

3

Healthcare Technology

Learning Objectives

- Describe the development of healthcare technology
- Distinguish types of technologies and their roles in healthcare
- Understand the benefits, costs, and assessment of technology
- Describe how technology in HSOs is managed
- Detail the roles of information technology and telemedicine in services delivery
- Comprehend the prospects for the future of healthcare technology

Discussion Questions

1. *Describe the effect of medical technology on HSOs/HSs and the costs of health services. Link the theories of distribution of scarce lifesaving technology described in Chapter 1 (and in more detail in Chapter 4) with the problems that HSOs/HSs experience in managing medical technology.*

Effect of Medical Technology. The diffusion of new technologies into medical practice has had a profound effect on HSOs/HSs. Technology's costs and potential legal liability have forced them to implement formal financial and capital expenditure planning and management of technology. Historically, HSO/HS managers relied primarily on physicians to review and recommend which technology to acquire. More recently, however, managers have asserted greater control. The best decisions for HSOs/HSs are made with a fully involved clinical staff. Comprehensive decision making about acquiring access to medical technology includes considering the following:

- Consistency with organization's mission and vision
- Efficacy of new equipment
- Value added to improving community health status
- Need and projected utilization in service area
- Useful life compared with anticipated obsolescence
- Similar technology/services in competing organizations
- Effect on utilization of other technologies
- Effect on operating costs and need for specialized staff
- Projected revenue, including possible decreased revenue from other technologies
- Safety of new equipment and risks associated with its use

Quality control and quality improvement are needed to maintain and operate equipment efficiently. Initial training of staff and maintaining competence are essential. Sophisticated technologies and their potential risks require clinical engineers and biomedical equipment technicians, either internal or external. Costs of technology are those to the HSOs/HSs and consumers *and* to the system. HSO/HS costs include purchase price or costs of lease; planning and engineering needs; site preparation; and operating expenses for utilities, supplies, maintenance, record keeping, and staff. Consumers' costs include out-of-pocket expenses and the risk associated with using a given technology. Health system costs include charges for the technology, as well as the opportunity costs of not using resources in other ways. Total costs will likely increase as technology is added to the healthcare system. Many new technologies reduce overall costs to society because they cost less to use; patient recovery times are shorter; and disease is prevented or its progression is halted.

Distribution. Partly because of escalating costs, providing scarce lifesaving technologies raises microallocation and distributive justice issues. Factors include scarcity of resources, such as organs to transplant or specialized staff needed to apply a technology, and the cost of devices, such as implantable artificial hearts or dialysis machines, or the cost of treatment in an inten-

sive care unit (ICU). Scarce resources mean that some who might benefit cannot obtain the technology. Who decides who receives medical resources? On what basis? Who decides who decides? Physicians determine medical need and appropriateness of the technology. Because they owe each patient the same ethical duty, however, physicians should not decide about allocating scarce lifesaving technologies to persons with equal medical need.

Theories of distributive justice help solve such dilemmas by requiring that like cases are treated alike; this requires a formal process to identify and prioritize like cases. Utilitarianism incorporates “a social worth or merit” criterion. This is a judgment about the patient’s previous or continuing contribution/importance to family and society and the effort to achieve the greatest good for the greatest number. Judgments about social worth are subjective, however. Further is the question as to who will be the decision maker, which is also value-laden and subjective.

Libertarian theory asserts that allocation should be based on the free market and a person’s willingness and ability to pay. This theory contravenes prevailing societal values as to “fairness” in the distribution of health services but is much less subjective than is utilitarianism.

Egalitarianism seeks to provide all with a “decent minimum” of health services. As with the “social worth” standard of utilitarianism, however, who determines the decent minimum? Egalitarianism is not useful in deciding how to distribute scarce lifesaving technologies, because they are not part of the concept of a decent minimum.

Other theories of distribution of scarce lifesaving technology include a lottery (random selection) and first-come, first-served for those who meet medical criteria. First-come, first-served is easily implemented and requires fewer difficult choices. However, this theory may compromise the premise of distributive justice that like cases be treated alike.

2. Identify the effects of various types of payment mechanisms on the development of new medical technology. What are the likely effects on use? What are the implications for patient care?

Types. Fee-for-service and cost-based reimbursement have the incentive to provide as much treatment as needed (or more) and to be relatively unconcerned about costs. Incentives in newer forms of payment, such as fixed-payment systems (including diagnosis-related groups [DRGs]), per member per month payments, and capitation, are to provide less treatment, especially that which is high cost. All services must be provided at lowest cost.

Effects. Less money for capital equipment will inhibit acquisition of technology and have a chilling effect on development and diffusion of technology. The incentive will be to choose lower-cost technology(ies). Fixed payment should promote more selective acquisition of technology and prompt greater attention to its effect on operating costs. Emphasizing operating costs will give priority to more cost-effective technologies or those that reduce overall costs of treatment by providing new clinical information. This should cause less cost-effective technologies to be abandoned or replaced.

Implications. Fixed payments should cause technology to be used more appropriately. This will improve patient care by eliminating unnecessary tests and procedures. Patient care may be adversely affected if incentives reduce costs by inappropriately limiting use of technology. Quality review activities in HSOs/HSs, as well as monitoring functions of quality improvement organizations (QIOs) (which replaced peer review organizations [PROs]), will help ensure the appropriate use of technology.

3. *The increasing portability of technology makes it available in settings other than traditional HSOs. As traditional settings for medical technology, acute care hospitals are greatly affected by portability. Identify the advantages and disadvantages from the standpoint of the HSO and the patient.*

- The advantages of portability of technology for the HSO and the patient include the following:

For the HSO

It may mean lower costs and increased availability.
It offers alternate ways to deliver services.
It increases ability to compete in the marketplace.
The HSO can deliver better quality care.

For the patient

It increases access.
It may lower costs.
It increases choice of providers.
Care is likely to be available on an outpatient basis.

The disadvantages of portability of technology for the HSO and the patient include the following:

For the HSO

It causes a more competitive environment—a technology arms race.
The HSO will compete with its licensed independent practitioners (LIPs), especially physicians.
Loss of market share could cause financial problems.
Delivering all services may be impossible.

For the patient

There is less control of quality.
Patients may receive unneeded services.
Lack of knowledge makes choices imperfect.
There is less coverage by traditional insurance.

4. *Trends suggest significant consumer interest in alternatives to traditional medicine. These include the low- or no-technology treatment found in holistic medicine, wellness care, and disease prevention. Identify the implications for society and traditional HSOs, such as hospitals.*

Implications for HSOs/HSs of consumer interest in complementary and alternative medicine (CAM) include the following:

- New types of HSOs will emerge to meet patient needs/demands.
- Current HSOs/HSs must be ready for new developments and change.
- HSOs/HSs whose income is derived largely from high technology may decline in number.
- HSOs/HSs that rely on revenue from technology to offset other losses will suffer.
- Technology-based HSOs will compete aggressively.
- LIPs and HSOs will increasingly compete with one another.
- Total costs to the healthcare system are likely to increase since CAM is additive.
- Political and economic issues among LIPs will cause major problems for HSO managers.

5. The control of development and generalization of medical technology is fragmented. Identify control points, and suggest ways to improve them. Distinguish the private and public sectors.

The National Institutes of Health is the most visible source of new medical technology. In fact, however, research and development of medical technology in the private sector dwarf that in the public sector. There are few controls in the initial stages of new technology development and innovation. This is a major advantage of a market economy.

There are both public and private control points beyond the early stages of research and development. An important control point is the Food and Drug Administration (FDA), which regulates drugs, biologicals, and medical devices. Its decision to allow new products onto the general market is based on data that show safety and efficacy. Generalization is the point at which technology is available for public use. Control points beyond FDA include the certificate-of-need laws described in Chapter 1.

Absent public control, however, once approval is obtained, final control points are private. They involve acquisition decisions by HSOs/HSs and decisions by LIPs to use a technology. The use of a technology is reviewed by HSO utilization review activities and by third-party payers such as QIOs, managed care organizations, and private insurers. DRGs and prospective payment schemes are indirect ways to control the use of technology.

6. Technology is present in HSOs/HSs because physicians ask for it and patients expect it. Describe changes in the external environment that affect availability and application of technology. Describe management's role in assessing technology.

The following changes in the external environment affect the availability of technology:

- Enhanced FDA regulatory authority beginning in the 1970s
- High purchase/lease and operating costs of much new technology
- Customer expectations
- Demands/expectations of LIPs
- Changing reimbursement
- Competitive environment

The following changes in the external environment affect the application of technology:

- Change from cost-based payment by Medicare and other payers to diagnosis-related groups (DRGs) beginning in the early 1980s
- Emphasis on cost reduction in fixed payment systems such as DRGs and capitation
- Customer expectations
- Demand and expectations of LIPs
- Increased interest in complementary and alternative medicine, especially in the 21st century

Management's Role in Assessing Technology. Management must apply the concepts of medical need for services, value added, and community health status, as well as the principles of sound financial management. Unrealistic LIP demands can be moderated by using a rational approach to decisions about adopting high-cost technology. Managers must be innovative to gain access to technology without incurring all of the costs of its acquisition, maintenance, and staffing, such as use of joint ventures and leasing.

7. The electronic health record promises to revolutionize the delivery of health services. Identify the advantages and disadvantages for the patient and for providers.

The advantages and disadvantages of the electronic health record for patients include the following:

- For the patient

Advantages

Improvement in continuity of care if multiple providers have access to the same health record
 Greater control if the patient establishes a personal health information web site
 Greater privacy/confidentiality if the patient establishes a health information web site
 Personal access to health information as needed

Disadvantages

Heightened risk of unauthorized use if the record is maintained by provider(s)
 Risk of hacking and breach of confidentiality
 Unease/discomfort because information is readily available for purposes that the patient may not know about or want
 Possible greater expectations for patient involvement in care and care processes, which some patients may not want

The advantages and disadvantages of the EHR for providers include the following:

- For the provider

Advantages

Enhanced ability to provide continuity of care
 Greater ability to monitor patients and deliver needed services
 Lower costs of storage and use of provider-maintained records
 Enhanced ability to obtain data or measure community health status/need

Disadvantages

Greatly increased responsibility and legal risk
 Training and staff use issues
 Possible increase in costs
 Pressures from government and insurers for access to patient information

8. The internal management of biomedical equipment poses several problems for managers. How do managers involve clinical staff to solve these problems? Identify the types of equipment that managers can purchase without involving clinical staff.

Managers can involve clinical staff to solve equipment management problems by establishing committees and task forces; using questionnaires and surveys; being responsive to clinical and service needs; making clinical staff stakeholders; having clinical staff participate in continuous quality improvement (CQI) activities, such as quality improvement teams; giving clinical staff budgetary accountability; and educating them regarding costs and the need to manage effectively.

All equipment that affects clinical staff or delivery of clinical services must be made available through purchase, lease, rental, joint ventures, and the like, *only* with their consultation. This approach is consistent with good management practice as well as the empowerment concepts of CQI. It means that actual users, not just managers of users, are involved. Technical staff such as registered nurses must be included, too. Even decisions to acquire technology used only in management, such as management information systems (MIS), require clinical staff involvement in determining needs and application, developing specifications, and understanding the system's use. In short, because of the clinical staff's importance to the organization's success, no technology or equipment should be acquired without involving them.

9. *Competition is a major force in health services, and marketing is critical to HSO/HS success. What are the relationships between marketing and acquisition and application of medical technology? Give examples from your experience or the literature.*

Technology is important in marketing. Americans are fascinated by technology and expect access, as needed. This attitude contributes to the technological imperative for LIPs and their patients. LIPs are trained in high-technology settings and expect to have and use state-of-the-art technology. Many HSOs focus on being centers of excellence at which the best is available. This means having state-of-the-art technology.

Thus marketing and acquisition/availability of technology are linked in settings in which high technology is expected. Strategic management and planning determine the need for services, and the HSO determines the technology to acquire and how to make it available to patients. Students can easily identify examples. Instructor-provided examples can include situations of excess bed capacity, competing and duplicative centers of excellence, disinterest in merging or sharing services, and technology “arms races.”

10. *Usually, little attention is paid to nonclinical technology such as financial or management data systems. Such technology can dramatically affect HSO/HS costs and effectiveness, however. Identify the types of nonclinical equipment and their effects on managing HSOs/HSs. What links are there between clinical and nonclinical technologies?*

Nonclinical equipment includes MIS, environmental control systems (heating, ventilation, and air conditioning [HVAC]), room assignment systems, scheduling systems, patient accounts, accounts receivable and accounts payable, payroll and time and attendance systems, PCs and local area networks, bar code–supported inventory control systems, supply chain management, and vertical transportation such as escalators and elevators. Primarily, nonclinical equipment enables the HSO to support clinical activities and maintain the confidence and goodwill of staff, LIPs, and patients and their families.

Directly and indirectly all nonclinical equipment supports clinical activity and the technology that makes delivery of clinical services possible. Elevators and HVAC systems are important examples. Elevators must quickly and safely provide vertical transportation for patients, staff, visitors, and others. Failing to do so affects almost every HSO activity negatively, with the added and unknown negative effect on public relations. HVAC systems provide treated air for patient rooms and clinical areas at a suitable temperature, with appropriate humidity. Positive air pressure is essential in some areas, such as operating rooms (ORs) and “clean” rooms, and negative air pressures are essential in others, such as isolation rooms and waste disposal and storage areas, to prevent spread of microorganisms and odors, respectively.

Scheduling systems not only provide bed control for patients, but they also determine availability of ORs for emergency surgery, for example. Even patient accounts may affect clinical activities: LIPs may want to send patients to an HSO, and patients may want to go there if its patient accounts system provides good service, whereas LIPs and patients who have had a bad experience with an HSO may decide to go elsewhere, or the patient may even decline treatment.

Case Study 1

The Feasibility of BEAM

This case will prompt students to think about the implications when HSOs/HSs acquire new technology. Brain electrical activity mapping (BEAM) is a high-cost technology, but many of the same considerations apply to less costly technologies.

1. *Using titles, propose the membership of a committee to assess the need for BEAM. If it should be made available at Metropolitan, recommend whether to buy, lease, or use County's BEAM.*

Committee members should include senior managers, director of planning, manager of radiology, chief financial officer, department head of engineering/maintenance, chief of radiology, and staff radiologists. Answers as to access to BEAM will vary: assumptions regarding reimbursement; competitive situation with County Hospital; relationship(s) with medical staff, including a possible joint venture; and alternate sources to fund BEAM.

2. *What types of information should be presented to the governing body in the committee's final report?*

The following information should be presented:

- Needs and types of patients using BEAM
- Projected useful life of the machine
- Status of FDA approval and benefits and risks associated with BEAM's use
- Purchase/lease price and installation costs
- Operating costs—staffing, supplies, utilities, maintenance, and the like
- Availability of staff to operate and maintain the machine
- Projected use and impact on imaging technology already present
- Projected volume, charges, and revenue
- Availability of, or plans for, BEAM in nearby HSOs/HSs and possible effects on utilization
- Options for gaining access to BEAM, such as by vendors, purchase, lease, or joint venture

3. *What political and economic complications are likely to be present in the decision-making process?*

The political complications include the following:

- Adding BEAM may be ill advised if physicians open a freestanding imaging center offering it.
- Not acquiring BEAM may alienate other physicians and cause loss of admissions.
- Acquiring BEAM despite knowing that physicians plan to do so may anger LIPs who will see it as deliberate competition and cause them to admit to County Hospital.
- Adding BEAM may not be approved by state certificate of need (CON) or other planning requirements.

The economic implications include the following:

- Using BEAM may mean DRG payment does not cover costs for Medicare patients using it.
- Non-Medicare, third-party reimbursement may be insufficient to cover costs.
- Revenue may be lost if physicians admit patients to County Hospital.
- Projected use and revenues may be lower if physicians open an outpatient imaging center. Loss may be in addition to reduced revenues from fewer admissions.

4. *How should the political and economic complications be addressed? Be specific in identifying the sequence of steps.*

To address these complications, Metropolitan Hospital should do the following:

- Determine if BEAM operating costs are in “service bundles” for DRGs and covered by health maintenance organizations and other payers.
- Determine the likelihood that the physician consortium will develop an outpatient diagnostic center. Reach a mutually beneficial agreement with the physician consortium, such as a joint venture.

Case Study 2

“Who Does What?”

This case considers the political and economic implications for HSOs/HSs when new technology is introduced and, as here, disputes arise as to which specialty groups may use the technology or assess the results of its application. These issues occur in HSOs/HSs among physician specialty groups and between physicians and LIPs of various types in the professional staff organization (PSO).

1. Identify the quality-of-care issues. How are they similar to, and how are they different from, the economic issues?

The quality-of-care issues are these:

- Cardiologists must become credentialed to read single-photon emission computed tomography (SPECT) scans if the results are read in the hospital.
- Radiologists' work must be reviewed to ensure that the problems alleged by the cardiologists are baseless.
- Too many physicians (radiologists and cardiologists) reading SPECT scans may mean that some physicians will read too few to maintain their competence for this specialized reading.
- Changes in patterns of practice and referrals may destabilize other relationships.

The economic issues are these:

- It is likely that the radiologists have an exclusive contract that the hospital would breach if other physicians were allowed to read SPECT scans.
- Depending on how the radiologists are paid, allowing cardiologists to read SPECT scans could reduce hospital revenues.
- Destabilizing patterns of practice and referral may cause problems with other specialties, with negative economic consequences for the hospital.

2. What information should Berson possess to understand the facts and issues? To whom should Berson turn for advice?

Berson needs

- information as to the accuracy of the allegations made by the cardiologists;
- a basic understanding of SPECT technology;
- to understand the typical clinical and economic relationships and practice in the field;
- analyses of the economic and political consequences; and
- knowledge of the clinical, political, economic, and referral pattern aspects of the situation.

Much of this information can be obtained from the vice president for medical affairs. Other clinical sources include the medical literature, especially the medical specialty literature. Non-clinical sources include managers of other hospitals with similar problems, financial analysis by the chief financial officer, and legal analysis by in-house or retainer counsel.

3. Develop three options that Berson could use. Identify and justify your choice of the best.

Three possible solutions to the problem are the following:

1. Act to eliminate any basis for the cardiologists' allegations of inadequate work by two of the radiologists; investigate and adjust their privileges, as necessary. If there are no problems, the status quo should be maintained.

2. Allow properly credentialed cardiologists to read SPECT scans if legal, economic, and political aspects permit.
3. Do nothing. Allow the problem to resolve itself, or worsen, at which time action can be taken if necessary.

Solution 1 is best. Like all HSO executives, Berson must take allegations of deficient practice very seriously. However, significant changes in existing clinical and economic relationships must be made with great caution and not because of what might be clinical and economic extortion by the cardiologists.

4. Identify three other quality/economic controversies that occur among institutional or personal health services providers.

Controversies identified by students may include the following:

- Use or presence of LIPs such as nurse midwives, who may seek to occupy professional turf traditionally held by obstetricians. Midwives' care for normal deliveries has lower costs but must have physician backup for complications. Obstetricians are reluctant to provide backup, because midwife deliveries that go badly are clinically and legally high risk.
- Hospitals may engage in a joint venture to establish ambulatory services that directly or indirectly compete with office-based physicians in the community.
- An imaging center established by radiologists will compete with a hospital-based radiology department.
- Freestanding home health agencies (HHAs) may have difficulty getting private-pay and insured clients from hospitals who own HHAs.

Case Study 3

"Let's 'Do' a Joint Venture"

This case considers the implications of diversification for HSOs/HSs. Especially important for students to consider are the risks and benefits of forming a joint venture with physicians, whether or not they are part of the PSO, as well as other types of LIPs.

1. Critique what Arcadia is doing in terms of the technology that it has considered and is considering. Include both the positive and negative aspects.

Physicians who specialize in rehabilitation medicine are known as physiatrists. Usually, physiatrists use lower-level technology.

The positive aspects of Arcadia's proposal for a joint venture are these:

- It provides a needed service.
- Rehabilitation may have better reimbursement.
- It connects physiatrists to Arcadia and keeps them from making arrangements with competitors.
- It makes Arcadia a more comprehensive provider.
- It may generate profits for other Arcadia services.

The negative aspects of Arcadia's proposal for a joint venture are these:

- There are opportunity costs of not undertaking other services, some of which are more essential.

- A joint venture has legal and economic entanglements and unanticipated complexities.
- It may erode Arcadia's financial base with changes in reimbursement.
- The decision to diversify may be unrealistic.
- Management's attention is diverted from Arcadia's core business.
- Travel time may cause physiatrists' interest to wane over time.

2. Identify additional compatible activities that Arcadia could undertake. Be specific as to how they fit with its current activities and implied mission.

Additional compatible activities include the following:

- Home health services
- Durable medical equipment
- Inpatient hospice
- Meals on Wheels
- Adult day services
- Travel services for independent-living adults
- Homemaker services for independent-living adults

These activities fit with rehabilitation and Arcadia's general mission. They are complementary by filling a niche in the general scope of its activities.

3. Identify the benefits and risks of forming a joint venture with the physiatry group.

The benefits of forming a joint venture with the physiatry group are the following:

- The economic tie focuses physiatrists' interests and energies.
- The relationship may be synergistic.
- It provides needed service(s).
- It is likely that the physiatry group has the range of expertise needed.
- It will provide improved, coordinated care.
- It will generate income.

The risks of forming a joint venture with the physiatry group are the following:

- As the general partner, Arcadia must provide most of the capital, which it does not have.
- There is the potential for contract disputes.
- The financial projections may be inaccurate; money may be lost.
- It may interfere with existing referral patterns and arrangements.
- Arcadia's public image may be diminished by for-profit initiatives.
- Arcadia's tax-exempt status may be at risk; it will have to pay tax on unrelated business income.

4. What is the role of Arcadia's managers, especially the CEO, in these activities?

Managers must take the lead to do the following:

- Investigate the proposal
- Collect and analyze the data

- Arrange financing
- Consider hiring a consultant
- Obtain and retain support of the governing body
- Negotiate with the physiatrist group and sign a contract
- Undertake planning
- Develop staffing patterns
- Recruit staff
- Equip the facility
- Manage the activity

Case Study 4

Worst Case Scenario—The Nightmare

This case suggests the problems that arise for managers and caregivers when critical lifesaving technology is insufficient to meet demands. The analysis can draw upon the information in Discussion Question 1. This is not an idle exercise. Shortages of scarce lifesaving technology—such as ICU beds—can be found throughout the health services system. Prominent among them is the shortage of organs for transplantation.

1. Outline the steps Means should take in the planning process.

- Gather background information
- Identify policies and procedures, especially those of the ICU committee, if one exists
- Determine control points for ICU admission and discharge
- Speak to staff knowledgeable about ICU capacity and access problems
- Determine availability of funds for possible ICU expansion
- Identify elements of the HSO's strategic plan that may affect ICU use
- Identify locations in the HSO at which higher-level, monitored acute care could be provided
- Identify facilities to which patients could be transferred, if necessary

Means must begin the planning process by collecting data and information about ICU use. The historical and current average daily census in the ICU should be determined. Sources of patients and types of conditions treated in the ICU should be determined to understand whether ICU care is necessary for them. All policies and procedures related to use of the ICU should be reviewed and understood. Special attention should focus on who controls admission into and discharge from the ICU. Instances in which there were too few ICU beds should be identified and analyzed. Options as to care for patients who cannot be accommodated in the ICU, whether or not it is expanded, must be identified.

2. Identify by title the members of the hospital staff who should participate in the process.

- Chief medical officer
- Chief nursing officer

- Director of respiratory therapy
- Hospitalist/ICU clinical director
- Chief executive officer, or designee
- Director of pharmacy
- Facilities engineer

3. *Outline the contingency plan.*

- Develop procedures for training purposes and to guide implementation of the plan
- Review criteria for ICU admission and discharge
- Develop a process to rapidly assess ICU patients and discharge those not needing ICU care
- Identify hospital locations where monitored beds, oxygen, suction, and ICU-level staffing could be made available rapidly, for a short time
- Develop a telephone and pager tree or other process to call in staff quickly for backup
- Test the ICU contingency plan as one would test a mass casualty or disaster plan

4. *Identify external resources to be inventoried and involved in this type of contingency planning.*

- Determine hospitals that could provide backup and to which patients could be transported.
- Identify nonhospital resources such as urgent centers, surgicenters, and nursing facilities and determine their suitability to provide short-term care for acutely ill patients.
- Identify resources to transport acutely ill patients and the typical time frame for obtaining transport.
- Emergency medical services (EMS), police, and fire and rescue personnel must be involved in planning—they might be able to transport acutely ill patients to other EDs if they know that the ICU is full.

Additional Case Study 1: Why Can't You Keep My Lab Running?!

This case applies the concepts and information in the text about how HSOs/HSs can manage their biomedical equipment.

Brent Jackson's assistant, Mark, had just buzzed and told him that Dr. Farrington was calling. Jackson tensed as he picked up the telephone. This isn't going to be pleasant, he thought. Farrington directed the pulmonary function laboratory and always seemed to be on the telephone complaining about one piece of equipment or another. The technician from Gateway Hi-Tech had not come as promised, and now Farrington had to cancel a procedure that was scheduled for the next morning. This time, Farrington didn't threaten to have Jackson fired—which he had done before. It was clear, however, that his patience was at an end. Something had to be done about equipment repair and maintenance.

Five years earlier, Jackson had joined Medical Associates, Inc., a large multispecialty group practice, as a strategic planner and marketer. After 2 years, he was promoted to a job with line management responsibilities. His work was exemplary, and he was asked to manage several other areas and departments. When Jackson became responsible for biomedical equipment management, there were two staff, a biomedical engineer and a technician.

The engineer left a few months later, and recruiting for the past 18 months has been unsuccessful. The technician is well trained and works hard, but there is too much to do. Jackson estimates that Medical Associates has about 300 pieces of diagnostic and therapeutic equipment, representing at least 200 different types. Some, such as the piece of equipment in Farrington's laboratory, are repaired under contract. In Jackson's experience, however, such contracts are expensive, and the response is often unreliable. In addition, Jackson knows that there are many activities, such as the evaluation of equipment being considered for lease or purchase, training staff to use equipment, and preventive maintenance, that receive little attention.

Farrington's complaints seem to be only the tip of the iceberg. Jackson isn't really sure where to start, but he knows something has to be done.

1. Develop a statement of the problem facing Jackson.

Students may develop a narrow-focus statement or one with a broader focus. Sample problem statements are provided here—Statement A is narrow, B is broader. Whether narrow or broad, the problem statement must be action oriented. Students should be asked to review Chapter 6 for guidance on problem statements.

Statement A—Narrow Statement

In what ways can we/I (Jackson) improve maintenance and equipment repair in the pulmonary function laboratory in order to enhance reliability and customer satisfaction?

Statement B—Broader Statement

In what ways can we/I (Jackson) organize the management of biomedical equipment in order to improve equipment reliability and customer service?

2. What alternative solutions are available to Jackson? Which would you choose? Why?

Alternative solutions will depend on the focus of the problem statement developed in Question 1. The solutions should be mutually exclusive to allow the most objective and thorough assessment by comparing them against the decision criteria.

Alternative Solutions to Problem Statement A

- Review the performance of Gateway Hi-Tech to determine if it has breached its contract; if so, find a new vendor.
- Fire Gateway Hi-Tech and draft a new maintenance contract for the pulmonary function laboratory.
- Upgrade the skills of the biomedical equipment technician so that he can service the pulmonary function laboratory equipment.
- If process is "in control" (as defined by W. Edwards Deming—see Chapters 7 and 8), do nothing regarding this event, but collect data to understand the process and improve it. (Chapter 7 explains common cause and special cause variation.)

Alternative Solutions to Problem Statement B

- Use a temporary agency to get short-term help for the technician while organizing the biomedical equipment management system.
- Contract-manage biomedical equipment with an outside firm.
- Organize a biomedical equipment maintenance program, including procurement, maintenance, and staff training.

3. List the advantages and disadvantages of using external equipment maintenance and repair companies.

Advantages of Using Contract Companies

- Fewer human resources problems
- Readily available needed skills/training
- Potential for lower total costs
- Lower staff costs
- Opportunity to seek a lower-cost provider
- Better parts and diagnostic software availability

Disadvantages of Using Contract Companies

- Less control regarding schedule and availability
- Less responsiveness and timeliness
- Potentially higher cost
- Need to work with many organizations or providers
- Need to review contract monitoring and performance compliance
- Potential reliability problems
- Potential liability issues

4. Identify the steps that Jackson should take if he chooses to develop a comprehensive in-house medical equipment management program.

The steps that Jackson should take are these:

- Review the literature for background/insights/options
- Research the needs of users/customers
- Survey the equipment to be included in the program to assess the need for preventive maintenance
- Secure expert assistance in developing the program
- Secure a part-time or full-time biomedical engineer/consultant
- Determine the placement of the service unit within the organization
- Add staff as needed per plan developed
- Develop a training program for staff

Additional Case Study 2: Isn't There a Better Way?

This case considers the administrative processes that can/should be used when new equipment is being considered for introduction into an HSO, whether by purchase or by lease. It suggests to students the problems and advantages of fully involving clinical personnel in the administrative processes regarding equipment acquisition.

Alice Smith disliked saying no to requests for new technology, but because she was vice president for clinical services at Community Hospital, it was an unfortunate fact of her professional life. Smith had just walked Dr. Madeline Jones to the door of her office; she knew Jones was very unhappy. Jones, the acting chief of anesthesiology, had asked Smith to authorize \$2,500 to modify an anesthesia machine. Although well educated and articulate, Jones was unable to explain how the modification would 1) save money for the hospital and/or 2) measurably enhance patient care (the quality of surgical outcomes). Smith always

asked these questions, and she could not believe that there was anyone on the clinical staff or in the hospital who did not know that.

As Smith sat down, she thought about how her response to Jones would be viewed by the members of the professional staff, many of whom would hear the latest news about the “ogre” in administration by day’s end. Smith knew that she had a reputation for being difficult to convince when it came to spending money. She didn’t mind that. Smith feared, however, that hostility was increasing among professional staff, especially the physicians, and that it would spill over into other relationships.

The outcomes of Smith’s discussions with various physician managers differed widely. Some did their homework and could answer her questions; their equipment requests were usually granted. Smith knew that this was seen as favoritism, but that simply was not true.

The intercom buzzer broke Smith’s reverie. She knew that there had to be a better way to make equipment-related decisions.

1. Develop a statement of the problem facing Smith.

Statement A—Narrow Statement

In what ways can I/we (Smith) regain the confidence of Dr. Jones regarding decisions about equipment in order to ease tension within the medical staff?

Statement B—Broader Statement

In what ways can I/we (Smith) improve the process by which clinical equipment is requested and approved in order to increase quality of care and user satisfaction?

2. Identify the positive and negative aspects of the situation that Smith has allowed and encouraged to develop.

Positive Aspects of the Situation

- Unsupported requests can be denied, and money can be saved.
- Fewer equipment requests save Smith’s time and energy.
- Lack of a clear process gives Smith more power/control.
- Physicians can be easily pitted against one another, thus enhancing Smith’s control.

Negative Aspects of the Situation

- Important, necessary equipment may be unavailable.
- The process seems capricious to staff.
- It sours relationships with and cooperation of staff.
- Only persistent/aggressive staff get their requests approved.
- The hospital may fail to offer state-of-the-art services.

3. Assume that Smith wants to enhance the ability of physicians to articulate their equipment requests. What steps should she take? With whom should she work most closely?

This discussion presumes that there are capital and noncapital equipment acquisition plans. The steps that Smith should take include the following:

- Develop policies and procedures for equipment requests, including forms and details as to data/information needed.

- Communicate this information to staff members who will use it.
- Offer seminars or training sessions to staff regarding the equipment acquisition process.

Smith should work closely with the chief medical officer, relevant PSO committees, the director of purchasing, and the chiefs of clinical departments.

4. What are the positive and negative aspects of enhancing the clinical staff's ability to articulate their equipment requests? What other group(s) would benefit from the same assistance?

Positive effects of enhancing the clinical staff's ability to articulate equipment requests include the following:

- Higher quality requests
- More rational equipment acquisition through purchase/lease
- Higher quality patient care
- Higher staff morale
- Improved relationships between administration and clinical staff

Negative effects of enhancing the clinical staff's ability to articulate equipment requests include the following:

- Higher expenditures for purchase/lease of equipment
- More difficulty for Smith in decision making
- Increased overhead costs for preparing requests for equipment
- Heightened need for capital and noncapital equipment purchasing plan/budgets

Other groups that would benefit from the same assistance include departments such as pharmacy, respiratory therapy, physical therapy, and other areas that purchase/lease clinical capital equipment. Administrative and support departments that may need assistance include patient accounts and materials management, which occasionally need new equipment, especially noncapital equipment.

Additional Case Study 3: The Geiger Counter Two-step¹

The issues present in this case study highlight staff safety in the context of environmental concerns raised by disposing of used radionuclides. A secondary focus is the need to establish protocols and systems that prevent recurrence of the problem described.

Federal and state laws and local government ordinances require that hazardous (red bag) waste cannot be put into landfills and must be handled using separate, special procedures. Radioactive materials are treated with even greater care. Most of radioactive waste is low-level radionuclides used as contrast media in radiology and that have a half-life of a few days. All radioactive hazardous waste must be kept separate from nonradioactive hazardous waste. Heavy fines can be levied against HSOs that do not follow legal requirements.

Harmony Hospital has special procedures for separating the two types of red bag waste. Since only a few areas of the hospital produce radioactive waste, the procedures have worked well. The dumpsters into which landfill waste is placed have Geiger counters that detect the presence of radioactive materials and sound an alarm. Specially trained maintenance staff respond to the alarm.

This morning a member of environmental services reported that when she took a cart of landfill trash to one of the dumpsters, she found that the alarm was disabled. Investigation by maintenance showed that someone from a crew working on a renovation project in the hospital must have inadvertently disabled the alarm. It was estimated that the alarm may have been disabled for as long as 4 days. A review of records showed that no dumpsters had been removed in the past week.

1. What is the first step that should be taken? By whom?

The manager in charge of arranging dumpster pickups must immediately contact the transportation company and cancel pick-ups until further notice. It will be prudent if the dumpster is blocked to prevent it from being moved.

Staff trained in radiologic safety and use of the Geiger counter should then examine the dumpster to see if radioactive waste has moved into the waste stream. It may be necessary to empty the dumpster (with participants using personal protective gear) and ensure that all areas have been tested.

2. Why does it matter if a small amount of radioactive material with a short half-life enters a landfill?

Two reasons affect the importance of mitigation: 1) Failure to control radioactive waste has significant regulatory and public relations implications; and 2) Persons and animals encountering the radioactive waste in the landfill are put at risk, even though the likelihood of harm to human beings is remote.

Efforts at prevention should use this episode to identify ways to prevent a similar lapse in the future. Care must be taken that costs (economic and other) do not exceed benefits.

3. How can or should the problem be resolved at the hospital?

The process of monitoring the alarm must be examined and re-engineered, as necessary, because, apparently, the alarm had been disabled for several days. Since this alarm monitors a high-risk function, it must be monitored centrally 24/7, or a system that monitors it frequently should be used.

4. What steps can or should be taken to prevent a similar incident in the future?

In addition to the monitoring noted above, special attention must be given to situations when outside contractors who are working at the hospital might interfere with the normal functioning of hazardous and/or radioactive waste disposal.

A risk assessment by the hospital's environment of care team and contractor(s) prior to the start of a renovation project would have identified hazardous/radioactive waste removal as needing special attention and contributed to the continued integrity of the radioactive waste alarm.

Note

1. Case study and answers to the questions were written by Mary Mohyla, RN, CIC, Director, Infection Control, Employee Health and Accreditation Services, Holy Cross Hospital, Silver Spring, Maryland. Used with permission.