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# **Effects of Increased Competition on the Use and Innovation of Medical Technology**

**Most decisions involve choosing between a little more or a little less—in other words, comparing the marginal benefit with the marginal cost.**

*—Victor R. Fuchs  
Who Shall Live?*

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# Effects of Increased Competition on the Use and Innovation of Medical Technology

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The use of clinical and ancillary technology requires that a person must decide to seek care and a medical care provider must decide to let that person enter the system as a patient. Not only the fact that use occurs but also the kind of clinical or ancillary technology that is used depends on the combined decisions of consumers, organizations, and individual practitioners. By contrast, organizations and practitioners can determine the use of managerial technology without the involvement or concurrence of consumers.

Through greater cost consciousness of consumers and providers, proponents of increased competition hope to improve technology use. Depending on the proposal, these changes in use are expected to come about from effects at several levels:

- consumers' decisions about whether or not to seek care, and if so, which providers and technologies to use;

- providers' (physicians' and organizations') decisions about whether or not to let a person enter the system as a patient and, if so, which settings and clinical and ancillary technologies to use;
- insurers' and providers' managerial decisions about their own interaction and their control over resources available; and
- innovators' decisions over time about kinds of technologies to develop and introduce.

This chapter first discusses the concept of technology diffusion and the ways that procompetitive proposals wish to change the diffusion process. After a review of empirical studies of greater patient cost sharing and of comprehensive care organizations, the likely effects of the proposals on technology use and innovation are charted. The concluding section considers the implications for policy. Related issues of quality are discussed in chapter 4.

## THE DIFFUSION OF TECHNOLOGY

Diffusion is the process by which a technological innovation enters and becomes part of the medical care system. An innovation may represent the introduction of a new technology or the refinement of an old one. The key feature is that an individual perceives it to be new, even though it may have existed for some time (232). The rate of diffusion of a medical technology is usually expressed as the percentage of medical providers, either organizations or individual professionals, who adopt it over time (46).

An often lengthy period of research and development precedes diffusion. Basic theoretical research from such fields as physics, chemistry, biology, and engineering lays the conceptual foundation, and applied research and development draws on that knowledge to solve medical prob-

lems. Once the feasibility of a new technology is demonstrated, the transfer of the technology from laboratory to marketplace is begun. A prototype may be built and refined, followed by manufacturing and marketing efforts. The developmental phase may also involve clinical testing on human subjects. During development, problems may be revealed that feed back into further research and modification or that lead to abandonment of the technology (202).

Adoption is related to but not synonymous with use (46). The adoption of equipment-embodied technology, such as computed tomography (CT) scanning, is usually marked as the point when the machine is acquired. But the acquisition of equipment does not ensure its use or predict the extent of its use. A hospital may ac-

quire a CT scanner, but clinicians' decisions determine its use for patients, and radiologists and the radiology department determine how long during the day it is available. Sociologists have theorized that technologies are adopted more quickly if they have a relative advantage (including profitability) over alternatives, are compatible with the adopter's values, are easy to understand and use, can be tested on a limited basis, and have results readily visible to others (232).

Certain behavioral theories have been advanced to explain technology adoption and use by medical providers (280). One is that hospitals are concerned with the perceived quality as well as the quantity of their services and therefore put more investment into expensive equipment than they would if profits were their main motivation. Such technology raises the prestige of the hospital and enables it to compete with other hospitals to attract prominent physician specialists (53). Another theory, which predicts a similar result, is that conflict among physician specialists and between physicians and administrators is resolved by expanding capacity and adopting technological innovations (114). It has also been suggested that physician specialists tend to adopt and use technology more than generalists, both to conform to their medical training and to match their peers (13).

Factors external to medical care providers, such as financing arrangements and governmental policies, affect technology diffusion by encouraging certain kinds of behavior and discouraging others. Chapter 2 described the role of current insurance and usual payment methods in stimulating inappropriate use of individual technologies and inappropriate combinations and settings of technologies. The chapter also outlined proposals to change the financing and organization of medical care so that those who buy or use technologies become sensitive to costs as well as the benefits of their decisions.

A major effect on technology use that is intended from greater patient cost sharing is that use will decrease because price will deter people from seeking medical care. The quantity and total cost (per unit price times quantity used) would

fall if people exercised more care in preventing illness and more discretion about seeking professional help for self-limiting as well as other conditions. It is also intended that consumers consider cost when they select providers and technologies to use. Effects on providers are expected to come from providers' reactions to changes in consumer behavior. Providers' sensitivity to the effect of technology use on their patients' finances and to consumers' preferences for low-cost providers and technologies would lead clinicians and administrators to pay more attention to cost in matters concerning adoption and use.

The competitive proposals that would use consumer choice to foster greater plan competition do not stress people's decision to seek care as a point to affect technology use. Instead, competition for enrollees is expected to lead organizations and physicians to make more judicious decisions about the adoption and use of technology—decisions that weigh the costs and benefits involved. Proponents of this approach point out that much of current technology use is discretionary instead of clearly necessary or unnecessary. This situation applies to the number (days of hospitalization for heart attack patients), the kind (surgery or drug therapy for angina), and the setting (inpatient or ambulatory) of technologies used for medical conditions.

With more competition among comprehensive plans, surgical and hospitalization rates, in particular, are expected to be lower. The emphasis on prevention would depend on whether consumers preferred that style of practice and whether providers were responsive to them. Although the process of change maybe lengthy, it is expected that expansion of alternative delivery systems (alternative to fee-for-service solo practice) and competitive pressure on other providers would ultimately improve technology use and lower medical costs.

Proponents of greater competition agree that insurance coverage and payment methods have affected the type and pace of innovation (79,89, 190). With innovation as with use, the potential benefits have been emphasized and the costs downplayed. The result has been rapid but costly technological change.

The ease of receiving reimbursement for mainstream medical technologies has been cited as a spur to innovation. With the present extent of insurance coverage and the usual type of payment methods, cost offers little deterrent to innovation, especially for expensive technologies used in hospitals. The incentives for innovation, as for use, are to channel efforts into sophisticated diagnostic and therapeutic technologies and away from preventive and rehabilitative ones. Since cost poses little obstacle to innovation, a new medical technology is valued if it provides even a slight additional benefit to diagnostic accuracy or patient management (235).

Proponents of competitive strategies have not specified in detail the changes in innovation to be expected from restructured financing. They expect the kind of technological change to differ as costs figure more heavily in decisions. Greater cost consciousness by consumers and providers is predicted to increase organizational innovation, for example. The development of alternative delivery systems could be stimulated if they provided the combination of costs and benefits that consumers desire (88,170).

## RESEARCH ON TECHNOLOGY USE WITH GREATER PATIENT COST SHARING

There is a consensus that the amount individuals pay for insurance premiums does not affect their decisions about using services, because that cost is not directly linked to use (14,215). Furthermore, any effect on consumers' decisions about technology use are likely to come from charges levied at the point of use, which would raise the patient's price of medical care. These higher charges potentially would influence consumers' decisions about whether or not to seek care and, if so, what to choose.

A prior issue is the extent to which people faced with substantial cost sharing would purchase supplementary insurance. That possibility was raised in chapter 2, and the conclusion was reached that although some people, especially the elderly, might purchase supplementary coverage, the net effect would be a higher level of cost sharing than now exists.

Studies have consistently reported that utilization rates are lower with greater patient cost sharing (15,192,238). These rates represented the combined effects of consumer and provider reactions to cost sharing.

The interim results of the Rand National Health Insurance Study deserve close attention because of the care exercised in designing and conducting the trial (192). The scope of benefits covered is broad, encompassing not only hospital and physi-

cian services, but also dental and mental health services, prescription drugs, visual and auditory services, and supplies. The extent of cost sharing is related to family income (either 5, 10, or 15 percent) and limited to an annual maximum of \$1,000. Coinsurance rates also vary: 0 (free care), 25 percent, 50 percent, and 95 percent (similar to income-related catastrophic coverage). The study excluded people over 62 years and families with incomes over \$25,000 in 1973.

The interim results of the Rand study represent only about 40 percent of the study's eventual total person years (192). With higher coinsurance rates, it was found, the annual likelihood of having a physician visit or hospital admission, as well as the number of visits per person and total expenditures were lower. With coinsurance rates of 50 or 95 percent, total expenditures were 45 to 90 percent below total expenditures with no cost sharing and almost 20 percent below those with 25 percent coinsurance. The lower total expenditures with higher coinsurance resulted because a smaller fraction of people used any services at all and fewer services were used per patient. The price per visit or per hospital admission accounted for little of the difference.

With 50 and 95 percent coinsurance, hospital admission rates for adults were, respectively, about 60 and 40 percent below those with no cost

sharing, and about 25 and 10 percent below those with 25 percent coinsurance (see table 3). These interim results are consistent with U.S. rates and the fact that patients' direct expenses for inpatient care average 10 percent nationally. The 1977 national hospital admission rate of 0.095 for a person under 65 years falls between the experimental rates for free care and 25 percent coinsurance (192).

With greater coinsurance, the Rand study found, the likelihood of having a physician visit and the number of such visits were also significantly lower. In 1977, the national likelihood of a physician visit was 0.75 and ambulatory visit rates were 3.9 per person, rates consistent with the partial coverage of physician services that now exists (192). The Rand researchers speculated that less contact with physicians led to the identification of fewer medical problems and less hospitalization. For the interim data, children's admission rates did not differ significantly by coinsurance rate.

In contrast to admission rates, annual expenditures per hospitalized patient in the Rand study did not vary by coinsurance rate. Of the patients admitted, 70 percent exceeded their catastrophic limit, and the experimental plans covered the cost of most inpatient services. The researchers concluded that unless people were exposed to more financial risk, "cost sharing appears to be a poor instrument for affecting costs once patients are admitted" (192).

The researchers' conclusion implies that under different coinsurance rates, cases of equal complexity and severity were admitted. However, in light of the higher admission rates with lower

coinsurance, cases less difficult and presumably less expensive to treat may have been admitted more often than under plans with higher coinsurance. If so, the similar average costs per case across plans may mask differences within plans. Under lower coinsurance, were lower costs for the higher percentage of less difficult cases offset by higher costs for the other cases? Or did similar cases receive less intensive care under higher coinsurance rates?

More importantly, the Rand experiment affected only a small portion of the patients of any one hospital or physician. On the theory that providers adjust their practice to the average insurance coverage of their patients, one would not expect hospitals or the physicians practicing in them to change their routine services or charges for the inpatients in the experiment.

An important caveat to the Rand interim results is that the companion data on people's health status have not yet been analyzed (85). The health effects of reduced use are especially important to indicate how much came from fewer discretionary services and how much came at the expense of health benefits.

Smaller scale studies have also found less use of services with greater coinsurance. In 1968, the Palo Alto Medical Clinic, a multispecialty fee-for-service group, instituted a 25 percent coinsurance rate for all physician and ambulatory ancillary services (238). The per capita use of physicians' services declined 24 percent and 4 years later remained stabilized at that low level: 5.2 visits in 1966, 3.9 in 1968, and 3.6 in 1972. The study found that little change occurred in physician visits in hospitals or, similar to the Rand interim results, use for young children.

**Table 3.—Interim Results of the Rand National Health Insurance Study: Annual per Person Probability of Use With Different Coinsurance Rates**

Coinsurance rate	Visits to physicians	Hospital admissions		
		Total	Adults (> 17 years)	Children (≤ 17 years)
Zero	0.84	0.102	0.133	0.056
25%	0.78 <sup>a</sup>	0.081 <sup>b</sup>	0.104 <sup>b</sup>	0.047
50%	0.75 <sup>a</sup>	0.072 <sup>a</sup>	0.082 <sup>a</sup>	0.057
95%	0.69 <sup>a</sup>	0.076 <sup>a</sup>	0.094 <sup>a</sup>	0.045

<sup>a</sup><sub>p</sub> < 0.05 compared with zero coinsurance,  
<sup>b</sup><sub>p</sub> < 0.01 compared with zero coinsurance.

SOURCE: J. P. Newhouse, W. G. Manning, C. N. Morris, et al., "Some Interim Results From a Controlled Trial of Cost Sharing in Health Insurance," *N. Eng. J. Med.* 305:1501, 1981.

Even if total use remains about the same, changes in coverage and cost sharing may have differential effects on certain subgroups. Proponents of greater cost sharing favor relating the amount paid to one's income. With cost sharing related to income, the Rand interim results showed similar changes in use for low- and high-income families. Cost sharing unrelated to income could be expected to lower use more among the poor than among nonpoor.

Prior instances of cost sharing have also found greater changes in use among low-income groups. When the Canadian province Saskatchewan levied a \$1.50 to \$2.00 copayment per physician visit in 1968, use for the poor decreased more (18 percent) than use for the nonpoor (6 to 7 percent) (15). The decline for patient-elective services, such as general practitioner visits, was greater than for physician-elective services, such as laboratory services.

In a similar vein, the few data about use of preventive services have indicated that use is fairly unresponsive to insurance coverage or cost sharing (147). An exception is use by low-income people, who had lower use rates with greater cost sharing, especially for preventive services for children (35,43). For example, in 1972 and 1973 copayments of \$1 per outpatient visit and \$0.50 per prescription for Medi-Cal recipients did not

seem to delay their eye examinations, dental care, or visits for "significant" conditions (24). However, for the copayment groups, immunization rates for children under 6 years were 45 percent lower than rates for the noncopayment group.

Over the past decade, a body of literature has indicated that people's responsiveness to price (elasticity of demand) varies among types of medical services (see table 4). As one would expect, the use of dental services and prescription drugs has been found more responsive to price than physician and hospital use. Under greater competition, hospitals may compete with each other for patients. Pauly has noted that what would matter in that context is the responsiveness to price of people's demand for the services of certain hospitals (210).

Empirical studies have indicated that fee-for-service physicians' use of technologies is sensitive to the additional revenue that they receive (181) and the cost-sharing provisions of their patients' insurance coverage (279). According to 1977 data from the National Medical Care Expenditure Survey, physicians are less likely to initiate ambulatory visits for patients with higher coinsurance rates. Although financial considerations matter, the research also indicated that patients' health status and medical condition have the strongest influence on physician-initiated use.

Table 4.—Estimated Price Elasticity of Demand for Medical Services

Medical service	Estimated price elasticity of demand <sup>a</sup>	Source
Physicians' services	-0.12 -0.20 -0.05 -0.08	M. Feidstein Fuchs & Kramer Newhouse & Phelps Newhouse & Phelps
Hospital services	-0.626 (admission) -0.494 (length of stay) - 1.120 (patient days per year) -0.41/-0.10 (hospital days) -0.062 (length of stay)	M. Feldstein   Newhouse & Phelps Newhouse & Phelps
Dental service	-1.43 -0.29 to -0.47	P. Feldstein Newhouse & Phelps
Prescription drugs	-0.40	Newhouse & Phelps

<sup>a</sup>Elasticity of demand =  $\frac{\text{proportionate change in quantity demanded}}{\text{proportionate change in price}}$

SOURCE Applied Management Science, *Synthesis of Research on Competition in the Financing and Delivery of Health Care*, Technical Proposal in response to RFP 233.81.3031, Department of Health and Human Services, National Center for Health Services Research, Silver Spring, Md., May 13, 1981

## RESEARCH ON TECHNOLOGY USE IN COMPREHENSIVE CARE ORGANIZATIONS

The literature about technology use by alternative delivery systems relates primarily to prepaid group practices and secondarily to individual practice associations (IPAs), both kinds of health maintenance organizations (HMOs). As described in chapter 2, HMOs both insure and provide or arrange covered medical care for their members in exchange for an annual cavitation (per capita) payment. Other arrangements, such as preferred provider organizations, have not been studied because they developed fairly recently. This section will examine technology used by different organizations and identify the changed incentives that would face providers.

Most physicians practice alone and receive revenue on a fee-for-service basis (100). But during the past generation, and especially during the past decade, a great variety of medical care organizations have developed and now account for a substantial share of the medical care market.

HMOs of all kinds account for about 20 percent of the market in California, which had 32 plans in 1980 (20,132). In California, 32 percent of Federal and State employees who have had an annual choice among multiple plans, have chosen an HMO option (20) (see app. D). In 1980, HMOs had more than 10 percent of the market in at least eight Standard Metropolitan Statistical Areas (SIVISAS): San Francisco, San Jose, 33 percent; Sacramento, 30 percent; Portland, 32 percent; Los Angeles, Riverside, Anaheim, 22 percent; Seattle, 21 percent; Honolulu, 20 percent; and Denver, 11 percent.

Fifty-two percent of the U.S. population lived in an area with an HMO in 1980 (61). Nationally, however, only 4 percent were enrolled in an HMO in 1980, and close to 5 percent in 1981 (61). In 1980, 14 cities with populations over 500,000 and 13 States did not have an HMO (132).

In 1980, one-fourth of all active non-Federal physicians practiced in a group, defined as three or more physicians (96). About 80 percent of all groups receive all of their revenue on a fee-for-service basis; 12 percent have some cavitation

(prepayment), but it accounts for less than 10 percent of their revenue; and 5 to 8 percent derive 50 percent or more of their revenue from cavitation payment (96,119). Although both fee-for-service and cavitation groups have similar methods for paying their physicians, cavitation practices are more likely to use salary and explicit productivity guidelines, and fee-for-service practices are more likely to base income on some measure of productivity (119). From 1975 to 1980, the number of physicians in cavitation groups grew 50 percent, much faster than the 20-percent increase in all physicians (203).

To what extent physicians would respond to a restructured market by affiliating exclusively with a plan is a matter of conjecture. These figures suggest that increasing numbers of physicians are already practicing in ways alternative to fee-for-service solo practice.

The term "alternative delivery system" has usually referred to prepaid group practice and has connoted an alternative to fee-for-service solo practice by physicians. Prepaid group practice differs from fee-for-service solo practice in two major aspects: the group form of organization and the cavitation payment method (see ch. 2).

Compared with solo practice, group practice has a greater scope of services—i. e., it represents a greater degree of vertical integration. Three aspects of vertical integration are of interest in this review. One is the combination in an organization of the dual functions of insuring and delivering medical care. This aspect is the focus of proponents of greater plan competition. All types of HMOs fall into this category. Another is an ambulatory group practice, which has a range of physician specialists and basic diagnostic facilities, but uses a separate hospital. About 75 percent of all groups own their own laboratory and about 70 percent own radiological facilities (118). At another level, the hospital-based group has its own hospital. Only about 4 percent of all groups own a hospital (119), but they are some of the oldest, largest, and most studied plans: the Mayo

Clinic, the Hawaii Medical Service Association, Ross Loos, most of the Kaiser-Permanente programs, and Group Health Cooperative of Puget Sound.

In addition to the extent of integration, practices differ according to their method of payment. The incentives of capitation payment and the differences between prepaid groups and IPAs have been described in chapter 2. The IPA combines the insurance function and capitation payment to the insuring organization with fee-for-service and usually solo practice for physicians. In addition, physicians in IPAs usually have a substantial fee-for-service practice outside the IPA. Thus, providers in an IPA do not operate with the constraint of a prospective budget as prepaid groups do (see ch. 2).

There is little patient cost sharing at the time of use in either kind of HMOS. Copayments of a few dollars may be collected for each office visit as a deterrent to patient-initiated use. However, greater cost sharing exists in other organizations. In the late 1960's, the Palo Alto Medical Clinic, an ambulatory fee-for-service group, started a 25 percent coinsurance rate for physician and ambulatory ancillary services.

A problem that plagues comparisons of technology used in alternative delivery systems is whether or not similar people are enrolled in the different plans. Controlling for patient age and sex helps to standardize the rates, but does not solve the problem. Theoretically, people might prefer HMOS if they expect high use from illness, if they prefer that style of care, if they are neurotic about seeking care, or if they do not have an ongoing relationship with another physician because of moving or good health (159). The direction of the total effect is unpredictable: people at lower risk have been found to select a prepaid group in one case (76) and a fee-for-service group instead of a prepaid one in another (239). There is evidence that HMO enrollees are more oriented to prevention and less likely to have a regular physician before enrolling. Any bias toward lower (or higher) use would pertain most to recent enrollees and may decrease over time (159).

## Hospitalization

Hospitalization is a technology in itself. Besides the fact that inpatient care accounts for about 45 percent of all personal medical care expenditures (103) and is a prerequisite for the use of many surgical, medical, and diagnostic technologies, the decision to hospitalize a person is often discretionary. Performing diagnosis or treatment on an ambulatory basis may lower lengths of stay and admission rates. Certain surgical procedures may be performed without admission; and for low-risk obstetrical patients, delivery without admission may be an option (285). Hospitalization rates could illustrate how physicians in different organizations and under different payment methods use an expensive technology.

From the small number of comparisons that have been made, there is insufficient evidence that IPAs have lower hospitalization rates. Sixteen cases involving twelve different situations have compared rates of IPAs with those of fee-for-service plans (75,159). Most of the studies (10 out of 16) did not adjust or control for the age or sex of enrollees, a major determinant of hospital use. Cases in which IPA enrollees had lower hospital rates far outnumbered cases of greater use. However, all four cases in which IPA enrollees had more days per 1,000 enrollees came from studies that had controlled for age, and only 2 of the 10 reports of few days per 1,000 enrollees were controlled for age. The majority of the cases with lower use used data unadjusted for age from the Federal Employees Health Benefits Program (75, 220), under which benefits and enrollee contributions differ among plans (see app. C).

There is strong evidence that enrollees of prepaid group practices have lower hospitalization rates than those in plans with fee-for-service, solo physicians, and separate hospitals (159). Of 23 situations studied, 16 reported total inpatient days and admissions or discharges per 1,000 enrollees lower for prepaid groups than for comparison plans. In addition, 12 comparisons of Medicaid eligibles and 1 of Medicare beneficiaries found lower rates in prepaid groups. These studies are

better designed than those about IPAs. Almost all, for example, have controlled for the age and sex of enrollees. Luft's review found enrollees in prepaid groups had about 30 percent fewer hospital days, mainly because of lower admission rates rather than shorter lengths of stay. These results were not explained by out-of-plan use (159).

People who select prepaid groups may have previously had lower hospitalization rates (159). Eggers concluded there had been such a selection effect among Medicare enrollees at Group Health Cooperative (76), and an increasing number of studies are being designed to compare use before and after enrollment. It should also be noted that a small number of older prepaid groups figured in the comparisons: seven with the Health Insurance Plan of New York (HIP), an ambulatory cavitation group that has had difficulty gaining access to hospital beds; nine with one of the Kaiser-Permanente plans; three with Group Health Association in Washington, D. C.; and three with Group Health Cooperative in Seattle, Wash. These earlier, more established groups may differ from others.

Other kinds of organizations have had low hospitalization rates. The hospital-based fee-for-service group in Hawaii, the Hawaii Medical Service Association, has had low hospitalization rates, although they have been slightly higher than the Kaiser-Permanente plan there. The two plans represent the same level of vertical integration but differ in payment method (268). The possibility of self-selection into these two plans has not been explored.

In another comparison of two group practices in Palo Alto, Calif., hospitalization rates of people opting for an ambulatory fee-for-service group were similar to those in Kaiser-Permanente (282). Inpatient days per enrollee were almost identical, but the admission rate excluding deliveries exceeded Kaiser's by 16 percent. Self-selection into the fee-for-service group by people less likely to be hospitalized may have been a factor (239,282). In Minnesota, the Mayo Clinic and Olmstead Medical and Surgical Group have reported rates comparable to large prepaid groups and much lower than national rates—30 percent lower for

hospital discharges and 38 percent lower for inpatient days after age-sex adjustment (193).

Two studies from the 1950's illustrate that management of medical care, resulting in lower hospitalization rates, can be achieved by physicians within solo practice. In one case, solo internists on a retainer reduced by 44 percent admissions among beneficiaries with multiple admissions (143). Management practices have been used to explain the similar hospitalization rates reported for enrollees of the Health Insurance Plan of New York and a union plan that used solo fee-for-service physicians (70).

The combination of cavitation payment and group practice has achieved low hospitalization rates, as would be expected from the incentives of payment and organization. The experience of IPAs is that cavitation payment to the plan is insufficient; some degree of risk to or management of the physician is needed. While group practices seem to provide this organizational control, other arrangements, such as a physician who manages total medical care and acts as gatekeeper for the use of other services, can produce similar results.

## Surgery

Great variation has been noted in rates of surgery within a State, among States, and among countries. In Vermont, for example, age-adjusted tonsillectomy rates across geographical areas have ranged from 13 to 151 per 10,000 persons (277). Since surgery carries the risk of mortality and other complications, such differences raise questions about quality of care (see ch. 4). Here surgical rates are considered as a possible explanation for differences in hospitalization among medical practices.

Many studies over the past 20 years have found lower surgical rates among enrollees in prepaid groups compared with those insured under other plans (280). In the early 1960's, annual surgical rates per 1,000 Federal employees were 39 in prepaid groups versus 70 in Blue Cross/Blue Shield, at the same time that total hospital days per 1,000 were 455 and 826 respectively. Age did not explain these differences (219), and the benefit coverage of the prepaid groups was usually

broad. In several studies from that period, surgical rates from prepaid groups were lower than Blue Cross/Blue Shield or traditional insurance plans (70).

A common finding is much lower rates of tonsillectomy in prepaid groups. In several studies, including some with design problems, prepaid groups had uniformly lower rates of hemorrhoidectomy and surgery for varicose veins and usually lower rates for hysterectomy (280). The rates for hernia repair, cholecystectomy, and prostatectomy were mixed (157). Of the four comparisons involving IPAs, the IPA enrollees had lower surgical rates than comparable populations with Blue Shield or indemnity coverage and Blue Cross (159). Two of these concerned Medicaid enrollees in California (101).

Both Luft and Donabedian concluded that enrollees of prepaid groups (and IPAs) had lower surgical rates, but noted that nonsurgical rates of admission were also lower (70,159). In prepaid groups, obstetrical admissions were higher, presumably because of the membership's age; admissions for diagnosis and tests were lower (159); and rates for certain surgical procedures (hemorrhoidectomy, surgery for varicose veins, and hysterectomy) were lower. Otherwise, prepaid groups appeared to have lower admission rates generally, rather than for any particular category that has been discerned.

One of the advantages claimed for organizations that deliver comprehensive care is that they can match their resources to the enrolled population (79). The case of surgery supports that claim. Physicians practicing in groups consistently have higher operative workloads than solo physicians. In 1978, general surgeons in multispecialty groups averaged 8.6 hernia equivalents per week (a standard measure of surgical time and complexity), compared with national estimates of 2.2 to 4.5 weekly surgical operations per physician (118). Physicians in prepaid groups had lower operative workloads than those in fee-for-service groups, although the complexity of the cases for surgeons was about equal. Surgeons in prepaid groups were much more likely than those in fee-for-service groups to perform operations on an ambulatory basis (119). Studies of specific groups confirm such

use at the group level. In a Kaiser plan, 32 percent of all hospital surgery was performed on a nonadmission basis compared to 14 percent in a multispecialty fee-for-service group (239). In prepaid groups surgeons also make up a lower percentage of the total physician staff (119).

### Ambulatory Physician Services

The level of ambulatory visits in organizations that provide comprehensive care reflects the lower level of patient cost sharing as well as provider incentives. Visit rates for people in prepaid groups are about equally divided between those higher and those lower than the comparisons with traditional coverage and providers. IPAs, whose physicians receive fees for additional services, have almost uniformly had visit rates much higher than the comparisons (159).

Enrollees of prepaid groups are more likely to have at least one physician visit during the year (159). This result is consistent with Rand's interim results that the likelihood rises with lower cost sharing. The exception was a comparison of a Kaiser-Permanente plan and a multispecialty fee-for-service group, which had higher income people (241). There were only four studies of IPAs, and the results were mixed. The extent of cost sharing also seemed to explain different annual visit rates (159). People in prepaid groups had more visits than people with less complete coverage, but fewer visits compared with people with more nearly complete coverage. Prepaid groups appear to have a lower proportion of people with many visits per year, but IPAs do not show this pattern (159). If self-selection is not a factor, these results suggest that prepaid groups control use by means other than cost sharing once a person has sought care. The results are especially striking because the ambulatory rates may be inflated by patients who received care in an ambulatory setting instead of being hospitalized.

In a study of Medicaid eligibles, who all had fairly complete ambulatory coverage, those in prepaid groups had about the same rate of patient-initiated visits as controls (159). Medicaid eligibles in IPAs, however, were more likely than controls to initiate visits. There was no apparent pattern

**for followup visits. In Seattle, only 26 percent of the poor who were enrolled in a prepaid group had no visits, compared with 36 percent of the poor enrolled in a Blue Cross/Blue Shield plan.** Within Kaiser-Permanente plans studied in California, low-income people were as likely as higher income to use some services annually. Regarding accessibility, the review concluded that the views of poor people about HMOS depended on the performance of the local fee-for-service system with which they were being compared (159).

### **Ancillary Services: Laboratory and Radiology**

No consistent pattern of ambulatory use of laboratory and radiological services has been found among different organizations.

In a comparison with a multispecialty fee-for-service group, a Kaiser-Permanente plan used 40 to 50 percent fewer laboratory tests for adults' physical examinations, slightly more X-rays, and two to three times more "other ancillaries" per examination (132). Members of an ambulatory cavitation group in Sault Ste. Marie had higher rates for both laboratory and radiological procedures (115). Among the poor in Seattle, enrollees of the prepaid group had higher rates of total laboratory procedures, hematology, urine, smears, and cultures than those in Blue Cross/Blue Shield. The prepaid group members had lower rates of panel battery tests (chemistry profiles), electrocardiograms, and X-rays (132).

### **Preventive Services**

Advocates of HMOS have speculated that cavitation payment contains an incentive for providers to use preventive medicine as a less costly alternative to treatment (231), and Federal legislation on HMOS (Public Law 93-222) mandates the coverage of certain preventive services. HMOS would have a greater incentive than other practices to use prevention if their members remained with the organization long enough for it to reap any financial benefits of better health. The mobility of American society and the turnover in plan membership make the existence of this incentive

doubtful. Moreover, preventive services, like other medical technologies, vary in their efficacy and cost effectiveness. Some, such as childhood immunizations, are clearly cost effective (281), while others, such as annual physical examinations and diagnostic tests, are more doubtful (23).

An almost universal finding has been that enrollees in prepaid groups and, to a lesser extent, IPAs have higher rates of visits classified as preventive than comparison groups (159). Part of this difference may stem from the tendency of HMO enrollees to be more oriented to prevention. One analyst attributed the higher rate of preventive visits to the more complete benefit coverage of ambulatory and preventive services rather than to the effect of HMOS themselves (159).

This generalization did not apply to the comparison of a multispecialty fee-for-service group in Palo Alto and a Kaiser-Permanente plan (241). The Palo Alto Medical Clinic had significantly higher annual rates of Pap smears (47 percent v. 34 percent of women) and general preventive visits, with the greater use connected with having a regular physician. Although the clinic rate is noteworthy because patients paid a 25 percent coinsurance rate, the clinic also had more women from higher socioeconomic groups, who are more likely to have Pap smears.

There have been too few studies of immunization rates to draw general conclusions. In two (of three) studies, children in prepaid groups had higher immunization rates than controls in fee-for-service solo practices (159). No pattern was evident among Medicaid eligibles with comparable coverage. Children in a Washington, D. C., prepaid group had significantly lower immunization rates, although that study had design problems (16,98). A larger study of Medicaid eligibles found little difference or slightly lower rates in prepaid groups and IPAs compared with fee-for-service controls (101). These two studies reported similar findings for prenatal care—lower or equal use in prepaid groups. The poor in the Seattle prepaid group had higher immunization rates, except for influenza vaccine (159).

## Managerial Technologies

Use of many of the clinical and ancillary technologies discussed in previous sections depends not only on clinicians and consumers but also on management. Managers plan, coordinate, and control the activities of their organizations and link them to others outside. In the delivery of medical care, managerial technologies support but are not directly associated with the provision of patient care. Managerial technologies may include hardware, such as computer-based management information systems; organizational structure; planning processes; and staffing policies (141).

Managerial technologies are associated with many of the differences observed among delivery systems. In comprehensive care organizations, the greater degree of vertical integration provides the means to rationalize the resources available and their use for patient care.

The medical care system consists largely of autonomous units that make interdependent decisions without bearing the full cost implications. Transactions among separate units do not always involve a transfer of funds. Physicians usually use hospital facilities and hospitals use the services of community physicians without payment. A practice that directs patients to an independent laboratory does not bear the costs of the tests. This fragmentation often results in duplication of tests and the use of more costly procedures and settings. But this situation persists, because the usual payment method rewards providers for additional use and present insurance coverage largely removes opposition from consumers.

In some cases, the delivery of medical care has become more integrated. The original Kaiser plan included a hospital because no other facilities were available to the workers building the Grand Coulee Dam. Prepaid group practices have sometimes sought to have their own hospitals, because of the added control that is gained over operating procedures and expenditures. In the cases where they have developed, more vertically integrated delivery systems internalize a greater range of costs. An ambulatory group with its own laboratory bears the cost of that operation, and a hospital-based group encompasses the costs of both inpatient facilities and physician services.

Coordinating diagnostic tests and therapeutic procedures could be easier and less costly within one organization. A separate hospital may refuse to provide information about patients admitted by an ambulatory group's physician (18), but a hospital-based group would have such information available for concurrent monitoring and control.

To the extent that an organization wishes to increase net revenue (revenue minus costs) and maintain fiscal viability, internalizing a greater range of costs would lead to attempts to lower costs in the production of specific services and in the mix of services provided for a medical condition. This possibility results from the discretion that exists about the combination of medical services used for a particular person and the method of providing them.

The cavitation payment method, which entails fixed revenue within a time period, provides an incentive to control technology use and acquisition because additional services add to expenses but not to revenue. The union of the incentives of cavitation payment and the management control of group practice underlies the lower hospitalization and surgical rates that have been reported. Although the format of a fee-for-service group gives it the same coordination and control, it does not face the financial constraints of a fixed budget. Like most medical providers, it gains greater revenue from greater use and operates within the relative fee structure that rewards highly the use of sophisticated technology.

In the present medical marketplace, providers are not pressed to adopt organizational structures that are most efficient, or to realize the potential of a more efficient structure. Nor can it be assumed that any lower costs realized are passed on to consumers in lower premiums or charges. This fact handicaps an analysis of different organizations. It is possible to state the theoretical potential and note previous results, but what has been observed is not necessarily what an organization is capable of achieving.

The proponents of competition who emphasize consumer selection of comprehensive care organizations would rely on the organization to control and rationalize technology use. In the managerial area, possible methods include control-

ling the number and kind of resources available and establishing policies about the coordination of services and the preferred setting for therapy. In the clinical area, information and education about decision analysis and technology evaluation could be directed to physicians and other medical professionals.

In the resource area, management's decisions about the number and kind of physicians can influence the quantity and type of care provided. Kaiser-Permanente, for example, develops annual plans based on physician-membership ratios by specialty. These targets guide the organization's recruitment of physicians, enrollment of members, and personnel budgeting. Prepaid groups have been significantly more likely than multispecialty fee-for-service groups to have pediatricians and obstetricians/gynecologists and less likely to have general surgeons (119). These staffing differences reflect the characteristics of enrollees in prepaid groups (prepaid groups are more likely to have young families), and they both reflect and influence the style of practice (prepaid groups have less surgery). Scitovsky and McCall have pointed out that a multispecialty fee-for-service group also controls the number and kind of physicians added to the group (239).

Also in the area of managerial technology, organizations can control their equipment and facilities. There is some evidence that Kaiser's internal planning process achieves greater regionalization of hospital services than separate hospitals. One study found that compared with other non-Federal short-term general hospitals, Kaiser hospitals in the San Francisco area were less likely to have certain facilities, and, when present, these facilities tended to be in the larger Kaiser hospitals (161). The facilities were postoperative recovery room, inhalation therapy, intensive care unit, electroencephalograph, diagnostic radioisotope, and genetic counseling. Kaiser hospitals were more likely to have social work departments and home care. Psychiatric inpatient facilities, psychiatric partial hospitalization, and occupational therapy departments tended to be in smaller Kaiser hospitals. The study concluded that the Kaiser system has some fully equipped larger hospitals and some smaller ones equipped for emergencies and chronic care (161). Because of the

lower density of Kaiser hospitals in the San Francisco area, members may have longer travel times.

Hospital-based group practices can plan the number of hospital beds per capita available for their members, just as they do physician-membership ratios. Kaiser-Permanente plans use that approach. Ambulatory groups can contract with a hospital, and perhaps negotiate a discount (112). An ambulatory group may also be able to negotiate certain arrangements concerning its patients, such as routine tests performed upon admission (112). The existence of facilities can affect the use of certain procedures. Kaiser-Permanente may have performed more of its surgery in its hospital on a nonadmission basis because that hospital was a part of the organization (239). The lower rates of diagnostic admission generally reported for prepaid groups may reflect that greater ability to coordinate testing within a group practice and the incentive from cavitation payment and comprehensive benefits to constrain hospital admissions.

Medical practices can also provide clinicians and departments with information to influence and to control decisions about technology use. Kaiser-Permanente in northern California has long provided regular notifications of the full-time equivalents and budgets as part of its planning and control procedures (44).

Theoretically, the combination of the insurance function and provision of medical care would entail greater monitoring and control over providers. The examples cited suggest that these activities occur in prepaid groups. Utilization review and preadmission certification have been used in some IPAs to limit hospitalization. Overall, however, there is insufficient evidence that IPAs have achieved lower rates. This finding may reflect the caveat expressed earlier, that the current medical marketplace does not press providers to achieve the level of efficiency of which their organization is capable. This caveat also applies to the fee-for-service sector, particularly to fee-for-service groups.

## **Total Expenditures for Medical Care**

It is insufficient to consider piecemeal the use of specific technologies. More important is the

overall expenditure level, which includes the mix of technologies used and their relative costs. Consideration of expenditures needs to be coupled with information about the benefits achieved, a matter taken up in chapter 4. There is no evidence that either the prepaid group practice or IPA form of HMOS produces any of the specific services used, including cost per inpatient day, at lower cost than solo fee-for-service practices (159). Information about total annual expenditures relates to the overall management of medical care for enrollees.

Total annual expenditures for medical care by an insured person consist of premiums paid for coverage under a plan plus any additional out-of-pocket expenses. \* The few studies that have reported both pertain almost exclusively to plans on the west coast.

Study designs prohibited the attribution of effects observed among certain factors; the plans compared usually differed in benefit coverage, age-sex distributions of enrollees, payment method, and integration levels. On the basis of the large and consistent differences, reviewers have concluded that total annual expenditures are lower for enrollees of prepaid group practices than for enrollees of conventional plans that reimburse fee-for-service, mostly solo providers (70,157,231, 282).

Five of the six studies of the general population included at least one of the Kaiser-Permanente plans in California, which are hospital-based prepaid groups (15s9). The sixth included

\*A portion of the taxes that people pay also goes toward public funding of medical care programs, such as Medicare and Medicaid. Another consideration is tax expenditures, the losses in Federal revenue that result from the tax savings allowed by the tax code for certain groups. In the health area, Federal expenditures on medical care for poor people are offset by tax expenditures from the deductibility of health insurance premiums and certain medical expenses, which favors high-income groups. The low-income group benefits the least (278).

the Health Insurance Plan of New York, an ambulatory prepaid group (3). For IPAs or foundations for medical care, under which the plan receives a cavitation payment but pays independent physicians by fee-for-service, the results were mixed and showed no clear pattern compared with conventional plans (70,231),

A similar expenditure pattern has been reported for people eligible for Medicaid and for those with low income. Two prepaid groups, an ambulatory one in the District of Columbia and a hospital-based one in Washington State, had total annual per capita expenditures 34 to 37 percent lower than conventional plans over a 3-year period (99, 169). Benefits and age and sex of enrollees were similar for the plans compared. In contrast, there was no evidence that a medical foundation affected the total expenditures per Medicaid eligible in San Joaquin County, Calif. (123). During the years studied, 1969 and 1970, the medical foundation was not at risk for hospital care, and, although the plan received revenue by cavitation, physicians were paid on a fee-for-service basis.

In 1969 and 1970, Medicare payments for elderly beneficiaries in five of seven prepaid groups were less than for a control group comparable in county residence, age, and sex (51). All five groups with lower expenditures than controls owned or controlled their own hospitals, while the two groups with higher expenditures were ambulatory groups with no such hospital control (275). Although consistent with the expected effect of greater vertical integration (280), the results are only suggestive because of other differences, such as the plans' sponsorship, selectivity of enrollment, size of Medicare population, and hospital occupancy rates. The most obvious differences in the two higher cost plans were in region (both were in New York City) and in their use of part-time physicians. Also noteworthy is that Medicare's cavitation payment to a plan covered only in-plan physicians' services.

## RESEARCH ON INNOVATION

In the general literature on technological change, there is disagreement about the relationship between competition and innovation. One

theory is that competition provides an incentive for firms to adopt new techniques. The view of Schumpeter and Galbraith, however, is that firms

under imperfect competition have more resources for research and development and more incentive to innovate, because their market control allows them to keep any resulting profits (165). Researchers have found no definite relationship between innovation and the degree of competition (138). Intermediate levels of competition instead of extremes may be most conducive to innovation (134).

The theory has been advanced that hospitals now compete in nonprice ways by adopting sophisticated technologies to attract prominent physicians (235). The empirical evidence is far from conclusive.

In one study, certain facilities, namely electroencephalograph, X-ray therapy, organ banks, and outpatient renal dialysis, were concentrated in nearby San Francisco hospitals, as one would expect if hospitals were using them to compete with each other (161). Both the extent and speed of adoption have been studied. The adoption of open-heart surgery occurred more often in less highly concentrated hospital markets, but no relationship was found for other technologies (235). Massachusetts hospitals were more likely to adopt most technologies, except computers and radioisotopes, if more local ones already had them (53).

Similarly, Russell found that prior local adoption speeded the adoption of intensive care units and electroencephalographs by the remaining hospitals (235). This pattern did not apply to diagnostic radioisotopes, and an appropriate measure was not defined for open-heart surgery, cobalt therapy, or renal dialysis (235). Greater but not faster adoption of intensive care units, open-heart surgery, cobalt therapy, and renal dialysis occurred in States with more physicians per capita (53).

Under greater cost sharing, any market pressure from patients' price sensitivity would relate to separate services. Patients might refuse to be hospitalized, or at least question the matter. Patients' cost concerns could also be conveyed through their physicians to hospitals, so that hospitals were more apt to adopt more cost-decreasing or fewer cost-increasing innovations. It is unknown whether hospitals would choose to compete in such new ways on the basis of costs.

There has been some work on hospitals' adoption under different regulatory approaches to cost reimbursement. Although these situations differ greatly from the competitive ones proposed, they shed light on how hospitals have behaved when attempts were made to constrain costs (271). A recent study examined hospitals' responses to prospective reimbursement (269). Prospective reimbursement sets rates in advance, but the unit of payment (per diem, per service, per case) and the mechanism for adjusting rates vary. Prospective reimbursement significantly speeded the adoption of cost-decreasing centralized energy management in Maryland and delayed it in New York. In New York and, to a lesser extent in Maryland, the number of electronic fetal monitors, upper gastrointestinal endoscopes, and infusion pumps acquired was lower (269).

Although greater cost sharing might lead to fewer admissions and a smaller number of patients for whom hospital technologies would be used, catastrophic coverage might have offsetting effects, and the development and adoption of new technologies might be channeled into areas of expensive acute and chronic care, which were not subject to cost constraints. With an income-related catastrophic limit, greater cost sharing would affect ambulatory care, most of which would come within the annual threshold and would be paid by the patients. To the extent that providers felt pressed on costs, innovations that were cost decreasing, or less cost increasing for similar purposes, would be expected in managerial, clinical, and ancillary technologies related to ambulatory care.

A great deal of innovation is already taking place in managerial technologies related to hospitals (141). One line of activity is to refine techniques for measuring the performance of physicians. In New Jersey, for example, reimbursement of hospitals is being tied to resources used for different "diagnostic-related groups," which are intended to represent standardized patient cases. Another development is organizational change in hospitals. By 1976, more than one-fourth of all hospitals were participating in multi-institutional arrangements.

Both greater cost sharing and greater plan competition are expected to produce innovations in

organizational forms of delivering medical care, another area of managerial technology. In fact, this development has apparently occurred in response to the establishment or growing market share of the prepaid group practice form of HMO (see app. D). Most common is the formation of an IPA, but other organizations have also developed. In Denver, for example, a preferred provider organization, which includes physicians selected for their low-cost practice patterns, began as an apparent response to the growth of a local Kaiser-Permanente plan (171).

There is no indication that the practice styles of prepaid groups or other comprehensive care organizations diverge greatly from the styles of other medical practices. This similarity is to be expected, since physicians, as professionals, are guided by external standards of the profession.

The key is that these organizations do not have to acquire a new technology to use it. They can rely on outside facilities and even screen outside use of the technology. The organization may wait until its volume of use reaches a point at which it is cheaper to own its own unit. This approach has the cost advantage of avoiding the startup phase, when volume is low and cost per unit is high, and avoiding the purchase of a new technology during the early phases when improvements are being made.

Kaiser-Permanente in Northern California used this strategy with computed tomography (CT) scanning (206). The plan initially arranged to use an existing machine outside the organization. Only when volume had reached the point at which the cost to buy the service exceeded the cost of producing it internally was a head scanner ordered. Kaiser similarly contracts with a nearby university hospital for its open-heart surgery (77). Several prepaid group practices, including those of Kaiser-Permanente and Group Health Cooperative of Puget Sound, routinely assess the relative costs of buying the services of expensive technologies from outside the group or of acquiring the technology and producing the services internally (45,273).

A recent study examined whether or not prepaid groups were less likely than other local practices to use amniocentesis, a diagnostic innovation that does not require a large capital investment (41). In New York City (Health Insurance Plan) and Southern California (Kaiser), the rates were about equal to those for other eligible women. In Washington State (Group Health Cooperative) and Oregon (Kaiser), the rates within the prepaid groups were about twice the local rates (41).

## LIKELY EFFECTS OF INCREASED COMPETITION ON TECHNOLOGY USE AND INNOVATION

### Greater Patient Cost Sharing

Greater patient cost sharing at the time of use clearly deters people from seeking care. Compared with present health insurance coverage, income-related cost sharing up to a maximum or catastrophic expense limit would reduce the percentage of people who receive hospital and physician services. There would be less effect on other services, which are already subject to more exclusions and cost sharing.

The reduction in patient-initiated use of these technologies would come about in different ways. One is that fewer people would be willing to pay

the additional cost to see a physician or enter a hospital. In some cases, people would not seek or obtain care for a medical condition at all. In other cases, and especially for expensive hospital care, a person's reluctance to pay the large sums associated with a hospital admission could lead the physician to use alternative, less expensive settings to provide the care. In general, initiation of care for children would be affected less than care for adults.

Use of preventive technologies, which people may initiate themselves, would not be much affected by greater cost sharing, because present in-

surance often excludes such coverage and because people's preventive use has not been very responsive to insurance coverage. An exception is use of preventive services for children in low-income families, technologies whose use has been lower with greater cost sharing (24,35,43).

Even with annual catastrophic expense limits that were related to income, it seems likely that low-income people would be deterred from seeking care more than others because of the initial sums involved. Elderly people, who are more likely to have low incomes, would be more affected than people of other age groups. Cash grants to people below the poverty line, as Feldstein suggested (88), could ease this effect.

At least initially, most of the people who did receive medical care would each use fewer and less expensive services. Part of this effect would occur because patients would not return for additional visits that physicians recommended or would not follow their physician's advice to have diagnostic tests or therapeutic procedures performed. Patients might be less inclined to seek second opinions, at least for procedures that were not very expensive, if they had to pay the full cost for the other physician's consultation. People might also resist undergoing medical or surgical treatment for conditions that were not life threatening and only a minor inconvenience.

In addition, people's reluctance to pay for an additional followup visit for acute or chronic conditions, for an expensive hospital stay, and for other technologies might lead physicians to recommend and use them less frequently. The technologies most affected would be those that physicians felt would provide little additional diagnostic information or little therapeutic or preventive benefit.

Because of the effect on their incomes, physicians would be likely to limit the use of technologies that were provided by other medical professionals or organizations more than the use of their own. And within their own practices, physicians would forego the use of less costly technologies more readily than the more expensive ones, especially if the practice had a sizable investment in a piece of equipment that was being paid for by charges for its services. There would be less

tendency to hospitalize people for diagnostic workups and for surgery that could be performed on a do-not-admit basis. \* If there were fewer admissions, the use of associated technologies would correspondingly fall. The medical care provided to children would be much less responsive to cost considerations.

Patterns of technology use in hospitals would respond to cost-sharing incentives more slowly than those in physicians' practices. Change would occur more gradually in hospitals, because more people are involved in the decisionmaking of a large organization. Although a hospital could try to streamline its operating budget in the short term, its present plant and equipment would constrain changes that could be made in the capital budget. An existing piece of equipment might be used until its capacity was approached, when more discussion about its appropriate use and price would surround the decision to replace it or buy an additional unit. Another factor restricting a hospital's ability to change is the standards of outside review bodies. Certain tests routinely given to hospital patients and some hospital operating practices fall into this category.

That expenses above the maximum annual limit would be paid with no patient cost sharing would support the prediction that the use and innovation of medical technology would be channeled in the direction of expensive care. If a person's annual threshold was approximately \$2,000, for example, most surgery, recurrent cases associated with some chronic conditions, and most hospital stays beyond a few days would exceed the limit. People might resist having the surgery or hospital admission because of the cost, but once the limit was passed, cost would not be a consideration. These cases are the ones for which physicians and especially specialists are trained to use sophisticated and expensive diagnostic and therapeutic technologies. They are also the cases in which patients are less likely to question medical advice and more likely to expect that all available technology be applied to help them. It thus appears that the use and price of technology at the upper end of the cost spectrum would be largely

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\*Do-not-admit surgery is performed in a hospital, but patients are not admitted as inpatients.

unrestrained. In addition, hospitals and physicians, faced with a potential loss of revenue or income, might try to maintain their incomes by trying to expand the use of expensive inpatient technologies.

If everyone had catastrophic coverage, the financial protection accorded to most people might not be very different from the current situation. Because of the increasing tendency for private insurance policies to include catastrophic coverage and the development of public programs such as Medicaid, people of all ages have a very low chance of having to pay catastrophic expenses (see ch. 2). What would be notably different is the complete coverage for large expenses relative to others. The use and price of low- and moderate-cost technologies would be restrained by the fact that patients would have to pay a sizable portion of their cost. With the tighter constraints on lower and moderate costs, technologies with high total cost for a patient's condition would be an attractive outlet for innovation and use. The total effect on use and cost is unclear; fewer cases would reach the catastrophic limit, but those that did would be treated more intensively.

How particular technologies would be affected by greater cost sharing would depend on the definition of minimum benefits to be included in comprehensive coverage. The Rand results discussed previously came from an experiment with a broad definition of comprehensive coverage that included mental health and dental services, prescription drugs, and visual and auditory services (192). In general, it can be said that technologies included in coverage would have their use and price restrained up to the threshold of the annual limit, but not beyond it. Among the technologies included in coverage, consumers and medical providers would select which technologies to use on the basis of whether their costs were commensurate with their benefits, without artificial boundaries created by insurance coverage. An important example is long-term care. This area of medical care is most responsible for catastrophic expenses, especially for elderly people. Access to long-term care facilities can also reduce the cost and length-of-stay in acute-care hospitals. Inclusion of long-term care in standard benefits could afford people greater financial security and could

help to make hospital use more appropriate, but it could also account for large expenses.

The effects of greater cost sharing on technology over a longer period of time are more difficult to predict. Studies of greater cost sharing have found that within 3 or 4 years, lower levels of use have developed and persisted. There is the possibility that delaying care would lead to greater use for some people in the future, if conditions that could have been identified and treated early are not found until they are more severe and difficult to treat. Balancing that possible source of a long-term increase in use and cost is the fact that some undetected conditions are self-limiting and some can be diagnosed but not successfully treated by medical care.

Empirical studies of greater cost sharing have traced the effect of changes for a limited number of consumers, physicians, and hospitals in an area. The effects might be much different if the changes applied to everyone. This caveat applies particularly in an era when the number of physicians is forecast to increase by 75,000 in 5 years (203). An overall decline or slower rate of growth in medical expenditures implies less income for providers. With continuation of fee-for-service payment and charge- or cost-based reimbursement, providers might try to offset less patient-initiated use (14). Providers might raise the prices of their services; emphasize more expensive services (such as, a complete instead of a partial physical examination); or "unbundle" services by charging separately for procedures previously billed together and more cheaply.

On the other hand, if providers in an entire community responded in the same direction as they have in the limited changes that have been studied, the results observed so far might underestimate the impact on cost and use. The effect on practice style from a systemwide change might be much larger if providers responded to the average level of their patients' insurance coverage. Also supporting that prediction is the view that medical providers, like others who wish to increase the sale of their services, would face consumers who are more careful about price and quantity when they are paying a substantial portion of the cost.

Even if providers responded by becoming more cost conscious, conflicting factors would act on hospitals and other organizations. Pressures to restrain costs would lead them to adopt cost-decreasing technologies, such as systems to manage energy use more efficiently. It would also lead them to scrutinize more carefully requests to purchase expensive equipment, especially if the hospital already had one such unit or if the technology was new and its use uncharted. A hospital might resist acquiring expensive technologies designed for unusual conditions and hence likely to have only low levels of use in one institution. Efforts to constrain costs might intensify the efforts of hospitals, other providers, and insurers to adopt different managerial technologies, such as mechanisms to monitor costs or alternative organizational arrangements.

From the other side, a hospital in a more competitive environment might rush to purchase a new technology considered to have great potential so that it could recoup its investment before others had acquired it. The lack of cost constraints on catastrophic expenses would spur the development and use of costly halfway technology\* for medical conditions that lend themselves to lengthy or intensive care. Also encouraging technology adoption and use would be the fact that medical providers would continue to be motivated and guided by the standards of their professions, which call for helping their patients, often with the use of expensive technologies.

The innovation of medical technology would be subject to these conflicting influences. Increased cost sharing would stimulate greater innovative activity and presumably more innovation in managerial, ambulatory, and cost-decreasing technologies. The effect on clinical and ancillary technologies and particularly expensive equipment is less clear. Fewer hospital admissions and greater pressure for providers to be efficient would predict less adoption and use and hence less innovative activity in these areas. However, unrestrained expenditures for expensive (catastrophic) care would have the opposite effect of stimulating use and innovative activity related to sophisticated and costly technologies.

\* Halfway technologies alleviate the effects of but do not prevent or cure disease and are usually expensive (255).

## Competition Among Comprehensive Care Organizations

On the basis of previous enrollment trends when people have had a greater choice of plans, prepaid group practices primarily and IPAs secondarily would accelerate their growth in membership, physicians, and market share (see app. C). The development of different organizational arrangements that combine the insurance and provision of medical care would also continue at a more rapid rate. Both commercial insurers and Blue Cross/Blue Shield plans would become even more involved in sponsoring such organizations and in overseeing their operations.

These organizations would be competing for enrollees on the basis of total costs to consumers (premiums plus out-of-pocket expenses) for the coverage, quality, and style of practice provided. There would thus be market pressure for them to produce services efficiently and to use the most efficient (lowest cost for a given level of quality) combination of technologies for the conditions and members under their care.

Even in the current context, prepaid group practices have been subject to financial pressures because they receive revenue predominantly by capitation payment, but they have so far had too small a market share to have had any discernible effect on community use or cost (see app. D). If organizations that felt similar pressures for efficiency predominated or exerted sufficient pressure on the others, it would be possible to make certain predictions about the use and innovation of medical technology. These changes would be relative to the present in which medical care is delivered primarily by fee-for-service solo practices and in which insurance coverage is widespread.

If the cost sharing for initial physician visits and other ambulatory care were lower, as it is in prepaid groups, cost would deter people less from seeking care. Both low- and high-income enrollees would have a greater likelihood of having some contact with the medical care system during the year. People covered under Medicaid would have at least the same rate of patient-initiated care as they do now.

Once people entered the medical care system, the comprehensive care organization would control their use of technology. If greater market pressure from other delivery systems restricted premium increases and made prospective budgets more restrictive, the organization would take measures to operate more efficiently. Since the organization would integrate the delivery of comprehensive care, it could make decisions about allocating personnel and other resources as well as the use of alternative technologies across the range of medical care. To be successfully implemented, these decisions would have to balance the preferences of consumers, clinicians, and administrators.

In the ambulatory area, more attention would be paid to the use of diagnostic technologies and drugs, which have low per unit cost but can account for a substantial portion of total costs. Laboratory and radiological tests that give unnecessary or redundant results would be discouraged. Depending on its availability, information related to the appropriateness and sequencing of tests and drugs would be channeled to clinicians. In the short term, these effects would be retarded in practices that already had expensive diagnostic equipment. As the equipment wore out or became obsolete, the long-term result would be lower rates of acquiring such equipment and of using drugs and laboratory and radiological tests.

The per capita rate of ambulatory visits would remain about the same or fall. The visit rate would combine the effect of fewer followup visits for many medical conditions and of relatively greater use of the ambulatory setting instead of the hospital. If market pressure were greater than now felt by prepaid groups, the organizations might try to curtail visits. One possible target would be visits now classified as preventive that involve technologies, such as annual physical examinations, that are not cost effective. Comprehensive care organizations would not necessarily provide more immunizations or counseling about methods to manage chronic conditions, such as diabetes, or about nutrition or lifestyle. If consumers had strong preferences in these areas or if the technologies could save costs for the organization, these activities could be undertaken.

Hospitalization rates would be lower for all age groups and income levels. These lower rates would apply across the range of diagnostic categories, reflecting the great degree of discretion that exists in the practice of medicine. Surgical rates in particular would be lower. Over time, the adoption and use of technologies associated with hospitalization would be correspondingly lower. This effect would be manifested gradually as equipment wore out and was not replaced.

In both ambulatory and hospital settings, pressures to limit costs would spur the adoption and use of cost-decreasing technologies. Managerial technologies would be a fertile area for innovation. Depending on legal and professional restrictions, different staffing patterns might emerge. A lower percentage of surgeons on the physician staff is one example. If less costly, other health professionals might be substituted for physicians. As more care would be shifted from an inpatient to an ambulatory basis, one would expect more innovative activity to surround the delivery of ambulatory services. Deliveries of low-risk mothers and babies and certain surgery would shift increasingly to a do-not-admit basis, and other procedures would follow. Also in the managerial area, pressures to limit costs might lead the physicians and institutions that now operate separately to forge links.

In effect, most prepaid group practices now cover catastrophic care by having no limits on physician and inpatient services. The way these practices handle catastrophic or high-cost cases would likely continue. The organization would exert control over expensive or lengthy cases in advance through the equipment, staff, and facilities that are available, such as long-term care as an alternative to more costly acute-care hospitals. The organization might also have standing arrangements and predetermined rates with outside providers for rarely used technologies, such as open-heart surgery. Clinicians, who would be aware of the organization's budget and facilities as well as patients' medical needs, would continue to make decisions about the use of technologies for individual patients.

Although catastrophic coverage would be more widespread in a restructured system, under the

proposal for greater competition among comprehensive care or organizations, catastrophic care would be controlled by providers and would be unlikely to take a larger share of total medical care expenditures. In fact, the portion would probably decline if market pressures pushed providers to greater efficiency in the way they treated these cases early in the episode and comprehensive coverage encouraged use of less costly settings and technologies.

Like the effects of greater cost sharing, the effects of greater competition among alternative delivery systems would depend on the definition of benefits to be included in comprehensive care. Again, long-term care exemplifies a technology that would reduce expensive hospital care, but could itself constitute a sizable expense.

## IMPLICATIONS FOR POLICY

Regionalization of specialized facilities would continue to be an issue under both competitive strategies. Even large comprehensive health care organizations would not have sufficient volume to justify all the equipment and surgical facilities that their patients would use. Regionalization of such facilities might both lower costs and improve quality (162,172). Different responses by providers are possible under greater competition. Hospitals, for example, might compete for patients and physicians on bases other than price by acquiring expensive technologies and appealing to the inclination to associate them with quality and prestige. Another possibility is that in the face of strong market pressure to limit costs, no hospital in an area would be willing to acquire expensive technologies used for medical conditions with a low prevalence. Under greater cost sharing, expensive technologies would not be restrained by market pressures.

These potential problems suggest that some kind of areawide coordination would be needed with regard to the number and placement of specialized facilities that no single organization would have sufficient volume to support with its own patient load. Enterprises might develop to provide such technologies on referral or by con-

The above speculation has proceeded as if organizations would compete by rationalizing technology use and by operating more efficiently, but other responses are possible. Price competition could lead competing delivery systems to skimp on the adoption and use of technologies for their enrollees, a matter of quality of care that is considered in chapter 4. Instead of tackling the more difficult problems of relating to providers and promoting efficient technology use, insurers might use their marketing expertise to seek enrollees likely to be low users. Furthermore, Americans associate sophisticated technologies with high quality, particularly in medical care. Plans or providers might vie for enrollees in ways different from those intended—e.g., by acquiring and using such technologies.

tract. Possible governmental approaches range from relying on local and State activities and placing certain facilities in medical schools and teaching hospitals, to changing the emphasis and continuing the federally supported Health Systems Agencies. With increased cost sharing, attention to expensive technologies used for catastrophic care would also be warranted.

If the pattern of technology use in prepaid groups were considered desirable, certain constraints could be removed from the growth of such groups. The Federal Health Maintenance Organization Act (Public Law 93-222) requires for qualification that plans cover certain benefits, have specific structures, and follow certain procedures with respect to premium rating and enrollment. About half of the organizations considered HMOS are not federally qualified. Moreover, financing arrangements under Medicare and Medicaid discourage HMOS from seeking the beneficiaries as enrollees.

Easing the requirements for Federal qualification, perhaps in line with State laws about HMOS, would remove disadvantages that HMOS have relative to other plans that are not so restricted. Guaranteeing Medicaid eligibility for a certain

period would reduce a barrier to HMO enrollment. The experience of Project Health in Portland, Oreg., indicates the feasibility of giving publicly supported beneficiaries a choice of plans, including a prepaid group (see app. D).

In a restructured situation, as in the present, medical providers would need evaluations of technologies. The interest of the medical community in information about the efficacy, safety, and cost effectiveness of technologies has grown greatly in recent years. If physicians, hospitals, and insurers faced more market pressure to limit costs, they would increasingly turn to evaluations of alter-

native technologies to guide their decisions about adoption and use. Large, well-established prepaid groups, which may be subject to such pressure, already develop some of their own information. Since it is difficult to retain exclusive control over information once it is developed, no one entity may find it financially worthwhile to undertake the initial expense. Yet the benefits to providers, consumers, and insurers would be widespread. Representing the social interest, Government could fund evaluations conducted in the public or private sector or sponsor a private consortium to do so (208).