

## MEDICAL TECHNOLOGY

### INTRODUCTION

Remarkable advances in medical technology continue to transform health care delivery. From gene therapy to tissue engineering to telepresence medicine, the proliferation of new technology promises even greater improvements in patient care, health status, and quality of life. Yet, while the benefits resulting from technological innovation profoundly enhance our lives, the costs to acquire, provide, and maintain cutting edge medical technologies increasingly strain hospital budgets.

The traditional role of Connecticut's acute care hospitals, many of which were established during the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, has been as the central providers of health care services to their surrounding communities. Connecticut hospitals have focused on offering a wide array of services that meet the increased needs and demands of their patients. This was accomplished primarily through the expansion and construction of physical facilities (after the First World War) and the addition of much needed health care services. Although the overall mission of most hospitals has not changed significantly over the years, their role in the provision of health care has evolved considerably.

The institution and utilization of new technologies in the hospital setting has dramatically influenced the way in which hospitals function as health care providers. Minimally invasive surgical procedures, highly advanced medical equipment and breakthrough prescription medications are particularly significant in the evolving role of hospitals as they have all contributed to shorter, and oftentimes costlier hospital stays.

Of key importance to technology management, particularly for newer advanced technologies, are discrepancies between technology costs and third-party payment to hospitals. When reimbursement fails to keep pace with these new procedures and technologies, hospital budgets and reserves that are already at risk are further compromised. The payment process for new technology, involving coverage, coding, and reimbursement-level decisions, often lags behind and falls below actual costs to hospitals. For example, updates in payment categories and levels using diagnosis related groups (DRGs) for inpatient care can be delayed and insufficient. As health care payment mechanisms using prospective payment structures expand from hospital outpatient care, long-term care, and other settings, it will be increasingly important to monitor the impact of payment mechanisms on health care budgets and technology use.

While the great diversity of technological innovations are affecting hospitals, outpatient clinics, freestanding surgicenters, long-term care and other health care settings, this discussion focuses primarily on technology that has a more direct impact on the acute care hospital environment. Medical devices, pharmaceuticals, minimally-invasive surgical procedures, and transplantation have made considerable contributions to the improved health status of our population. At the same time, these technologies carry economic implications that must be identified, understood, and managed to the greatest extent possible. For the last 30 years, medical technology has been

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identified as one of the major drivers of increasing health care costs. The attention to this relationship intensifies when national health care costs or health insurance premiums are rising at rates that are significantly higher than the overall U.S. economy. Weighing the benefits of new medical technology against its costs continues to challenge policy makers, industry leaders, employers and insurers alike. For hospitals, the need to remain competitive by offering state-of-the-art technology often collides with the need to operate in an environment where cost cutting is requisite to survival.

## OVERVIEW OF ADVANCES IN MEDICAL TECHNOLOGY

### Medical Equipment

Medical devices, instrumentation, and equipment are highly competitive technology sectors, often characterized by continued incremental advances and short life-cycles. As such, maintaining state-of-the-art technologies can be an ongoing, costly effort. Medical equipment is a far reaching term that includes thousands of items ranging from medical supplies, such as stethoscopes and rubber gloves, to surgical instruments, such as scalpels and suturing devices, to medical assistive devices such as wheelchairs and knee braces, and even major medical equipment, including linear accelerators, magnetic resonance imaging (MRI) units and angiography equipment.

Most hospital services involve the use of medical equipment

and supplies. Some medical equipment, such as blood pressure cuffs, centrifuges for hospital laboratories, and computerized tomography (CT) scanners, are primarily used in diagnosis and monitoring of disease. Other forms of medical equipment, such as stents and pacemakers, hyperbaric oxygen chambers, lithotripters for the elimination of kidney stones, and linear accelerators for radiation oncology, are used for therapeutic purposes to treat disease and injury. Some medical supplies are single-use only items; these items must be continuously reordered to maintain sufficient inventory.

It is difficult to estimate how much Connecticut hospitals spend annually on the medical supplies and equipment they must acquire to maintain and improve their service levels. According to a 1995 estimate, U.S. hospitals spend approximately \$7.3 billion annually to acquire new and replacement patient care equipment.<sup>1</sup> The expense associated with major medical equipment not only includes major initial capital outlay, but also the costs for maintenance over the equipment's useful life and eventual replacement costs. For instance, in Connecticut since mid-1999, seven CT scanners were replaced at six

acute care hospitals at an estimated total capital cost of more than \$6 million (including related costs). The machines ranged in age from 6 to 17 years, and their original total purchase price was nearly \$8 million. This apparent decrease in cost may be attributable to the introduction of enhanced CT



technology and increased competition in the manufacturing marketplace.

This, of course, is not necessarily the case for all major medical equipment. All hospitals must decide how to fund and prioritize equipment acquisitions and replacements, as funds are limited. Hospitals frequently must stagger acquisition of costly replacement projects in order to fund them individually over a period of time. Rather than expending a large amount of capital at once, many hospitals must determine which equipment is in most urgent need of replacement, and which equipment can be refurbished or replaced at a future date.

The declining purchase price of some major medical equipment allows non-hospital based providers to acquire the advanced technologies that allow them to compete with hospitals in offering such services as imaging, diagnostics, and surgery. For example, OHCA Certificate of Need (CON) records for MRI acquisition activity during the past six years reveal that MRI equipment is being acquired by non-hospital based providers at an ever-increasing rate. In 1994, seven MRI units were acquired by Connecticut acute care hospitals while only one was acquired by a non-hospital based provider. In 1996, there were four units acquired by hospitals and four by non-hospital providers. From 1997 to the present, 26 hospitals acquired MRI units while 39 non-hospital based providers (mainly private practice radiology groups) acquired MRI units. A new lower cost MRI market emerged in the mid-1990s allowing for a majority of the non-hospital based units to be acquired at much lower costs than the hospital-based units. The hospital-based units typically cost significantly more as hospitals generally acquire higher field strength units in order to provide the quality imaging needed at an acute care level.

Despite the complexities of equipment acquisition and replacement, there are clearly some alternative and creative solutions that Connecticut's hospitals do and should continue to utilize in order to address some of their various capital equipment acquisition dilemmas. Many hospitals have elected to join a consortium of providers in order to provide services on a shared-use mobile basis. For example, lithotripsy is currently only offered on a shared-use mobile basis. This allows a hospital to provide a service to its patient population without having to incur an enormous capital cost. The shared-use option is generally available for diagnostic imaging equipment, such as CT scanners, MRI units and PET scanners and is one way in which hospitals in the state can provide these services at a reasonable cost.

#### *The Example of*

#### *Positron Emission Tomography (PET)*

One specific example of the dynamic changes in the use of medical technology in the state is PET scanning. PET scanners are among the most expensive units of major medical equipment available today. PET scans are non-invasive procedures used to detect metabolic rates of organs and tissues using radioactive agents that emit positively charged electrons (positrons). While useful in a number of specialties, PET is increasingly valuable in the fields of neurology, cardiology, and particularly cancer imaging including monitoring the effectiveness of chemotherapy and radiation therapy. The cost of a PET scanner varies by manufacturer and model but is generally

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in the range of \$1.5 to \$2 million. Along with the cost of acquiring the scanner itself, a PET provider will also have to incur additional expenses associated with this technology. This includes the cost of facility and other physical plant modifications, radioisotopes (which usually must be transported to the site), staffing, and training.

In 1999, the Health Care Financing Administration (HCFA) expanded reimbursement for PET studies for Medicare beneficiaries, thereby increasing its clinical acceptance. Prior to this, PET technology, which had been in existence for many

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years, was not widely used outside major teaching and research institutions. Medicare payments had been approved in early 1999

for a short list of procedures (including procedures related to lung cancer, melanoma, lymphoma and colorectal cancer). The list of procedures approved for payment continues to expand. With the growth of federal reimbursement opportunity, so grows the demand for this technology. Other payers have taken HCFA's lead and now reimburse for these PET studies.

With the 1999 HCFA decision to expand PET reimbursement, a large number of providers in the state have begun the process of designing PET scanner acquisition proposals. There are currently five separate Letters of Intent or Certificate of Need (CON) applications filed with the State Office of Health Care Access. The five projects involve one fixed site (equipment is based at one site and not transported), and four shared-use mobile sites. The five projects involve 14 acute care hospital sites and three private practice radiology sites. Reviews of all of these projects are currently pending.

## **Surgical Advances**

Surgery is another area of medicine that has been virtually transformed by innovative new techniques and technologies. The acceptance and refinement of minimally-invasive surgical procedures, improvements in anesthesia, patient demands and the push towards greater cost savings have facilitated the shift of surgical procedures from the traditional hospital setting to free-standing ambulatory surgical centers, outpatient clinics, and physicians' offices.

Ambulatory surgery may be classified as any elective surgery where a patient is able to leave the site of the surgery the same day it is performed. Some common procedures performed on a same-day basis include certain gastrointestinal, ophthalmic, gynecological, and orthopedic surgeries. By 1998, more than 50% of all surgeries performed in the United States were done on an outpatient basis.

The cost of these procedures is often 30%–60% less than the corresponding inpatient procedure.<sup>2</sup> Connecticut appears to be following these national trends.

First performed in the 1960s, minimally invasive surgical procedures (including arthroscopic, endoscopic, and laparoscopic surgeries) now use small cameras and video monitors for visualizing the surgical field, and have improved outcomes, reduced morbidity, and lowered costs. One common procedure, laparoscopic cholecystectomy (for gallbladder removal), replaces an open surgical procedure that required a minimum overnight hospital stay, and is typically performed on an outpatient basis with a high success rate.

Ambulatory surgical centers, or ASCs, are highly regulated, often at the federal, state and peer level. Federally, ASCs must undergo rigorous inspections to be approved for

Medicare reimbursement. As of 1998, 41 states, including Connecticut, required licensure for these facilities. ASCs also choose to undergo a voluntary accreditation process by their peers, which may include the Accreditation Association for Ambulatory Health Care (AAAHC) or the Joint Commission on Accreditation of Healthcare Organizations.<sup>3</sup> By 1996, over three million surgeries were being performed yearly at ambulatory surgical centers nationwide. The proliferation of freestanding ambulatory surgical centers, equipped to perform numerous outpatient procedures, has had a profound impact on hospitals. According to the American Hospital Association, the number of inpatient hospital surgeries decreased by 25% between 1984 and 1993 as the number of ambulatory surgeries increased.<sup>4</sup>

While less-invasive procedures have yielded positive outcomes including lower morbidity, greater convenience, cost savings, shorter recovery periods and fewer missed days of work, hospitals have been affected financially in the form of decreased revenues from shortened hospital stays. Hospitals are also facing stiff competition from ASCs, which can not only choose to offer more lucrative selections of procedures but can avoid having to provide care to lower reimbursement patients including Medicare and Medicaid enrollees. As a consequence, hospital inpatient care environments are left with a sicker, more costly mix of patients. The need to provide care for this costly patient population continues to drive rising hospital costs, despite other cost-cutting efforts.

To take greater advantage of cost saving efficiencies and better-aligned reimbursement mechanisms, hospitals have also begun to establish their own off-site, freestanding surgical centers that operate

independently under a separate license. While all Connecticut hospitals currently provide ambulatory surgery, outpatient caseloads are often forced to compete with inpatient needs. An individual scheduled for an elective, non-emergent procedure could potentially be bumped or rescheduled if an inpatient emergency arose. A separately functioning facility would avoid these delays and maintain normal, uninterrupted daily schedules.

### **Pharmaceuticals and Biologicals**

Pharmaceuticals affect both the type of care that hospitals can offer and the cost of those services. Major drug advances over the last two decades have been made in such high-volume classes as antihistamines, antidepressants, cholesterol-lowering agents, and anti-ulcer agents. The emergence of drug-resistant pathogens is prompting greater attention to new antibiotics. Continued advances are being fueled by drug discovery technologies such as combinatorial chemistry and rational drug design. Development of new vaccines and other biologics are also having dramatic impact on patient care. New therapeutic vaccines are being investigated and used in the treatment of some cancers, for example, by boosting the body's cytotoxic response to tumors.<sup>5</sup> Those currently receiving the greatest attention are the ones that treat various chronic infections, viruses, neurological, and mental diseases. The development of anti-cancer vaccines has also gained momentum as their side effects tend to be far less traumatic than other forms of cancer therapy. While advanced pharmaceuticals have expanded treatment options, they have contributed to the increased cost of inpatient acute care.

Spending on pharmaceuticals has increased dramatically over the past several years. HCFA reports that expenditures in

pharmaceuticals have increased from \$50.6 billion in 1993 to about \$90.0 billion in 1998.<sup>6</sup> From 1980 to 1997, pharmaceutical spending as a percentage of total health care spending grew from 4.9% to 7.2%.<sup>7</sup> With the aging of the baby-boom generation, one of the pharmaceutical industry's strongest markets, the increase in pharmaceutical expenditures is expected to continue. The pharmaceutical industry spent over \$17 billion on research and development of new pharmaceuticals and nearly \$8.3 billion marketing its products in 1998.<sup>8</sup>

While the majority of drug spending takes place on the outpatient care side, the rising cost of drugs has clear and dramatic implications on hospital spending. With drug expenditures of \$13 billion, hospitals held 51% of the institutional market while sales to clinics accounted for 25%.<sup>9</sup> The American Society of Health Systems Pharmacists' (ASHP) National Survey of Pharmacy Practice in Acute Care Settings for 1998 revealed that the average spending for drugs accounted for roughly 71% of total hospital pharmacy expenditures. Among all types of drug spending, oncology drugs represent a disproportionate share in hospitals. One Connecticut acute care hospital claims oncology alone accounts for 43% of its drug budget. Gene

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and receptor-specific cancer drugs and other cutting-edge oncology therapies are extremely expensive.

Direct-to-consumer (DTC) marketing strategies have also played a role in the increase of drug cost and usage. In the past, drug advertising was limited to marketing directly to physicians by means of professional medical journals. FDA changes in 1985 and 1997 made it possible for drug companies to advertise their products directly to con-

sumers. Pharmaceutical companies are capitalizing on this marketing opportunity, expanding patient demand and increasing their own marketing costs, which must be recovered in drug sales. Recent statistics on drug spending trends of the most heavily marketed prescription drug products demonstrate the great impact that DTC marketing has had on pharmaceutical sales. During the five-year period of 1993-98, spending on oral antihistamines increased by 612%, cholesterol-reducing drugs by 194% and anti-depressants by 240%. Patients, convinced of the effectiveness of newly advertised wonder drugs, now lobby their physicians to prescribe them. Surveys of physicians have found that most have been pressured to prescribe newer advertised drugs and a majority of them are generally willing to comply with their patients' wishes.<sup>10</sup> In addition, other factors including the more expensive mix of products (i.e., where more expensive and often more effective drugs replace older, less expensive ones), and price inflation (higher unit prices) also contribute to these extraordinary increases in drug spending.

### THE ASSESSMENT OF NEW TECHNOLOGIES

Hospitals and other health care providers must continuously manage health care technology in order to remain competitive and fulfill their organizational missions. A value analysis of the technology being considered by an institution requires detailed assessments of certain sets of technological effects, properties or impacts including safety, effectiveness, cost, cost-effectiveness and others. Hospital technology acquisition committees can help hospital administrators screen and interpret the considerable bodies of information available on any particular technology. While most technology acquisition decisions are routine, new technologies that represent clinical breakthroughs tend

to require more careful assessment, as do those that replace older technologies or represent large differences in unit or aggregate cost.

An important managerial and strategic consideration for hospitals is identifying, acquiring, and interpreting information for technology assessment. This is available from various sources, including technology manufacturers, scientific and biomedical literature, medical professional organizations, academic institutions, government agencies, and technology assessment report vendors. Examples of such vendors are the Blue Cross and Blue Shield Association, HAYES, Inc., and the University Health System Consortium. The World Wide Web is an increasingly important medium for identifying and acquiring technology assessment information, although it also provides access to many sources that are of questionable validity.

One of the key technology assessment sources in the federal government is the Agency for Healthcare Research and Quality (AHRQ), formerly the Agency for Health Care Policy and Research. AHRQ's Center for Practice and Technology Assessment (CPTA) is responsible for three important programs related to technology assessment. The Internet-based National Guidelines Clearinghouse makes available clinical practice guidelines generated by public and private organizations for reference by clinicians, patients, health care managers, and others. CPTA coordinates the Evidence-based Practice Centers (EPC) program, in which 12 private organizations (primarily academic centers) generate evidence reports and technology assessments on topics of national importance that can be used by other organizations to develop their own technology assessments, practice guidelines, and other initiatives to manage technology and

improve quality of care. Also, CPTA is responsible for AHRQ's own in-house technology assessment program, which generates publicly available technology assessments and technology review, primarily in response to requests from HCFA to inform national Medicare coverage decisions. Most of the technologies addressed by the EPCs and AHRQ's in-house program, are medical and surgical procedures; a small number are device based (e.g., involving radiological procedures); and several involve drug therapy.



### **MEDICAL TECHNOLOGY CHALLENGES FACING CONNECTICUT'S HOSPITALS**

Despite a greater level of awareness surrounding the difficulties faced by today's hospitals, there remain significant issues that have yet to be addressed. Numerous challenges face Connecticut's hospitals in the area of the medical technology. Hospitals must:

- ◆ be able to manage technology effectively. This includes monitoring the current status and demand for technology, as well as forecasting demand and making technology

acquisition and management decisions accordingly.

- ◆ determine the short- and long-term cost implications of technology. They must determine whether a new technology has short-term costs that will achieve long-term savings or institutional goals, whether it will produce revenue immediately, in the long-term, or not at all, yet must be acquired nevertheless. They must also be able to determine the best way to acquire technology, e.g., outright purchase, leasing, or sharing arrangements.
- ◆ determine whether there are certain areas of specialization they should pursue, and to establish the necessary technological portfolio, facilities, and staffing to do so.
- ◆ weigh strategically their corporate alliances and other relationships with external institutions in order to optimize their offerings of technology and related services. A number of hospitals have corporate affiliations that should be considered in determining institutional medical technology needs. Hospitals within integrated health systems need to determine what technology should be at each facility and whether technology should be standardized across affiliate lines. In some cases, it might be feasible to enter into non-affiliate multi-provider agreements to share technology.
- ◆ prioritize needs within their institutions and evaluate resource capabilities. Addressing the needs of sometimes competing interests, including

the purchase of costly new equipment, financing the high cost of specialized physical plants, and maintaining a skilled workforce within the constraints of a limited capital and operating budget makes setting priorities a continuing challenge to hospital administrators.

- ◆ determine demand and resource requirements for health care technology at institutional, regional, and statewide levels, in cooperation with other institutions and state policymakers. Decisions regarding such major technology allocations such as transplant programs, new cancer centers, major medical equipment purchases, and major surgical programs have implications at multiple levels of health care delivery in the state and region.
- ◆ identify and have access to multiple, evidence-based information sources about technology assessment and management. Given the richness and diversity of the new technology pipeline and increasing demand for advanced technology, hospitals must have ready access to current, credible information to support their technology management decisions.
- ◆ perform not only initial assessments of new technologies, but, with the dynamic nature of technology, continually reassess them in order to determine whether there is a continued need for existing types of supplies and equipment.

## CONCLUSION

High demand for continued technological advances is deeply embedded in the American health care system. More informed and better equipped to make knowledgeable health care decisions, patients and other consumers expect unfettered access to new, safe, and effective drugs, medical devices and equipment, and medical and surgical procedures. Superior health care is no longer considered a luxury but the benchmark by which health care has come to be defined. However, most advanced technology is costly on a unit basis, aggregate basis, or both. For hospitals, meeting the ongoing need to remain cutting edge is essential in remaining competitive. Accomplishing this in an environment where reimbursement for services lags behind their actual costs has become increasingly difficult. Tight budgets make capital outlays for new purchases problematic. Addressing the needs of competing interests, including purchasing costly new equipment, financing the high cost of specialized physical plants and maintaining a skilled workforce within the constraints of a limited budget makes setting priorities a continued challenge to hospital administrators. With the continued proliferation of medical technology, developing strategies to maximize limited health care resources and manage costs to deliver high quality health care are expected to pose a continued challenge to policy makers, health care providers, insurers, and consumers of health care.

### FOCUS GROUP COMMENTS AND RECOMMENDATIONS

In the summer of 2000, the Office of Health Care Access sponsored a focus group composed of hospital administrators, commercial payer executives, bond insur-

ers, hospital auditors, and State officials to discuss the impact and challenges of medical technology for Connecticut hospitals. The following is a summary of group comments and recommendations.

The greatest concern expressed by the focus group was the financial impact of medical technology on hospital systems. To fulfill their missions, hospitals must provide access to advanced medical technology. Not to do so would compromise their missions and the care of patients. The focus group emphasized, however, that third-party payment systems, including coverage, coding, and reimbursement levels, are too slow and insufficient to enable hospitals to provide needed technology. The new equipment and information technology (IT) platforms that will be necessary to stay apace with advancing technologies are becoming increasingly expensive. Hospitals are struggling to remain financially viable while providing high-quality health care. Hospital administrators, payers, and others concur that more rigorous, evidence-based assessment of medical technology would support better informed, cost-effective management of technology. In the view of the focus group, while advanced medical technology has the potential to help Connecticut hospitals pursue their missions and to improve patient health, the management and financing of such technology also pose great challenges to the fiscal viability of these hospitals.

- ♦ Medical technology and reimbursement: Medicaid reimbursement should be reformed, so that increased State payments would result in a matching increase in federal payments. Medicaid is a high-volume, low-rate payer. Increases in reimbursement

rates would help hospitals substantially. The State should mandate a capital funds program dedicated to improving technology in Connecticut. Funds would be used to subsidize medical technology costs in hospitals.

- ♦ Management of medical technologies: Provide greater support systems for technological evaluations, perhaps via the State Certificate of Need program. Some participants suggested the State provide committees to assess effectiveness of new technologies, which would assist hospitals in making more prudent acquisitions. A technology information repository

or clearinghouse should be established, which would give individual hospital facilities easy access to literature and the necessary data to determine the effectiveness of new technological developments.

- ♦ Health informatics and information technology: Develop a funding system to help hospitals acquire needed, yet expensive information technology (IT) platforms. The focus group indicated that Connecticut could lead the nation in developing a universal IT platform for hospital facilities.

## NOTES

<sup>1</sup>“Clinical Engineering Helps Reduce Equipment Costs,” David M. Dickey. *Healthcare Financial Management*. 1995.

<sup>2</sup>“History and Growth of the Ambulatory Surgery Center Industry” Federated Ambulatory Surgery Association. 1998. [www.fsa.org/asc.html](http://www.fsa.org/asc.html).

<sup>3</sup>Federated Ambulatory Surgery Association. *The Regulation of Ambulatory Surgical Centers* 1998. [www.fsa.org/asc.html](http://www.fsa.org/asc.html)

<sup>4</sup>“Ambulatory Surgery Centers: Harbinger of Managed Care Shift.” Gail Stout. *Journal of Health Care Resource Management*, April 1996.

<sup>5</sup>*Health and Health Care 2010, The Forecast, The Challenge Medical Technologies*. Robert Wood Johnson Foundation, [www.rwjf.org/iftf/index.htm](http://www.rwjf.org/iftf/index.htm).

<sup>6</sup>“States Face Increased Expenditures for Pharmaceuticals,” National Governors Association Center for Best Practices. *Issue Brief*, February 2000.

<sup>7</sup>“Factors Affecting the Growth of Prescription Drug Expenditures” Barents Group, LLC. Washington D. C.: National Institute for Health Care Management Foundation, July 1999.

<sup>8</sup>*Pharmaceutical Profile 1999*. Pharmaceutical Research and Manufacturers Association. June 30, 1999.

<sup>9</sup>“Projecting Future Drug Expenditures,” Bernard Mehl and John P. Santell. *American Journal of Health System Pharmacists*, January 2000.

<sup>10</sup>*Direct to Consumer Advertising Ads “Raising Consumer Awareness”* Scott-Levin Consulting, July 24, 1998 News Release (<http://www.scottlevin.com>).