

Medical Technology

In General

A person may observe that health care costs increase dramatically while monetary inflation remains relatively flat, in spite of many cost-containment programs. The reasons are numerous; one of the main reasons, however, is technology.

Because technology is a major factor in driving up health care costs, it is treated with some thoroughness in the following pages. Technology is viewed from three different perspectives:

- Societal
- Third party payor
- Managed care.

Unbelievable Medical Technology

Consider the following:

1. Molecular medicine is changing the way we look at disease. Researchers are investigating how a cell receptor receives external messages and how those messages direct the activities of the cell. Molecular therapies treat dysfunctions in this flow of information. Molecular medicine will replace the scalpel with enzymes that act as internal surgeons to patch up a flawed DNA.
2. The diagnosis of disease will be transformed by the polymerase chain reaction that amplifies samples to spot tiny fragments from the outside of the molecules that cause diseases such as Lyme disease. Polymerase chain reaction gives quick, definitive results that do not require the interpretation of physicians. Some diagnostic tests will even identify which antibiotics will be most effective against a patient's pathogens. And as the ability to diagnose disease at the molecular level improves, we will have the ability to diagnose diseases that patients have yet to feel.
3. New drugs such as Proscar and Hytrin, which shrink tumors of the prostate, may dramatically reduce the need for urologists. The discovery that a microbe causes ulcers has led to the ability to eradicate ulcers with antibiotics, reducing the need for gastroenterologists.
4. By telemedicine, physicians may bring quality medicine to remote settings.
5. Instead of thoracic specialists treating asthma and gastroenterologists treating colons, both diseases will be treated by the physician-scientist generalist through the *loving touch* of physician assistants and nurse practitioners.

6. The shape of health care will change as we move toward diagnostic and therapeutic certainty. Health care will shift to the home and outpatient settings. And the acute-care hospital will increasingly be devoted to trauma care.

Societal Considerations

In General

Technology has scientific, economic and social consequences. The standard followed in evaluation is that of *efficiency* and *safety* as promulgated by the Congressional Office of Technology Assessment. The problem with this technique with medical technology is that it omits the key element of *cost*.

How Technologies are Studied

When viewing medical technology, there are seven dimensions that should be considered.

- Technology
- Application
- State of Diffusion
- Properties
- Assessors
- Methodology
- Purpose of Assessment.

Technology. Technology goes beyond medical equipment; it encompasses information systems, support systems, procedures, administrative overheads, e.g.

Application. Examples of applications of the technology would include:

- Presentation
- Screening
- Diagnosis
- Treatment
- Rehabilitation.

State of Diffusion. Examples are these:

- New
- Emerging
- Established.

Properties. Examples of properties of technology would include:

- Safety
- Effectiveness
- Cost-efficiency
- Social implications.

Assessors. These are the persons or groups who assess the effectiveness or describe the properties of the technology. Examples are these:

- Medical panel
- Health professionals
- Economists.

Methodology. Examples of various methodologies that can be used are these:

- Expert opinion
- Group judgment
- Literature synthesis
- Clinical truths.

Purpose of Assessment. Examples of the purpose of the assessment are these:

- Quality
- Reputable products
- Creation of a knowledge base.

Technologies Under Federal Study

There are many medical technologies currently being analyzed and assessed by the technique outlined in the previous section. Some, but by no means at all, are as follows:

1. Devices, materials, components, fabrication methods, application/implantation procedures, such as:

- Cystic fibrosis screening system
- Portable blood pressure monitor
- Cardiovascular-defibrillation devices
- Vascular prostheses
- Rate-responsive pacing sensors
- Blood gas monitors
- Implantable drug infusion pumps
- Scoliosis treatment devices
- Spinal cord stimulation devices
- Synthetic speech device
- Electrode gels
- Electro-chemical sensors.

The Food and Drug Administration is involved whenever there are medical devices.

2. Certain procedures involving the eye:

- Laser trabecular surgery for open-angle glaucoma

- Ophthalmic neodymium: YAG lasers
 - Botulinum toxin therapy of eye muscle disorders
 - Automated Perimetry
 - Radial keratotomy
 - Keratophakia and keratomileusis
 - Thymoxamin.
3. Certain tests are being studied because many hospitals routinely require these for many inpatients.
- Diagnostic imaging for breast disease
 - Radionuclide scan and x-ray for bone metastases
 - Upper GI fluoroscope study
 - Chest x-ray
 - Cardiac exercise stress test
 - Outpatient cardiac rehabilitation
 - Echocardiogram.
4. Other medical technologies which are being researched at the federal level include these:
- Medical information systems
 - Colon cancer screening
 - Automated multichannel chemistry analyses
 - Keyes technique
 - Artificial heart
 - Blood policy and technology
 - Technologies for urinary incontinence
 - Assistive devices for severe speech impairment
 - Nuclear magnetic resonance imaging
 - Imaging care units
 - Digital subtraction angiography
 - Liver transplants
 - Breast cancer screening
 - Supportive therapy in burn care
 - Interocular lens transplants
 - Fresh frozen plasma
 - Total hip replacement
 - Dental sealants in prevention of tooth decay
 - Drug therapy for depression
 - Lowering blood cholesterol to prevent heart disease
 - Electroconvulsive therapy
 - Adjuvant therapy for breast cancer
 - Management of pain.

Databases and Information Sources

Medical technologies that are computer related represent a fast developing field. There are, for example, numerous online databases accessible with microcomputers. There are numerous medical news services accessible with microcomputers.

Criteria When Considering Medical Technology

These criteria should be considered:

- What is the cost?
- What is the frequency?
- What is benefit-risk factor?
- Is the technology used inconsistently?

Third Party Payer

Medical technology should be viewed broadly so as to include drugs, devices, procedures or clinical services. From the provider's viewpoint a medical technology should be both efficacious and appropriate to be payable.

Efficacious. This consideration is for the most part limited to new technology. The primary criteria for the procedure to be efficacious is the degree of investigation to which it is subjected. A procedure while being investigated would not be eligible for coverage.

Appropriateness. Tests of medical necessity are applied to determine the appropriateness of the technology.

Principles in Reviewing Technologies

When assessing technology for efficaciousness or appropriateness, these principles should be followed:

- Governmental body should have given the *final* approval.
- Effect on health outcomes must be measured scientifically and published.
- Technology must not be as effective as any established alternative.
- Technology must be limited to investigational setting; must be capable of being generally used.
- Provider group generally must be able to perform the technology.

Cost Effectiveness

Medicare is beginning to add another criteria, namely, cost effectiveness. There are numerous technologies that meet the first criteria but would fail the cost-effectiveness criteria.

Pressures on Third-Party Payers

Third-party payers are constantly pressured to pay for investigational technology. The FDA is often criticized for taking too long to either approve or disapprove a technology. The National Cancer Institute has, or will have, tens of thousands of patients who are being tested with new technologies; because of the enormity of the costs, the Institute pressures the third-party payer to *ease up* on the investigational criteria. A new pressure arises from the highly expensive technologies such as liver transplant, *in vitro* fertilization and bone marrow transplants.

Screening expenses were a few years ago of minor significance because fully insured plans could exclude them as routine examinations. As such, screening tests became state-mandated; the costs therefore are sharply increasing. Screening tests include: mammograms, pap smears, cholesterol tests, colon cancer tests, e.g.

Social-Type Problems

Three problems that are growing in costs are AIDS, drug abuse and alcohol abuse. Persons so affected are increasingly demanding ever more costly medical technologies.

Prescription Drugs

Within the past few years many very expensive drugs have come on the market.

Near Future Technologies

There are several new technologies close to being accepted as noninvestigational that will be coming up for payment in the near future:

- Gall Bladder Lithotripping
- Position Emission Tomography Scanning
- Chorionic Villus Sampling (replaces amniocentesis).