

How Hospitals Confront New Technology

Help for hospitals as they navigate the treacherous waters of new technology—one of the most promising avenues for improved quality and safety.

by Molly Joel Coye and Jason Kell

PROLOGUE: Emerging technologies that offer medical benefit but require substantial capital investment pose a challenge to hospitals and hospital-based health systems, whose leaders make most purchasing decisions independently of one another. Of particular interest are “disruptive technologies,” not a felicitous term, which change business models or affect the flow or nature of work within an institution. Digital radiology—medical equipment that is also information technology (IT)—is one example; hemofiltration is another. Currently confined to intensive care units and emergency departments for the care of patients with congestive heart failure (CHF), hemofiltration is migrating to outpatient settings. The authors of this paper note that reimbursement policies driven by federal agencies such as the Centers for Medicare and Medicaid Services (CMS), as well as by private insurers, have the perhaps unintended effect of encouraging the purchase of costly technologies that will shape the course of hospitals’ programs and costs for years to come.

The authors propose that a national forum be developed to track emerging technologies and their spread. Such a forum would be, in effect, an evidence-based organization that would serve as a resource to hospital and health system decisionmakers before they invest in high-cost technologies. As the authors envision it, this forum would not only warn against investments that might not be warranted but would also provide advice about technologies that are most likely to both improve care and justify costs. Such a forum could also track the adoption, use, and, eventually, outcome of the use of new medical technologies.

The lead author, Molly Joel Coye (mcha@healthtech.org), is CEO and founder of the Health Technology Center, a not-for-profit research organization in San Francisco. HealthTech, as it is known, exists to advance “the use of beneficial technologies for healthier people and communities.” Coye, who received medical and master of public health (MPH) degrees from Johns Hopkins University, is a member of the board of the Program for Appropriate Technology in Health (PATH) and the board of directors of the American Hospital Association. Jason Kell is director of projects at HealthTech. In this position he coordinates and oversees all research responsibilities of the organization.

ABSTRACT: Hospital technology decisionmakers now confront a growing pipeline of information technology (IT) and major medical equipment that challenges traditional capital allocation processes. In a highly fragmented industry that is driven by coverage and reimbursement policies set by the Centers for Medicare and Medicaid Services (CMS) and private insurers, the cumulative impact of hospitals' technology investment decisions shapes health care for decades. We propose a framework for the development of a national collaboration for the planning and assessment of emerging technologies, designed to improve the quality and efficiency of hospital decisions. Broader application of technology assessment would restrain inappropriate technology adoption and use. [*Health Affairs* 25, no. 1 (2006): 163–173]

HOSPITALS AND HOSPITAL-BASED HEALTH SYSTEMS are struggling to keep pace with purchasing decisions about emerging technologies. New technologies have become more complex and challenging to evaluate, and in the case of disruptive technologies—those that change existing business models or work processes—estimating the impact on clinical programs, operating costs, and workforce and facility needs is particularly difficult.¹ These problems are exacerbated by new demands for improvement in hospital safety and quality and for performance reporting, requiring further investments in information technology (IT) and in the clinical transformation of care processes.

The hospital sector is still very fragmented in comparison with other sectors. Despite a wave of mergers and acquisitions in the 1990s, 30 percent of licensed hospitals are not part of a multihospital system.² Even within such systems, capital planning decisions are largely made at the individual hospital level.³ Hundreds of individual decisions, then, commit much of the available capital in health care for decades forward.

In this essay we explore the limitations of current hospital planning for major capital investments in technology. From this we propose a framework for private and public policies that would improve the quality and efficiency of hospitals' decisions about emerging technologies. A recent study of hospital investment in “quality-enhancing technology projects” found that 86 percent of responding hospitals have already acquired or budgeted for one or more of the technologies.⁴ Although capital has always been unevenly distributed among hospitals, “have-not” hospitals now face a widening gap in access to the technologies that are critical for making care safer and more efficient.⁵

Hospitals are often accused of adopting technology too rapidly or haphazardly.⁶ Conversely, health care as a whole is accused of adopting many beneficial technologies too slowly (including those that are hospital-based) and generally being slow to innovate.⁷ In fact, hospitals invested an estimated \$26 billion in IT in 2004, and approximately 2 percent of operating budgets were allocated to all technology, including devices, imaging, and IT.⁸

The purchase of new technology, including IT and major medical equipment,

reached 51 percent of all hospital capital spending in 2001.⁹ Investment in IT has been spurred by public and private purchasers' demands for improvements in clinical care and for reporting, and by federal policy initiatives from the Office of the National Coordinator for Healthcare Information Technology (ONCHIT) that support the electronic exchange of health care data and the adoption of electronic medical records (EMRs). Although overall capital spending remained relatively flat in the late 1990s, hospital executives reported an increase in this decade, and spending is expected to climb an average of 14 percent per year.¹⁰ Hospitals are relying more on earnings from operations to finance capital investments, which makes technology acquisition more challenging for low-margin institutions.¹¹

The distinction between medical equipment and IT is blurring as these technologies converge.¹² Digital radiology systems are an excellent example of the technology convergence. Digital radiology equipment is the most commonly planned investment for the next five years; therefore, the convergence cannot be ignored. Many other new medical devices generate streams of data that require analysis, storage, retrieval, and distribution, as well as periodic assessment by providers and response to alerts and reports. In the near future, hospital digital medical records will incorporate information directly from physiological monitoring devices, including "smart sensors" that automatically trigger adjustments such as the release of pharmaceuticals or stimulation of neural centers.

Barriers To Effective Technology Planning

Hospital leaders are concerned about the capacity of their traditional planning processes to evaluate complex and disruptive new technologies. Capital planning committees usually make major decisions regarding technology adoption, but few studies have documented the decision-making processes or the outcome of the acquisition.¹³ A review of existing research and intensive collaboration with approximately one-fifth of U.S. hospitals on technology planning and adoption at the Health Technology Center (HealthTech) during the past five years reveals important barriers to optimal technology planning.

■ **Locus of decision making.** Coverage and reimbursement decisions by the Centers for Medicare and Medicaid Services (CMS), Medicare contractors, state Medicaid agencies, and commercial health plans continue to drive technology adoption, which places hospitals in a largely reactive mode. CMS and health plan coverage policies largely determine the revenue potential that hospitals can expect to derive from adopting a new technology. CMS decisions directly affect hospitals' adoption of beneficial technologies: The early CMS decision on national coverage for drug-eluting stents, for example, led to their rapid adoption, while restricted coverage and reimbursement for implantable cardioverter-defibrillators (ICDs) slowed their adoption despite demonstrated clinical benefit.¹⁴ In lung cancer, positron emission tomography (PET) scanning was initially covered for staging purposes. When coverage became available, its use expanded to monitoring treatment response or re-

currence of the disease, uses beyond those originally intended. On the other hand, CMS coverage will drive adoption of technologies that add to the cost of hospital care but do not provide substantial new benefit; in these cases, both health plans and hospitals find it difficult to constrain physician demand.

■ **“Disruptive” technologies.** When technologies are disruptive, operating and financial impacts are challenging to estimate, which makes it difficult to construct a “business case” for investment. Hemofiltration, for example, has been developed to shorten the time required to remove excess fluid from the circulation of certain patients with congestive heart failure (CHF).¹⁵ It is used in intensive care units (ICUs), but its use will expand to the emergency department (ED) in the near future and eventually to outpatient facilities. Over time, this shift in care setting will greatly reduce the use of ICUs and EDs. But the resulting impacts on ICU and ED usage, elective surgery, and nurse staffing are difficult to estimate. CMS decisions about coding, coverage, and reimbursement rates are also difficult to anticipate in the case of disruptive technologies yet will greatly influence adoption rates. Hospitals could reasonably fear losses in this uncertain environment, despite potentially beneficial results for patients.

Disruptive technologies make it difficult to conduct return-on-investment (ROI) analyses. The recognition that even nonprofit hospitals needed to improve their business management in the 1990s led trustees and executives to demand ROI reports to justify many capital investments in new technologies. In cases such as investment in a new computed tomography (CT) scanner, ROI analyses are a familiar exercise for hospital planners, based on acquisition cost, expected volume, and known reimbursement rates. The same cannot be said for disruptive technologies such as surgical robots, picture archiving and communication systems (PACS), or computerized physician order entry (CPOE) systems. Each of these emerging technologies adds more uncertainty regarding operating impact, reimbursement, and ROI—and further complicates the capital planning process.¹⁶

■ **Physicians’ preferences.** Technology purchases continue to be dominated by physicians’ preferences, especially those of physicians responsible for a sizable volume of admissions.¹⁷ Indirectly, patient demand also influences technology adoption as a driver of physician demand.¹⁸ The income requirements, professional interests, and personal enthusiasms of medical staff are difficult for capital planning committees to challenge, particularly when these things are cloaked in terms of “patient need” and “community service.”¹⁹

■ **Competition.** Local competition among hospitals also sways technology purchase decisions. The “arms race” for medical imaging and other technologies within local or regional markets frequently contributes to the most egregious cases of overinvestment.²⁰ For-profit niche providers—such as heart hospitals—often are better capitalized and able to share risk with physician-investors than is the case for community facilities.

■ **Lack of information.** A lack of detailed, neutral information about candidate

technologies leaves hospital administrators poorly prepared to fend off physician champions of undesirable technologies or to advance beneficial technologies. Hospitals' decisions about technology investments have historically relied largely on information supplied by vendors. In a 1999 survey of hospitals and health systems by the purchasing alliance VHA, the Lewin Group found that fewer than half of all hospitals used external sources of information other than vendors; of those using external independent sources, the majority employed general consultants, and fewer than one-fifth used research institutes or firms specializing in technology assessment.²¹

In more recent commentaries, hospital leaders have discussed concerns about the traditional methods of capital planning for technology.²² Chief among these is the tendency to make isolated decisions about individual technologies without integrating them into long-term mission and strategy.²³ The lack of independent information led a group of health system and health plan executives in 2000 to form HealthTech, a nonprofit organization dedicated to researching emerging technologies, forecasting their evolution and potential impact on health care.²⁴ Other entities, for-profit and funded in part by the developers and vendors of technology, have also entered the market to provide technology-forecasting information.

■ **Reactive posture.** Perhaps the most important limitation, however, has been hospitals' reactive posture in regard to technology: waiting for physician requests or adoption by other hospitals to trigger the planning process. This should not be surprising. If all change is difficult, managing the introduction of a new technology must rank near the top of the organizational pain meter.²⁵ The natural tendency of all organizations confronting complex and disruptive technologies is delay, which results in gridlock.

An escalating pipeline of new medical technologies, new expectations for investment in IT, long-term diminishing access to capital, and limited hospital capacity for planning and evaluating the relative value of various technologies are important contributors to the gridlock. Technology planning is risky and challenging for hospital executives. As L.H. Friedman pointed out, "The acquisition of new technology can be one of the most critical decisions a senior hospital executive makes, and it can have dramatic effects on the organization."²⁶

In a 2005 survey of twenty health care delivery systems conducted by HealthTech and the Monitor Group, chief executive officers (CEOs) overwhelmingly stated their beliefs that hospitals should become more adept at technology innovation and adoption and that technology should play a larger role in their organizations' strategy. Some health systems are attempting to embrace and manage the consequences of disruptive technologies that will ultimately benefit their organizations.²⁷

A 1995 study of hospitals acquiring advanced imaging systems found that hospital leaders' interest in key technologies played a greater role in the acquisition of magnetic resonance imaging (MRI) and CT scanners than did goals related to profit maximization and clinical excellence.²⁸ Some health systems today are at-

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tempting to make technology decisions more systematically and to embrace and manage disruption in the case of technologies they believe will benefit the organization.

Traditional approaches to technology decision making and evaluation of ROI will change as pay-for-performance is further implemented by public and private payers. Because CMS reimbursement drives hospitals' revenue, pay-for-performance will affect traditional cost-effectiveness analysis. Many successful innovators have reported that technologies adopted to improve safety and quality of care, such as bar coding and the “electronic ICU,” have resulted unexpectedly in improved financial performance.²⁹ This discovery might be something of a tautology: Successful innovators might be those most capable of both implementing a technology and extracting its full value. It is consistent with innovation in other industries, in which the success of a new idea is correlated with an organization's ability to maximize value from complex and disruptive technologies.³⁰

Policy Options To Improve Technology Planning And Decision Making

In the early stages of organized quality improvement efforts, health care leaders were exhorted to transform care processes in their organizations despite the lack of a business case for the investments needed to do so. The Institute of Medicine (IOM) Committee on the Quality of Health Care in America observed in *Crossing the Quality Chasm* that this approach could not succeed, however; in the absence of system change, simply “trying harder” will not succeed when there is a lack of a business case.³¹ Similarly, we cannot expect health care leaders at thousands of U.S. hospitals to greatly improve the speed or quality of technology decisions without some systematic changes to support their efforts.

A new framework for public and private policies must address two critical barriers that hamper hospitals from making effective technology decisions: fragmentation and funding. The first issue is the fragmentation of health care providers. Studies of innovation in other industries find that individuals or organizations alone can rarely accomplish successful disruptive change.³² This is because the barriers to improved technology planning and decisions are deep and wide: deep, in that vertical collaboration is required, from suppliers and vendors up through the providers to the payers (the CMS, health plans, and third-party administrators) and purchasers (the CMS, employers, and union trust funds); and wide, in that the participation of other hospital-based delivery systems, as learning and support partners, is also needed. In other sectors, this is described as the need for networks: organized groups of stakeholders collaborating to create the conditions

conducive to change and maintaining that change over time.³³ Just as there was “no business case for quality” until networks of providers, purchasers, and payers changed the requirements and incentives for quality improvement, today there is no business case for rapid adoption of beneficial and cost-effective technologies.³⁴

The second related issue is hospitals’ lack of power in making technology decisions. When the CMS and health plans cover a technology, the floodgates are opened, which makes it nearly impossible for many hospital administrators to fend off pressures from admitting physicians to acquire and use that technology—even more aggressively than initially intended by payers.³⁵ Former CMS official Sean Tunis, Mark McClellan, and others have described the limitations of the CMS’s historical processes for coverage decisions, including a lack of explicitness, consistency, transparency, and opportunities for stakeholders to provide input, and new efforts to address these problems.³⁶ The CMS is attempting to shift to more national coverage decisions, to rely increasingly on evidence-based assessments and comparative analyses of competing technologies, and to signal to hospitals and other providers that beneficial technologies should be adopted more rapidly.³⁷ The Medicare Prescription Drug, Improvement, and Modernization Act (MMA) of 2003 laid the groundwork in current demonstration projects for eventual reimbursement adjustments to support chronic disease management, IT, and other important innovations. Health plans recognize the need for a more public and transparent process of technology assessment: The Blue Cross Blue Shield Association (BCBSA) formed the Technology Evaluation Center (TEC), which has made assessment reports publicly available online since 2003, and in 2004 the Blue Shield of California Foundation established the California Technology Assessment Forum for public education, review, and discussion of technology assessments.³⁸ While the increasing availability of credible technology assessment and forecasting should help, simply having good information is only part of the solution. As long as hospitals remain fragmented and payers’ decisions about coverage and reimbursement broadly influence technology adoption, it will remain difficult for hospitals to plan and allocate scarce capital for the optimal deployment of emerging technologies.

A framework for better decisions by hospitals will require new public and private policies to address these critical barriers. We propose three components: a network of stakeholders to identify potentially beneficial technologies and advance their development, assessment, and adoption; a national set of goals and criteria and a tracking system to implement beneficial technologies; and financing vehicles, to ensure access to these technologies for all who could benefit.

A National Forum For Forecasting And Assessing Technology

There is no centralized resource that tracks such developments and assesses the impact on hospitals’ service-line demand and capacity requirements.³⁹ A national forum would address this broad need in two stages: by forecasting the po-

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tential effects of classes of technologies that are still emerging, and by evaluating specific technologies for which the evidence is sufficient to allow full assessment. The Blue Shield of California Foundation’s forum focuses on this second stage and has already demonstrated that this initiative can work and should be considered a starting point for national collaborations. Similar observations about the lack of a national forum recently led to a proposal that the IOM establish a national program, the IOM Roundtable on Evidence-Based Medicine, for the forecasting and assessment of emerging technology.⁴⁰

■ **Network of stakeholders.** A national stakeholder forum would allow key health care constituencies to work in concert on neutral territory to develop industry agreements about potentially beneficial and cost-effective technologies. The intent would not be to pick winners or losers but rather to promote comparative analyses of alternative technologies and to identify and reduce barriers to the dissemination of beneficial technologies that provide value to the health care system. Such a forum could identify the cost of the technology, specify the type of evidence required by payers and providers to justify use of specific products or services, and improve the likelihood that market incentives will support beneficial technologies once they have cleared their review criteria. It would be reasonable to expect resistance from adversely affected stakeholders. The opposite result, of course, would also occur: Technologies that are unlikely to provide major value or quality would also be identified. A national forum would broaden stakeholders’ involvement in the early evaluation and modification of potentially beneficial technologies, when there is still the opportunity to influence their design, function, and applications. Such a forum would also reduce the likelihood that hospitals will confront a growing pipeline of new technologies in isolation. Although previous efforts at establishing a national forum for health technology evaluations have failed, increasing cost pressures on the health care system and the bulging pipeline of costly emerging technologies are creating an environment that could provide the stimulus for this type of process to succeed.

■ **Goals and criteria.** Technology adoption goals should be clearly identified. One key consideration should be to explicitly include cost-effectiveness. Tunis emphasized the need for improved technology decisions that incorporate cost-effectiveness analysis: “Obtaining good value from healthcare spending is an urgent policy priority, made more so by the accelerating pace of medical discovery. Perhaps the most important benefit of expanding the use of economic analysis in health policy decision making would be to support more informed public dialogue about how best to achieve a healthcare system that produces high-quality and safe healthcare, allows patient freedom of choice in healthcare decisions, maintains

healthy innovation, and expands access to care while remaining affordable.”⁴¹ As Tunis and others have pointed out, the early evaluation of technologies would be even more useful if the adoption and use of technology could be tracked more accurately.

Purchasers and payers have been understandably reluctant to provide incentives for quality and safety improvement without genuine accountability for providers and plans. The adoption and use of technology—the source of both enormous cost and great impact on care—should be monitored to ensure accountability and to learn about technologies as they are deployed. Revisions to current coding systems and the integration of technology utilization indicators into clinical reporting are among the changes that will be needed to accomplish this.

■ **Financing vehicles.** New sources of capital will be needed to ensure access to beneficial technologies for all patients. A few safety-net provider systems have been able to adopt key technologies despite heavy uncompensated care burdens and limited capital access. These include the New York City Health and Hospital Corporation and Cambridge Hospital in Massachusetts. But these institutions stand in contrast to hundreds that lack the capital, leadership, and community support needed for such bold investments. Again, the conclusions reached by the IOM Committee on the Quality of Health Care in America ring true: Systemic changes are needed.

To assist organizations with limited access to capital, new funding mechanisms should be developed. Federal support is needed to prevent stagnation of investment in EMRs, CPOE, IT, and clinical technologies. In an era of burgeoning federal deficits and employer cost shifting, it might seem unrealistic to suggest a need for federal action. But the government can accomplish much of what is needed through the establishment of a financing vehicle used extensively in other sectors, such as highway construction and environmental remediation. A revolving loan fund (which Molly Coye and Bill Bernstein first proposed in 2003) would make financing of investments in beneficial technologies feasible for the majority of hospitals and could provide direct grants to safety-net institutions as needed.⁴² As for other incentives, loan fund financing would require hospitals to report technology use, which would be added to a national database similar to that required by the U.S. Food and Drug Administration (FDA) for postmarket surveillance of drugs and devices.

HOSPITALS AND HOSPITAL-BASED SYSTEMS face many challenges over the next decade, from the influx of aging baby boomers to the shortage of nurses and other practitioners. Helping hospitals make better decisions about technology to improve quality of care and maximize the use of scarce capital should be a priority for all stakeholders. A framework that brings stakeholders together to identify the best use of capital and the most beneficial applications of technology, with accountability for its appropriate use and commitment to equita-

ble access, is urgently needed. Organizations that have pioneered technology assessment demonstrate expertise but have often appeared hostile to technology because of the need to counter the overwhelming incentives that encourage clinically unnecessary utilization. A framework encouraging the appropriate adoption of beneficial technologies and their scrupulous testing will release the gridlock and prove to be a strong platform for collaborative policy development.

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NOTES

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