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Prologue:
We live in an age of high technology, whether the subject is medicine, the exploration of space, or unraveling other mysteries of mankind. One small reflection of this reality is the presence on Capitol Hill of the Office of Technology Assessment, an arm of Congress created to assist legislators to better understand the relentless pace of technological change in our society. One of the pursuits of OTA involves a wide range of health related issues, which command the attention of a professional staff numbering about a dozen at any given time. David Banta, a board-certified specialist in preventive medicine, directs this work. One of his senior associates is Jane Willems, a Ph.D economist with a particular interest in technology. The thinking of Banta, as it relates to the appropriate role of government in monitoring technology, has changed in the seven years he has worked on Capitol Hill. Once a devout believer in strong regulation as the primary force to improve the use of technology, Banta has come around to thinking that a variety of instruments may be needed to undertake such tasks in the United States. Willems, on the other hand, has maintained a firm belief in the workings of the marketplace and in decentralized decisionmaking. The paper written by Banta and Willems reflects this tandem of thought. Three congressional committees in particular make use of the OTA’s health work: the Senate Labor and Human Resources Committee, the Senate Finance Committee, and the House Energy and Commerce Committee. Recent studies undertaken by the OTA include technology transfer at the National Institutes of Health, the role of technology in Medicare, alternatives to health and safety regulation in the workplace, and technologies for handicapped people.
Several public policy issues converge in the growing concern about the appropriate use of medical technology. Medical technology is made up of drugs, devices, and medical and surgical procedures, as well as the organizational and supportive systems within which such care is delivered.\(^1\) There is alarm about rising expenditures for medical technology and misgivings about whether or not the benefits justify the costs of its use. The efficacy of both new and existing medical technologies has been called into question.\(^2\) Overuse of technology may lead to greater expenditures and unwarranted risks to the population. Indeed, a basic problem is the lack of a generally accepted standard for determining the appropriate use of medical technology.

Many factors affect the use of medical technology. Paramount is the desire of physicians to provide good care for their patients. Physicians’ use of technology is stimulated by medical education, which encourages excessive faith in the efficacy (benefit) of therapeutic technologies.\(^3\) Fear of malpractice seems to promote overuse of technology, especially diagnostic technologies such as laboratory tests.\(^4\) And the delivery of medical care takes place in a society prone to seek technological solutions to problems. For most goods and services, payment acts as a deterrent to use. But prevailing methods of financing medical care provide incentives for additional use of medical technologies, regardless of the extra health benefit gained.\(^5\) There is little evidence that consumers or providers weigh the costs and benefits of a technology before deciding to use it.

In a system in which most forces encourage the use of technology, a regulatory framework has been developed as an attempt to control technology. Such measures as certificate-of-need legislation and peer review by professional standards review organizations (PSROs) attempt to counteract the uncritical use of additional, perhaps unnecessary, medical technologies.

This article will discuss options for improving policies toward medical technology, with the ultimate aim of improving its use. While regulatory strategies have been criticized in recent years, other options have not been thoroughly explored. Political pressures produced by the rising costs of medical care make change possible. Options suggested fall into six general classes: (1) develop more effective guidance for biomedical research and development; (2) change medical education to produce more discerning users of medical technology; (3) develop better information on efficacy, safety, costs, and social effects of medical technology and disseminate it to those who use technology; (4) strengthen regulatory programs; (5) use the financing system more aggressively to make the use of medical technologies more rational; and (6) examine the organization of medical practice.
Guiding Biomedical Research and Technology Development

Concerns about rising costs of health care have led to proposals to guide the research process more effectively. A former Director of the National Institutes of Health (NIH) has stated the problem: “A corollary problem is presented by palliative technologies, such as renal dialysis, applied at exorbitant cost in present-day clinical settings. The mounting demands that they be extended to every patient in need of them suggest that science has some obligation to anticipate the fruits of its research....”

Attempting to exert tighter control over investment in biomedical research has several drawbacks. It is impossible to assure the results of basic research. Furthermore, the federal effort in health R&D is spread over a number of agencies with different mandates and administrative structures. Perhaps the most serious impediment is the large amount of private research and development. Attemping to prevent development of a technology by refusing to fund it with public money would have little effect if private industry (or the governments of other countries) decided to develop it. The decision whether or not to incorporate the technology into the medical care system would still have to be faced.

The computed tomography (CT or CAT) scanner, for example, was developed largely in the private sector. In addition, the CT scanner illustrates the difficulty of controlling international diffusion of technology. The United States did not develop a scanner until after the British scanner began to be rapidly accepted here. The result was that EMI Ltd., a British company, dominated the early CT scanner market in the United States. In 1980, 551 of the 1471 operational scanners were British, representing a capital investment of approximately $250 million.

On the other hand, technology assessment might be used in selected instances to anticipate the social consequences of medical technologies. A study conducted in 1973 by NIH on the totally implantable artificial heart examined its many ramifications, and may have caused a change in the NIH program. In 1978 Congress passed a law establishing the National Center for Health Care Technology, one of whose responsibilities was to examine social impacts of selected technologies. As will be discussed later in the paper, the Center ceased to exist with the 1981 cuts in the federal budget.

Additional funding for certain research areas would also be worthwhile. The emphasis on the biomedical model has resulted in what Lewis Thomas has called “half-way technology.” This is technology “designed to make up for disease, or to postpone death.” Examples are transplantations of hearts, kidneys, livers, as well as artificial organs. Focusing on the development of such technologies has led to a lack of resources for
research on nutrition, epidemiology, social science, and prevention. We believe that chronic disease can be more effectively controlled with new knowledge from these nontraditional health disciplines. We also favor additional funding for the evaluation of medical technology, as discussed below.

Changing Medical Education

Physicians are largely responsible for technology use, and it is their behavior that must change. The current training of physicians emphasizes the use of the latest procedures and equipment, both because the medical faculty is specialized and because teaching hospitals are at the forefront technologically. Medical training also stresses that physicians use extensive tests to diagnose patients’ problems.

In addition, specialists tend to use technology more than generalists. In many instances, specialists are dependent on technology. Radiology is an example, as is surgery. The Graduate Medical Education Advisory Committee (GMENAC) projects surpluses in such specialties as pulmonary diseases, cardiology, and endocrinology. While the numbers in the GMENAC report have been controversial, most observers feel that there will be an excess of specialists in the future. Such surpluses seem certain to lead to greater use of certain technologies. The GMENAC report recommends encouraging physician trainees to enter primary care fields such as general pediatrics, general internal medicine, and family practice. This recommendation, made for other reasons, might also have a beneficial impact on the use of medical technology.

Physicians could be trained more effectively in the scientific method and in the conduct and interpretation of clinical trials. They could also be guided to use technologies with more discretion and could be exposed to the cost implications of their decisions through information about patients’ hospital bills. This option will be further discussed later in the article.

Developing Information on Efficacy, Safety, Costs, and Social Effects

Decisions concerning appropriate use of medical technology depend on information about the efficacy and safety of medical technology. Such information is necessary to physicians and to all those who must make decisions about medical technology, including hospital administrators, government regulators, consumers, and public and private third-party payers. It has long been stated that physicians act as agents for their patients because people have insufficient knowledge. It is being increasingly recognized that even the medical profession lacks knowledge
about the effects of medical technology, both new and existing. With the growing appreciation that resources are limited, it is necessary to develop better information on costs and cost-effectiveness. The applicability of this information to the level of the individual physician and patient is uncertain. Some would argue that it is the role of physicians to do all they can for the individual patient, and that it is the role of the overall society to make resource allocation decisions. Even for the individual patient, much of the use of medical technology is discretionary. Life or death situations make up only a small part of medical practice. Furthermore, physicians and hospitals do not provide technological services to all who might benefit. Better information and more informed decisions could increase the benefits and reduce the harm to the population.

Resources for assessment are also limited. Developing useful information requires setting priorities among technologies that might be assessed. For example, should new technologies or old technologies be emphasized? Is the problem with machines or medical and surgical procedures? Should a widely used technology be assessed before one used on only a few people? Information from assessments also needs to be put into usable form, which means synthesizing information from assessments to reach conclusions. The resulting information needs to be disseminated to both individuals and organizations that need it. These tasks require a systematic approach to medical technology and its assessment.

In 1978 this problem was recognized and partially addressed in legislation that established a new National Center for Health Care Technology (NCHCT). NCHCT grew slowly, with a budget of about $4 million in 1981. In addition, the mandate for NCHCT went beyond tasks described here, including the role of providing advice on Medicare coverage decisions to the Health Care Financing Administration. This made it a quasi-regulatory agency and it became a target for abolition by industry and the medical profession. The Reagan administration proposed that it not be funded and Congress acquiesced. NCHCT ceased to exist late in 1981. Thus, the problem of setting priorities, assuring that important studies are done, synthesizing information, and disseminating it to those who need it remains largely unaddressed.

Providing syntheses to individuals and organizations would aid them in making decisions concerning technology. This information could reduce errors in judgment that such individuals and organizations make under the present informal system. This assumes that credible syntheses are possible and that involving the most knowledgeable people in making judgments would usually lead to a better conclusion. We believe that both are true. The process would, of course, be more
effective if it involved medical practitioners, both in setting priorities and in doing the syntheses.

With the disappearance of NCHCT, there is active consideration of developing a private sector activity in the assessment of medical technology. Already, certain organizations are active in assessing medical technology for their memberships: For example, the American College of Physicians has a large Clinical Efficacy Project that develops recommendations on specific technologies of interest to internists.\textsuperscript{16} Bunker has proposed the development of a private organization that could perform and fund original research as well as provide syntheses appropriate to the user of the information.\textsuperscript{17} Such an activity might be funded by insurance companies, who have much to gain in both cost savings and improving the efficacy of the services that they support.

The development and dissemination of information to individual physicians are not controversial. Almost everyone agrees that, though perhaps costly, these steps could do no harm and probably would do quite a lot of good.

Information on the efficacy and safety of medical technologies seems to affect physician behavior. For example, the results of the Coronary Drug Project trial of cholesterol-lowering drugs appear to have led to a marked reduction in prescribing of Clofibrate, saving enough to pay for the trial itself.\textsuperscript{18} A study of the most efficient diagnostic approach to a relatively rare form of high blood pressure, that related to problems in the kidney and kidney blood vessels, seems to have had an effect on practice.\textsuperscript{19} Since little research has been done on the effects of such trials, little is known about the best methods for disseminating information.

Nonetheless, there have been a number of attempts to educate physicians to modify their patterns of use of medical technology. Several programs have shown initial reductions in ordering tests, for example, although long-term effects have not been evaluated.\textsuperscript{20} A number of studies have also assessed effects on the ordering of treatment. An educational program concerning appropriate therapy for urinary tract infections resulted in improved-prescribing behavior and significant cost savings in the group which received the education in comparison with a control group which received no special education.\textsuperscript{21} Educating physicians as to the cost of services has been found to reduce the ordering of laboratory tests, X-rays, electrocardiograms, electroencephalograms, and hospital charges per patient.\textsuperscript{22} An extensive educational effort in Strong Memorial Hospital in Rochester, New York appeared to curtail the ordering of a number of diagnostic tests.\textsuperscript{23} Finally, Wennberg has reported that rates of surgical procedures in similar areas of New England vary remarkably. When physicians in high use areas were informed, their rates of surgery fell.\textsuperscript{24}
Clinicians have been less inclined to act on information about preventive technologies. Among physicians of newly married women known to be susceptible to rubella, 24 percent reported that they did not offer rubella vaccine to susceptibles and 56 percent offered it sometimes.\textsuperscript{25} Physicians who supported annual influenza vaccination of high-risk people, in fact vaccinated only 54 percent of their elderly patients with chronic diseases and one-third of their patients without chronic diseases.\textsuperscript{26} It is noteworthy that influenza vaccination rates doubled during the 1976-77 swine flu program, which entailed an extensive national campaign promoting the use of the vaccine.\textsuperscript{27}

Developing information for formal groups, especially federal agencies, is more controversial than attempting to change individual physician behavior. Evidence and expert judgments could be used much more than they are to determine which technologies are covered by financing programs. The judgments would then become the focus of considerable political and economic pressure, and, in effect, could be used by health care providers to defend existing practices. One possible way to avoid this problem is to encourage professional groups to develop soundly based standards for use of medical technologies. The American College of Physicians has been a leader in this area. The College has a Medical Efficacy Project that screens technologies and advises its membership as to whether they are efficacious or not, and under what circumstances they can be appropriately used.\textsuperscript{28}

### Strengthening Regulatory Programs

Partially as an attempt to offset the powerful incentives encouraging the use of medical technologies, Congress has established three regulatory programs: The Food and Drug Administration (FDA), professional standards review organizations (PSROs), and capital expenditure review through health planning programs. The FDA evaluates the efficacy and safety of drugs and medical devices before marketing may occur. A PSRO, which is representative of practicing physicians in a geographical area, reviews services reimbursed through federal financing programs for appropriateness and cost. Local health systems agencies (HSAs) have responsibility for area-wide planning and for initial review of applications for major capital investments, usually $150,000 or more.

All of these programs have obvious weaknesses. Private physicians’ offices are largely excluded from capital expenditure review, despite their importance. Partially as a result, about 20 percent of computed tomography (CT) scanners in the United States, representing a capital investment of more than $100 million, are operating in out-of-hospital settings.\textsuperscript{29} After marketing approval, FDA does not have authority to
restrict subsequent use of drugs and devices by patients or physicians. PSRO review has largely been limited to inpatient use and to Medicare and Medicaid patients.

However, we do not propose use of these regulatory programs as the main policy tool for managing health care technology. Not only are the programs unlikely to be strengthened for political reasons, but regulatory approaches are inherently limited and are associated with negative consequences. FDA gives a minimal degree of protection against unsafe or ineffective drugs and devices. It is a powerful mechanism for dealing with the relatively clear-cut case, and its power over marketing is sufficient for those cases. However, it has little effect on use of technologies after they are available to physicians. We are skeptical about the power of the PSRO program and the capital review program to have a great influence on utilization of technologies. These programs often lack the best scientific information on technologies in making their decisions, and the federal government has not been active in providing such information. Even if the results of randomized controlled clinical trials of a technology are available, that information will often not provide the answer to the question of interest to health planners: How many scanners should be allowed in this area? Likewise, studies will only partially answer questions asked by PSROs: What is appropriate use of this technology, and what acceptable standards of use should be defined? The National Center for Health Care Technology was created in part to meet this need, but did not begin in its early work to meet the needs of PSROs for information. PSROs have largely relied on local standards of care in making their regulatory decisions.

While these programs were developed in part to counter financial and other incentives that promote the rapid and often premature application of technology, the general literature on regulation indicates that the programs could not be expected to achieve their goals. As noted by Enthoven and Noll:

If a regulator attempts to make the regulated behave in a way that is directly opposed to their financial interests, regulated entities will have a strong incentive to attempt to bend, fight, or evade regulations. This will force regulators to deal with many individual cases and will subject them to continuing pressure to grant exceptions to their general policies.

It is certainly clear that regulation that failed to control rising costs of hospital care. The effects of the PSRO program on quality have not been examined. Likewise, the capital expenditure program has not had demonstrable effects on costs. For example, it seems to have had little overall effect on the diffusion of CT scanners, the major test for such
agencies in the last five years.\textsuperscript{34} (This may be contrasted with the experience of state rate review programs, described below.)

There is growing interest in using financial incentives to achieve the goals of regulatory programs.\textsuperscript{35} Moreover, changing the financing system could help make regulation more effective, if the incentives toward rapid acceptance and overuse of medical technology were eased.

### Financing the Use of Medical Technologies

The climate of public policy has changed greatly since language in the 1965 legislation establishing Medicare warned the program not to interfere with the practice of medicine. Experience since that time has indicated that third-party payment by its very existence affects medical practice and the use of technologies.\textsuperscript{36} The recent groundswell of proposals for changing financing arrangements, including “competitive” proposals, reflects acceptance of that fact. If one assumes that financing affects technology use, failure to be attentive to the implications of the arrangements could result in missed opportunities to guide use in socially desirable directions, and is tacit acceptance of whatever patterns of use develop.\textsuperscript{37}

Present health insurance coverage fuels the use of medical technologies by insulating patients, physicians, and hospital administrators from the financial implications of using technology. Insurance pays more than 90 percent of the expenditures for services in hospitals, and increasingly large portions of expenditures for physician visits and dental services. As a result, cost has a reduced role in deterring patients from seeking medical care or in rewarding them for selecting a less expensive technology or provider. Physicians are less likely to consider a patient’s finances when deciding about the use of a medical technology. Since insurance does not usually cover preventive and rehabilitative technologies, their use is discouraged relative to others.

Prevailing methods of paying providers both encourage and facilitate technology use. Since physicians usually receive fees for their services, their revenue increases with greater use. The structure of fees promotes the use of expensive sophisticated technologies. A physician’s time spent using such a technology is rewarded much more highly than time spent taking a history or counseling a patient.\textsuperscript{38} Hospitals are paid for the costs they incur or the charges they bill. Coupled with insurance coverage, these payment methods have permitted hospitals to pass on the costs of expensive, perhaps duplicative and underused, medical technologies. The overall result is that technologies are often used when they add little to improving a diagnosis or a patient’s health. The financing arrangement does not push physicians or hospitals to perform services at the least cost, or to
select the least costly technology or setting for a given medical condition.

An option that has gained increasing acceptance since the advent of CT scanning is to make third-party payment conditional on an evaluation of a technology's efficacy and safety. This policy seeks to avoid payment for the use of technology that is inefficacious compared to alternatives. Medicare, under the section of its legislation limiting payment to services that are reasonable and necessary, has evaluated and, on occasion, denied payment for certain technologies. Since the case of CT scanning, these reviews have gone beyond clearly outmoded technologies to those that are more controversial. The evaluation procedure is also becoming more systematic, although the disappearance of the NCHCT leaves the immediate prospects of this activity uncertain.

In the private sector, Blue Cross/Blue Shield has taken similar steps. The national organization recommended that local plans establish appropriate indications for CT body scans. Under its Medical Necessity Program, the organization will pay for certain outmoded or inefficacious procedures only if physicians justify their use.

While less intrusive than directly prohibiting the use of technology, this option could help prevent inappropriate, harmful, and excessively expensive technologies from being adopted and used. Providers and patients could still use unapproved technologies, but at the price of foregoing Medicare payments. Reimbursement as a force driving the adoption and use of new technologies would be moderated.

This option depends heavily on the existence of evaluative information. Since clinical studies, syntheses, and judgments are all lengthy undertakings, linking third-party payment to more systematic evaluations of technologies could only occur as a gradual, incremental process. Establishing relative efficacy and cost-effectiveness as rigid criteria would be impractical, considering the present state of knowledge.

Within the Medicare program, the system for triggering the evaluation of a technology is presently too haphazard to permit uniform application of criteria. Carriers now raise most coverage issues at their own discretion. Certain prominent and controversial technologies, such as heart transplants, are only now undergoing review.

Nor could formal evaluative results provide definitive answers about appropriate use to third parties or clinicians. In addition to efficacy, safety, and cost-effectiveness, decisions about appropriate use require incorporating social and ethical considerations. And at the level of clinical decision making, circumstances are rarely identical to those in formal analyses. Room must be left for the exercise of clinical judgment.

Third parties can use evaluative results in ways consistent with clinical discretion. The results of clinical trials and cost-effectiveness analyses, for
example, could guide extensions of benefits. Studies of primary preventive technologies, such as influenza and pneumococcal vaccines, suggest that some may be cost-effective for certain high-risk groups. The Congress responded to an OTA study of the cost-effectiveness of pneumococcal vaccine by amending the Medicare law to cover the vaccine. While it may be more difficult to limit or remove services based on such analysis, over a period of time, evaluations could guide frequency of use and types of patients that would be covered.

Another option within the context of present financing arrangements is that third parties could base their rates of payment on costs incurred when services are performed efficiently, and on fees designed to encourage the appropriate use of technologies. Medicare and other third parties base their rates of payment on the costs or charges of providers, with little regard for the efficient use of resources to perform a service or for the least costly setting or practitioner. For example, insurance companies pay $240 for an endoscopy examination of the stomach which takes about forty-five minutes to perform. In contrast, a physician might receive $25 for an office visit involving a simple examination and some health counseling. As an alternative, third parties could limit payment to the amount of the most efficient method of performing or locating a service. The least expensive method of achieving the desired result could serve as the maximum paid. Such a policy would be consistent with current practices of cost-based payment, such as setting depreciation schedules for equipment. Similarly, fees paid to physicians could reflect socially desired income levels as well as the desired mix of alternative technologies.

This option would require considerable expertise to set, monitor, and review rates. For both hospitals’ and physicians’ rates, third parties would require experts with detailed knowledge of such factors as budgets, methods of performing services, and types of equipment. While such attention to rates of payment has the advantage of working within present financing arrangements, it has the disadvantage of perpetuating additional payment for additional services. With rates of payment set, use of technologies and total expenditures may continue to rise.

A more global approach, such as state rate review or prospective reimbursement, would eliminate the present situation whereby physicians are rewarded with higher revenue for performing additional services, regardless of the marginal costs and benefits. Different forms of prospective reimbursement have in common that rates are set in advance of the time period when they apply. Cromwell found that both the Economic Stabilization Program and prospective reimbursement at the state level lowered the rate of adoption of expensive,
complex services in hospitals. An as yet unpublished study has found that rate review programs constrained the diffusion of CT scanners.

Limiting total revenue would both enable and force providers to make choices among alternative services and among alternative methods of performing those services. Within the predetermined revenue, a provider could choose which services to perform and how to perform them. Physicians and hospital administrators, rather than third parties, would make the decisions about particular services. The factors that physicians and hospitals weigh when making decisions would undoubtedly undergo great change. Additional services would no longer automatically increase their revenue and might even decrease their incomes by increasing their costs.

This global approach has the advantage of creating an environment with different incentives without necessitating substantial changes in the way providers are organized. Providers could continue to practice under current arrangements. The altered financial incentives might enhance the competitive position of health maintenance organizations (HMOs), which are already paid on a capitation or prospective budgeting basis.

Like the previous option, this would require technical expertise; in this case, to set capitation payments and to review budgets. Moreover, the presence of different incentives would affect the kind of medical care delivered and expenditures only after a period of time. Continuation of certain regulatory activities would be compatible, if not desirable, under this option. Certificate-of-need and utilization review could help to protect against any tendency by providers to consider costs exclusive of benefits as they operate within fixed revenues. Different forms of this option could be assessed on an experimental basis for the effects on the use of specific technologies, effects on access to technologies, and effects on expenditures for medical care.

Proposals to instill greater cost-consciousness into the medical care system could indirectly affect the use of medical technology. One approach would change insurance coverage to increase cost sharing by patients at the time they use services. The intention is to reduce the extent to which people seek care and to stimulate them to choose low cost providers, low cost technologies, and low cost settings. It is expected that providers will become more efficient to attract more cost-conscious patients.

Another proposal would inject more cost-consciousness into consumers’ choice at the time that they select insurance coverage. The intended effect on technology use is similar to the above proposal to increase cost sharing at the time of use: to push providers to be more efficient as they compete for consumers. The implications of such “competitive proposals” for medical technology is the subject of a study now underway at the Office of Technology Assessment.
Examining the Organization of Medical Practice

The organization of medical practice rarely receives attention separate from financing arrangements. Yet the organizational structure within which medical care is delivered is a factor independent of insurance coverage and payment method, and one with implications for the use and cost of technology.

The delivery of care is fragmented, with separate practices and organizations, such as physicians offices, diagnostic facilities, and hospitals, providing care to patients. Rarely is the placement or use of technologies coordinated across organizations. The result has been duplication of facilities and tests, and underuse of capacity as each provider considers its revenue and costs separate from the total care provided to each person.

Greater coordination has been identified with capitation payment because some group practices receive revenue from enrollees on a per capita basis, independent of the number of services provided. The incentives of capitation payment and greater integration are often similar but separate. More integrated organizations, such as group practices, have both the ability and the incentive to use technologies more efficiently. Because they provide a wider scope of services, they have the ability to coordinate the use of alternative settings and technologies. They also have the incentive to do so because they bear the costs of purchasing and using a greater range of technologies.

There is general agreement that prepaid groups, which combine greater integration with capitation payment, have lower hospitalization rates than those of fee-for-service physicians practicing separately. There is some evidence that fee-for-service groups may have low hospitalization rates more similar to prepaid groups than to the fragmented situation where physicians’ offices are separate from ancillary facilities. For example, a fee-for-service group with its own hospital in Hawai’i has low hospitalization rates, only slightly higher than the Kaiser-Permanente plan there. Although all factors including self-selection of enrollees were not rigorously controlled in this report, these results point to the possibility that group practice, independent of capitation payment, may be able to control hospitalization.

Hypotheses about the effect of organization on technology remain to be tested systematically, but merit further examination. Relying on the internal management and bureaucratic controls of more complex practice organizations represents an alternative to increasing direct regulatory activities. Government programs during the past decade have encouraged changes in medical practice by promoting the regionalization of technologies and the development of health maintenance organizations.
At a minimum, the implications of evolving forms of medical organization should be assessed. Examining the organization of medical practice is also consistent with proposals to restructure financial incentives. In both cases, there is the underlying assumption that providers in a restructured system could improve the efficiency and effectiveness of using medical technologies.

**Conclusion**

Improving the use of medical technology must be considered within the general context of health care delivery. The effects of medical technology—health benefits and risks, costs, and social implications—are issues that occur within a medical care system and a social system.

In the present context, greater regulation is unlikely to be productive or accepted. Medical care is obviously provided primarily through the private sector in the United States. A host of incentives and influences, including cultural attitudes about technology, drive the ever-greater use of medical technology, even if health benefits are small and costs are high. Because incentives have not been changed, regulations to counter them have attempted to “make water run uphill,” instead of attempting to “channel the stream in its downhill course.”

In this situation, regulation has not had notable success in moderating the use of technology and the costs of care. Of course, one does not know what would have happened without existing regulatory programs. Nonetheless, physicians and consumers have and will continue to have a large amount of discretion. The many thousands of decisions made by health care providers would have to be scrutinized in a regulatory system. Regulation thus requires considerable detail and is pitted against the expertise, resources, and often the self-interest of those being regulated.

The other strategies reviewed in this paper hold greater promise for improving use of medical technology. Activities of both the public and private sector figure in each strategy. For example, changes in medical education and in organizational forms of delivering care are primarily private sector activities that could be guided by health services research sponsored by government. Altering the incentives inherent in present financing methods is the major area of change indicated. This strategy involves both the private and public sectors as third-party payers, providers, and purchasers of medical care. The other strategies, especially improving information, would support better decision making in a restructured system.

This paper has not described a final solution in detail because we do not feel that these issues are amenable to immediate and final resolution. In a fundamental sense, the wise use of medical technology depends on
the state of medical science, which is improving continually. The delivery of medical care is complex, and its improvement requires a multidimensional and system-wide approach. Only gradually and with continued effort can measures be developed to ameliorate the current problems with medical technology.

NOTES


29. Office of Technology Assessment, Policy Implications of the Computer Tomography (CT) Scanner.


34. Office of Technology Assessment, Policy Implications of the Computer Tomography (CT) Scanner.


44. T. Bice, personal communication, 1981.
50. Enthoven and Noll, “Regulatory and Nonregulatory Strategies.”