the remarks, they found an excellent suggestion that led to the redesign of the physicians' command screen. In addition, the fact that the committee acted on his suggestion helped "convert" the physician to the cause.

Subcommittees Physicians' involvement in subcommittees that addressed key medical staff concerns also promoted physician acceptance of the hospital medical information system. A medical records subcommittee worked through issues such as the legalities of electronic signatures, and an allergy/pharmacy subcommittee settled (among other issues) how often an allergy has to be recorded in the medical record. Finally, a security subcommittee addressed security and confidentiality issues.

Future Enhancements Lehigh's patient care and accounting system recently became operational. Gordon noted that physician cooperation and input not only helped the hospital install the system on schedule but continues to be critical in helping information managers refine and improve

the system. Planned enhancements include:

- Integration of nursing and physician data to reduce duplicative data acquisition and entry
- Activation of patient safety alerts (i.e., allergy and toxicity notices)
- Initiation of on-line cost indicators
- Establishment of a clinical data network that links inpatient and outpatient services

Lehigh also hopes to work with other hospitals and healthcare providers to develop electronic medical record standards that can be accepted by state and local agencies as the equivalent of the current hard-copy records.

Linking Process to Outcome

One of the most difficult challenges information system designers face is developing a clinical information system that effectively links care processes to outcomes. As Suzanne Bakken Henry noted, even defining the basic terms on which such systems could be built has proven to be a complex task.

No existing vocabulary effectively links processes to outcomes, Suzanne Bakker Henry said.

Henry, an assistant professor at the University of California, San Francisco, School of Nursing, said attempts to evaluate and control quality in healthcare require accurate descriptions of a patient's condition on admission to a hospital, of the activities and interventions that made up the patient's care regimen, and of the outcome of this care. Vocabularies exist to describe each of these aspects of the patients' experience and history, Henry noted, but none was developed with the explicit purpose of linking process to outcome.

For example, the Systematized Nomenclature of Medicine (SNOMED III) provides a relatively complete vocabulary for describing patient conditions and outcomes but lacks a formalized system for using its codes. Thus two different facilities using the system (or a facility and a third-party

OBSTACLES TO AUTOMATED PATIENT RECORDS

Healthcare providers' experience with attempts to introduce automated information systems have proven how daunting the task can be. As hospital information systems consultant Sheldon I. Dorenfest noted, the possibility of automated patient records was first envisioned 30 years ago, and many persons expected them to become a reality by the early to mid-1970s.

But early developers of electronic medical records oversimplified user needs and based their system on inadequate direction from hospital managers, Dorenfest told the audience at a session of the Healthcare Information Management Systems Society in San Diego. They also brought products to market before they were ready and underestimated the time and capital development required. They usually failed to design effective "person-to-machine" interfaces, and as a result many systems created, rather than eliminated, work, Dorenfest said.

He added that hospital managers have also contributed to the poor performance of information systems. They have been unrealistic in assessing what can be done. Moreover, they have often been unable to define what they would require of a system.

A number of factors contribute to successful system implementation, Dorenfest said. Providers and vendors must first ensure there is adequate time, capital, vision, and leadership to implement a system. As the development process unfolds, providers must continuously clarify how available capital will be allocated and managers' time used.

Dorenfest also suggested that the following elements be part of any front-end development phase:

- A review of present and likely future technology to assess options for system architecture
- A study of the manual information systems at a variety of hospitals to determine the range of functional requirements and how they vary among providers
- A list of essential electronic information system requirements
- A study of what works and what does not work in current automated information systems
- A general plan for the system's functional design and architecture
- A timetable for developing and installing the system

Having the human resources in place for addressing the project's managerial, analytical, and technical needs is another critical success factor, Dorenfest said. He also suggested that managers keep project development isolated from other parts of the organization during formative years.

Dorenfest said hospitals should look carefully at what other providers do well and where they fail when setting their strategic vision. He pointed out that the ideal system of the 1990s does not yet exist. Hospitals that want such a system, he said, "need to either develop their own solution, wait until a more ideal system is proven, or ally with companies or other hospitals in a development project."

payer) may be unable to pass data to one another. Without a large data base linking process and outcomes—and this would certainly require comparable data from a number of facilities—meaningful insight into quality of care will be impossible.

Developing standardized, usable terminology is only a first step, however. As Stanford University Professor of Medicine Leslie Lennert pointed out, quality of care measurements must focus on a minimum of five factors:

- Appropriateness of treatment
- Length of stay and other measures of resource use
- Mortality in hospital and after hospitalization
- Functional status in hospital and after hospitalization
- Patient satisfaction

Overemphasizing or omitting any one of these elements will inevitably lead to a faulty analysis of outcomes, Lennert stressed. He cited one study in which a researcher found that 44 percent of coronary artery bypass surgeries were either inappropriate or had equivocal appropriateness. Patient outcomes data at hospitals performing large numbers of inappropriate surgeries are likely to appear more favorable than they actually are, he said. Such hospitals will have lower mortality rates, shorter lengths of stay, lower charges, and fewer complications.

In the end, Lennert said, accurate assessment of the quality of a particular course of care requires some form of severity adjustment in describing outcomes. The important factor in assessing quality would not be the outcome itself but the difference between observed and expected outcomes in a number of areas. For various interventions, he noted, facilities need to define expectations not only with respect to factors such as mortality rates and functional status, but also in terms of what they expect the intervention to cost and the patient satisfaction to be. Only when a facility has set up adequate systems to measure quality (with appropriate adjustments for severity) can it begin to design and implement strategies to improve quality.

Quality Control

The professional manager attempting to develop an information system that links care processes to patient outcomes must begin with a broad vision of the essential elements of the quality assurance enterprise. Blackford Middleton, MD, who is medical director, Clinical Information Systems, at Stanford University Hospital,said the goal of a clinical information manager should be a system that not only facilitates information management but also promotes interaction between data, analysis, and the user.

The system should not only facilitate information management but also promote interaction between data, analysis, and the user, said Blackford Middleton.

Those developing a system designed to support such a process must be aware of the practical problems that will arise in implementing it and take steps to address them, Middleton said. In this area, perhaps the most critical issue is how to help care givers cope with the additional demands of a quality control process. To facilitate this, information managers should set up systems so that the data required for quality control can be collected as a by-product of routine care and not require additional work, Middleton stressed.

He added that an effective information system will also have consistent measurement scales for clinical findings. Finally, the system should be set up so that results of quality assurance analyses are as easily accessible to care givers as the basic measurements that gave rise to the analyses.

An integrated information environment is critical to these quality assurance work processes, Middleton stressed. Users with access to tools that permit immediate analysis of data should be able to "add the results of these analyses to the clinical information environment as if they were yet another clinical observation," he said. "Requiring the user to switch from one information-processing environment—such as a clerical workstation—to another work terminal for a separate function—such as clinical results reporting—will make it impossible to deliver quality alerts to the user consistently and prevent the user from combining data in novel ways for user-initiated analysis."

Middleton added that ready availability of data or quality alerts that allow providers to compare their therapeutic and diagnostic plans with those of their colleagues can have an important impact on how physicians assess and adjust their practice patterns.

Transforming Heterogeneous Systems

Most information managers must build on systems already in place. At Stanford, Middleton said, the hospital originally installed a financial information system, and over the years other systems were developed in various departments such as pharmacology, radiology, and cardiology.

Continued on page 26

Continued from page 21

The resulting patchwork of computers speaking different computer languages and using different data structures has made it difficult to share data, Middleton observed. To simplify such an environment, the first step is to link computers in a network that enables them to communicate with one another.

The next step, Middleton said, is to create a clinical data base that integrates data elements from information servers throughout the organization. Such a data base would allow users to relate sets of data that previously did not exist on a single system. "A clinician may review a patient's clinical laboratory results along with a current medication list, or a graphical display of changes in blood pressure and pulse shown with changes in prescribed medications," Middleton noted. He added that the ability to compare data would also be useful to an administrator who could, for example, view the case mix of patients, adjusted for severity of illness, for a particular employer or health maintenance organization group contract.

User Interface

User-friendly workstation interfaces are the final requirement for an effective system. Middleton suggested that a manager could begin to create an effective interface by developing a standard layout recognizable to all users of the system. He added that it should also be "tailorable" to the needs of particular users.

Although well-constructed interfaces have many potential benefits, Middleton noted that the most obvious benefit—increased efficiency—may also be the most important. "Simply having access to important clinical data such as the current problem list, the current medication list, the most recent laboratory and x-ray test results, the last hospital discharge summary, and the last office visit note will go a long way to reducing wasted time and duplicated efforts in clinical care." —*Phil Rheinecker*

Continued from page 15

CHA reflects your collective determination to improve the lives of people.

members, has joined with the Public Health Service, the Centers for Disease Control and Prevention, and the American Academy of Pediatrics in an effort to immunize all children under the age of two? Does it surprise you that CHA led the way in the design and articulation of voluntary community benefits standards?

These are not unique roles for CHA. Rather, they are the ways by which CHA reflects your collective determination to improve the lives of people. This is why CHA advises the nationwide Nutrition Screening Initiative, a five-year effort to improve the nutritional status of the elderly. This is why CHA is working with the Healthy Mothers, Healthy Babies Coalition on issues related to breast feeding and immunizations. This is why the Nameless Children of Romania are important to CHA.

Advocating on a Range of Issues

A final major direction is the advocacy, at the federal level, on a range of issues other than systemic reform. Yes, there really are other government relations issues.

Only addressing issues that are critical to the future vitality of the ministry *and* that we can substantially affect, CHA's advocacy range is as varied as your essential interests. Medicare benefits and payments, Medicaid benefits, tax reform and tax exemption, guidelines for grassroots advocacy, unrelated business income tax, Civil Rights Restoration Act, prospective payment system capital fold-in, the "ethics of healthcare rationing," Patient Self-Determination Act, "Bread for the World," Religious Freedom Restoration Act, and the Freedom of Choice Act—all of these are recent examples of CHA's advocacy interests. As you have come to trust, our goal is credible and effective advocacy on your behalf.

Indeed, the words "credible" and "effective" apply to all CHA efforts. It is the promise of our program budget; it is our quality commitment to you. By doing a few things well, CHA encourages you to rely on it when you have special needs arising from your uniqueness as the healing ministry of the Catholic Church. I believe that you can be proud of board leadership and initiative, the determination and ingenuity of CHA's advisory committees, and staff judgment and competency. Together, we have achieved the most unique, responsive, and effective association of its kind in the country.

Profound Change

This year's assembly was an anniversary for me. Fifteen years ago, in New Orleans, I was first elected to the CHA Board of Trustees. One year later, I became CHA's president. I have both enjoyed and appreciated the opportunity to serve CHA. I like working with all of you.

Fifteen years have witnessed profound change: change in our nation, change in our Church, change in healthcare, change in our ministry, and change in CHA. I have no doubt that profound change will be the hallmark of our future. While I would not dare to forecast much of that change, I will risk one prediction: Catholic healthcare will find ways to thrive. We will continue to find ways to grow in the service of people. We will find new ways to bring Christ to the people we care for. *We must because that is our calling.*

I am proud to be joined with all of you in these works. □