# Physician Use of Services for the Hospitalized Patient: A Review, with Implications for Cost Containment

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PRESSURES TO SLOW THE RATE OF INCREASE IN hospital expenditures, especially the threat of federal regulation of hospital costs, have sparked concerted efforts toward cost containment. Among these is the present Voluntary Effort, in which participating hospitals and physicians voluntarily strive to stem the rapid growth in hospital costs (McNerney, 1980). Hospitals account for 40 percent of the national health care bill, which in 1979 amounted to $212 billion or 9 percent of the gross national product (Gibson, 1980). Expenditure increases can be attributed partially to price inflation and population growth but, as managers of patient care, physicians bear major responsibility for determining levels of hospital expenditure. They admit and discharge patients from the hospital and order for patients such hospital services as laboratory tests, X-rays, nursing services, pharmaceuticals, critical care, and surgery. Yet, because their role in managing patient care and influencing expenditures is central to the health care industry, they also offer an opportunity for judicious control of medical care costs.

Given the growing tendency of states to impose limits on hospital reimbursement (Biles et al., 1980), pressures to reduce physician use of hospital services will be felt by hospital administrators and others

Milbank Memorial Fund Quarterly/*Health and Society,* Vol. 59, No. 4, 1981

0160/1997/81/5904/0481-27 $01.00/0

responsible for hospital finances. It thus becomes increasingly important to understand the determinants of physician use of hospital services and the ways in which physicians' behavior may be modified. In this paper we explore the ordering behavior of physicians in the hospital setting—its nature, determinants, and problems—and, through a critical review of the research, assess various strategies for modifying physician ordering. We present data that support the thesis that a reduction in use of hospital services can be effected without endangering quality of care. We then outline factors that encourage physicians to order increasing amounts of hospital resources, and examine the hospital's role in promoting resource use. On the basis of research to date, we evaluate four major strategies that could be employed to reduce unnecessary ordering, with regard both to their relative effectiveness and to their comparative feasibility.

Although this review focuses on care of patients who are already hospitalized, we emphasize that the decision to hospitalize a patient in the first place is the most costly one a physician makes. Further, we concentrate largely on the teaching hospital and on ordering of diagnostic laboratory and radiologic procedures by physicians in training, since these have been the most commonly studied. Where possible, however, we include assessments of physician determination of hospital stay, surgery, nursing, pharmaceuticals, and other hospital services. The studies reviewed range from methodologically sound endeavors to studies marred by inadequate experimental designs. In combination, they nevertheless provide a preliminary insight for those who seek to control medical expenditures by moderating patterns of physician ordering.

This review is addressed to medical educators and others, such as hospital administrators, physicians in private practice, and state and federal policy makers, who are concerned about the physician's role in the rising cost of medical care. It exemplifies a common policy dilemma: action to rectify a problem often must be taken before the problem is fully understood and before solutions are adequately evaluated. In the case of the pattern of physician ordering, despite an abundance of published research, its nature and magnitude elude precise definition; and sporadic attempts to trace its roots or to modify it yield suggestions more than prescriptions. Despite the inadequacy of such information, however, few quarrel with the need to change ordering behavior and thereby to slow the rise in hospital costs.

## Physician Ordering, Quality of Care, and Cost Containment

Use of specific clinical services for hospitalized patients has increased markedly and steadily during the last two decades, becoming an important contributor to the general increase in hospital costs. For certain illnesses, the average number of some diagnostic and therapeutic services provided per patient grew by over 500 percent between 1951 and 1971, while length of stay dropped by as much as 40 percent (Scitovsky, 1979). Laboratory procedures and radiologic services alone now account for up to 25 percent of total bills at some hospitals (Griner and Liptzin, 1971; Schroeder and O'Leary, 1977; Smith et al., 1979). Patients and physicians alike have come to equate more intensive medical care with better care, thereby making it difficult to contain costs by reducing services.

The law of diminishing returns, applied to the relation between intensity of service use and outcome of patient care, demonstrates the weakness of a "more is better" approach. Every unit of care provided has a relative clinical value for that patient. Yet as increasing amounts of an input are employed in a production process, all other things being held constant, each additional unit of input, in general, will yield a relatively smaller benefit. The "improvement" of the product associated with the addition of one more unit of input may actually be reduced to nothing or even become detrimental.

The concept of diminishing returns applies both to multiple use of a single service and to use of multiple services for a patient. For example, in the first instance, an initial chest X-ray can yield valuable clinical information for the diagnosis and monitoring of pneumonia. Once the diagnosis is made and treatment initiated, however, daily chest films will provide little additional data beyond what the physician can learn through physical examination and patient interview. Since changes in the pneumonia usually will not be apparent on a chest X-ray from one day to the next, the benefit from each daily chest film will in most cases be negligible. In an example of multiple service use, an abdominal mass can be located and its size estimated through use of an X-ray, sonogram, radionuclide scan, or computerized tomography (CT) scan, each yielding differentially accurate information. When the four are used sequentially in diagnosis, each duplicates in part the information gained from the previous test, and

the relative gain in knowledge may decline with each procedure (Showstack et al., 1981).

Figure 1 illustrates a marginal benefit curve where health is the "outcome" and medical services or expenditures are "inputs." Early in a diagnostic or treatment process (point 1 in the figure), the application of a specific medical service, such as a chest X-ray or a day in the hospital, may have a sizeable impact on patient care in either confirming a suspected diagnosis or providing basic nursing and custodial support. At some point in the patient's care (point 3), however, the treatment may be well under way and an additional

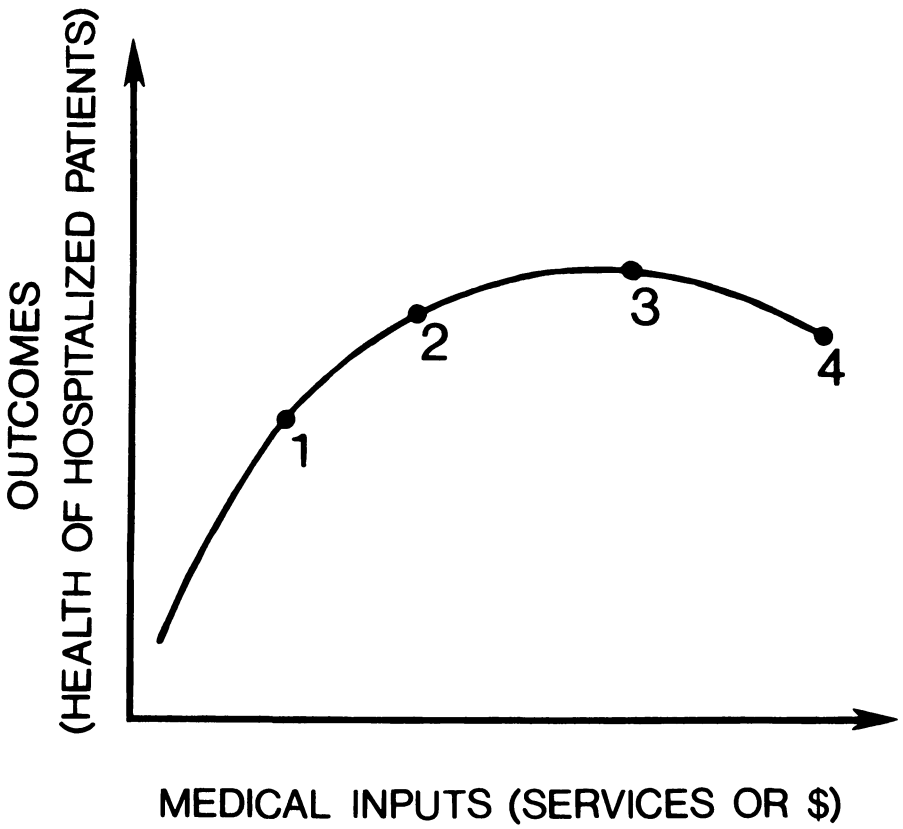


FIG. 1. Marginal benefit curve showing relation between medical services or expenditures (inputs) and patient health (outcomes). At point 1, provision of a specific service will produce a certain and dramatic improvement in health. At point 2, additional services do not add greatly to the patient's health. At point 3, no gain in health results from additional services. Finally, at point 4, additional care does more harm than good.

chest X-ray or an extra day in the hospital will add nothing to the patient's health. This is what John Bunker and Alain Enthoven call "flat-of-the-curve medicine" (Enthoven, 1978). For instance, previously recommended long hospital stays have been found to be unnecessary for uncomplicated myocardial infarction and postdelivery patients, adding nothing to patient recuperation (Hutter et al., 1973). Beyond this flat of the curve, additional care may be detrimental to patients (point 4). For example, needless surgery, excessive medications, or invasive procedures may cause iatrogenic disease and extended periods of hospitalization (Schimmel, 1964; Rogers, 1975; Seidl et al., 1966; Knapp et al., 1980; Schroeder et al., 1978). Unnecessary tests also can be detrimental: false positive results can misdirect physicians and patients into clinical wild goose chases through more unnecessary tests, diagnostic procedures, and in some instances even surgery (Barkin et al., 1977). Although the figure portrays a hypothetical curve, marginal benefit analysis can be applied to clinical situations, albeit not easily. Actual curves would vary according to service, patient, and disease. Similar marginal benefit curves, applied in the aggregate, can illustrate, for example, the relation between the frequency of a surgical procedure, such as a coronary artery by-pass, and health outcomes for a defined population.

Studies on diminishing returns of hospital services suggest that when increasing numbers of services are provided to patients, neither quality of care nor patient outcome necessarily shows a corresponding improvement (Table 1). For instance, hospitalized patients at the Strong Memorial Hospital in Rochester, New York, with one of two diagnoses, diabetic ketoacidosis or pulmonary edema, who received substantial increases over time in the use of laboratory test procedures or intensive care, showed no greater improvement in relation to length of stay or mortality than did a retrospective control group not receiving this additional treatment (Griner and Liptzin, 1971; Griner, 1972). A similar study of patients with myocardial infarctions yielded the same result (Martin et al., 1974). These studies may underestimate the effectiveness of added diagnostic or therapeutic services, however, because they rely on retrospective control groups, do not control vigorously for case severity, and use relatively insensitive indicators of outcome—length of stay and mortality. These methodologic flaws not only reflect the difficulty of conducting this type of study but also demonstrate the need for further research in this area. Despite

TABLE 1
Summary of Studies on Impact of Increased Physician Ordering

| Setting | Patient Diagnosis | Findings |
|---|---|---|
| Hospital | Diabetic ketoacidosis | Observed increased use of laboratory tests for patients in 1969 compared with those in 1966. Found no difference in length of hospitalization (Griner and Liptzin, 1971). |
| Hospital | Pulmonary edema | Noted increased arterial blood gas determinations, intubations, and total charges for patients hospitalized during 1 year after opening of an intensive care unit compared with those hospitalized 1 year prior. Found that those hospitalized after had longer hospital stays but showed no difference in mortality (Griner, 1972). |
| Hospital | Myocardial infarction | Observed increased use of laboratory tests, bacteriologic exams, X-rays, ECGs, oxygen therapy, and sedatives over a 30-year period. Found no difference in length of hospital stay or mortality (Martin et al., 1974). |
| Outpatient Clinic | Hypertension | Found no correlation between patients' total annual charges for laboratory tests and blood pressure control (Daniels and Schroeder, 1977). |
| Hospital | Medicine (various diagnoses) | Examined physician attention to laboratory test results and found that both normal and abnormal results were often ignored by physicians (Griner and Liptzin, 1971; Williamson et al., 1967; Dixon and Laszlo, 1974). |
| Hospital | Medicine (various diagnoses) | Applied ordering criteria for serum lactic dehydrogenase and calcium determinations and found 50–75 percent of patients receiving multiple determinations in a 7-day period had received unnecessary tests (Eisenberg et al., 1977). |
| Outpatient Clinic | Various diagnoses | Applied definitions of appropriate prescribing to commonly used drugs and found 13 percent of prescriptions calling for excessive amounts (Maronde, 1971). |

these shortcomings, the results of one study led to tougher criteria for admission to the intensive care unit at Strong Memorial Hospital in order to reduce excessive use of the unit (Griner, 1972).

Blood pressure control, a more proximal measure of treatment outcome, also has been used to test marginal effectiveness of care. When physician ordering of laboratory tests was matched to blood pressure control for a sample of similar ambulatory hypertensive patients, no relation was found between average annual laboratory costs per patient and patient outcome. Physicians who used more and costlier laboratory tests did not necessarily provide a better outcome for their hypertensive patients (Daniels and Schroeder, 1977).

One measure of excessive use of testing is the attention paid by physicians to results. Retrospective audits of medical records reveal that both normal and abnormal laboratory test results apparently are often ignored by physicians (Griner and Liptzin, 1971; Williamson et al., 1967; Dixon and Laszlo, 1974). This implies that the laboratory determinations were not needed in the first place. For example, in one study, reports of white blood cell differential counts were withheld to assess physicians' need for the test result (Griner and Liptzin, 1971). Two measures were used: 1) the number of phone calls to the laboratory requesting the test results; and 2) the frequency of tests reordered during the subsequent 48 hours. In none of the 37 test cases were phone calls placed to the laboratory requesting the test result. In 40 percent of the cases, the differentials were ordered daily before and after the withholding of results; of the remaining 23 cases, only 7 were reordered within 48 hours.

In another setting, a committee of physicians at a community hospital defined minimally acceptable physician responses to abnormal screening test results; e.g., did the physician mention the result in the chart or order follow-up tests? Applying these criteria to abnormal findings from urinalyses, fasting blood glucose tests, and hemoglobin studies, they found minimally acceptable physician responses for only 35 percent of the cases studied (Williamson et al., 1967). In another study, Dixon and Laszlo (1974) found that only 5 percent of chemistry panel tests yielded results that caused physicians to alter patient care. The latter two studies, however, were weakened by their definition of inattention to test results: ignoring test results was defined operationally as failing to acknowledge results in medical records or to follow up with additional testing. Although it may be considered

essential for good care, chart notation may not be a valid measure of physician attention to test results. Especially in the case of normal or unchanged abnormal findings, the physician may respond to the test result, yet not note it in the chart. The degree to which excess ordering is thereby overestimated is unclear.

Eisenberg et al. (1977) developed ordering criteria for serum lactic dehydrogenase and calcium determinations and applied them to patients receiving multiple orders for these tests over a one-week period. Fifty to 75 percent of the patients were found to have undergone unnecessary tests. Observations of frequent unnecessary orders also have been made for blood cross-match, barium enema, upper gastrointestinal series, and nursing service orders (Devitt and Ironside, 1975; MacEwan et al., 1978; Vautrain and Griner, 1978; Marton et al., 1980). In these cases, overordering was judged by assessing the extent to which the ordered service either provided needed clinical information or changed therapy.

Maronde et al. (1971) studied outpatient drug prescribing at the Los Angeles County-University of Southern California Medical Center. Definitions of appropriate use of each drug in the medical center formulary were developed by a group of physicians and pharmacists at the center. Applying these definitions to prescriptions for 78 commonly used pharmaceuticals, they found that 13 percent of the prescriptions called for excessive amounts of drugs. Excessive prescriptions occurred most frequently for sedatives and barbiturates, ranging up to nearly 40 percent for some individual drugs and raising the prospect of potential disease.

The evidence on the marginal value of physicians' orders is preliminary and fragmentary, but it provides many examples that hospital services are overused. If this is the case, physicians may be able to help their patients more by ordering less, and physicians in hospitals may be able to reduce hospital expenditures without endangering quality of care.

## Why Physicians Order Hospital Services

The principal goal of physicians is to ensure the health of their patients. There may be many alternative pathways to that goal, differing in both treatment and cost. Physicians vary considerably in the

amounts and types of services that they order for their patients. For example, in an outpatient setting, internists have been found to differ as much as 17- to 20-fold in mean annual charges per patient for laboratory and X-ray services when caring for similar patients (Daniels and Schroeder, 1977; Schroeder et al., 1973). Physicians also vary in their ordering of numerous other services, including surgery, diagnostic procedures, and pharmaceuticals, as well as additional days of hospital stay (Schroeder et al., 1973; Heasman and Carstairs, 1971; Childs and Hunter, 1972; Lyle et al., 1976; Roos et al., 1977). Most of these studies tried to control for patient diagnosis and severity among physicians by selecting similar patients for comparison. Two of them, however, failed to control for patient characteristics, making it unclear how much variability in ordering actually could be attributed to physicians (Childs and Hunter, 1972; Roos et al., 1977).

One major setting contributing to greater use of hospital services by physicians is the teaching hospital. In 1978, hospitals affiliated with medical schools accounted for 36 percent of all acute-care hospital beds and 47 percent of total national hospital expenditures (American Hospital Association, 1979). In teaching hospitals, physicians use more resources for the same types of patients than do physicians practicing in community hospitals—greater use of consultations, laboratory tests, X-rays, and scans (Schroeder and O'Leary, 1977; Feigenson et al., 1978). Greater use of diagnostic tests per patient in a university hospital accounted for 56 percent of the differences in charges for similar patients between this hospital and a neighboring community hospital, even though patients were admitted by the same internists at both institutions (Schroeder and O'Leary, 1977). Use of specific blood tests, radiologic procedures, and consultations was significantly greater for patients in the teaching hospital. Greater use of services at teaching hospitals has been attributed, at least in part, to house staff inexperience. Results of a case simulation study of physician ordering behavior supports this reasoning: describing how they would care for a set of hypothetical patients, residents "ordered" more tests and procedures than did experienced physicians, who relied more on history and physical examination (Hardwick et al., 1975). The dual medical-educational purpose of teaching hospitals also may be responsible for greater resource use: ordering of tests or procedures can have both clinical benefits for patients and educational ones for residents and medical students. It should be noted, however, that the

educational return on increasing levels of ordering probably also follows the pattern of diminishing returns.

A physician's clinical decisions may be influenced by any number of individual, organizational, and economic considerations, most of which promote the increased use of services (Eisenberg, 1979; Schroeder and Showstack, 1979). Below, we discuss three of the more important incentives for physicians to order more, rather than fewer, services. The potency of these three major reasons to order may also be influenced by many other characteristics of medical practice such as clinical specialty, organizational mode, perceived risk of malpractice litigation, and method of physician reimbursement.

## *Belief that Patient Care Will Be Improved*

Physicians request services for patients principally to improve the quality of patient care. Thus, more diagnostic, monitoring, and therapeutic services are ordered in the belief that a condition will be diagnosed, that possible complications will be averted, that the patient's fears (or physician's anxieties) will be assuaged, and, finally, that the disease will be cured. With the dramatic increase in the number and type of services available, few physicians can be fully informed of the indications for and the appropriate use of all hospital resources (Zieve, 1966; Williams et al., 1979). At one hospital, for example, some physicians ordering graded treadmill tests were unaware of the appropriate indications, interpretation, and follow-up for the tests. As a result, they often ordered the procedure inappropriately and excessively while believing it to be in their patients' best interest (Abbott et al., 1977).

Clinical diagnosis and treatment are complex, and by nature entail uncertainty. In highly ambiguous situations, physicians order more services than in more clear-cut situations (Pineault, 1977). Physicians in training are particularly vulnerable to the fear of missing information, in part because attending physicians and senior house staff are more likely to criticize junior house staff for ordering too few rather than too many tests and procedures (Dans, 1978). Uncertainty about how to use hospital services, added to the ambiguity of clinical situations and the fear of missing vital clinical information, may account for much of the overuse observed in hospitals (Casscells et al., 1978).

## *Patient Demand*

Patients influence physician ordering by requesting particular treatments or by reinforcing liberal ordering practices. Patients often associate advanced technological procedures and medications with good care. In a survey of patient attitudes toward testing in general and toward the upper gastrointestinal X-ray series in particular, Marton et al. (1978) found that nearly two-thirds of the patients believed that "the better a doctor is, the more tests he will order in evaluating a patient's problem." Moreover, these patients valued the upper gastrointestinal series highly even when it had little actual clinical value for diagnosis or treatment in their individual cases. With regard to prescriptions for medications, Maronde et al. (1972) attributed multiple and excessive prescriptions for psychoactive drugs to "prescription shoppers." Although the number of these patients was not large, they posed the potential problem of serious adverse drug interactions. Although it has been asserted that patient demand is partially responsible for increased drug prescribing, little empirical evidence exists to assess the magnitude of the effect on physician ordering (Hemminki, 1975).

## *Financial Incentives*

Many financial incentives encourage physicians to order increasing amounts of services. Physicians may receive direct financial compensation for ordering or administering tests and procedures, depending on the organization of their practice. The financial incentive occurs most strikingly in private practice settings in which physicians own major pieces of equipment, such as X-ray and electrocardiogram machines, and have a financial stake in promoting use of this equipment (Schroeder and Showstack, 1978). These same financial incentives exist when physicians have part ownership of hospitals with accompanying laboratories, when they are members of group practices that include radiologists or other similar specialists, or when they invest in private clinical laboratories (Relman, 1980). Physicians also have financial incentives to treat patients in the hospital rather than in the office and to perform surgery when surgical procedures can be substituted for office visits (Burney et al., 1979). Most of the examples of financial incentives for physician ordering arise from outpatient

settings. While hospital reimbursement patterns tend to create financial incentives as well (see below), their impact on physician ordering has not been documented.

These three major factors all encourage physicians to order more, not fewer, hospital services. Except for concurrent review of length of hospital stay and prospective review of admissions, there are no examples of incentives to order fewer. On the contrary, placing a standing order for tests is as easy as requesting a single test. Other factors also contribute to potential overuse of services. Physicians may be ignorant of the prices of services; in a number of hospitals, physicians have been quizzed on the charges for frequently ordered tests and procedures (Skipper et al., 1975, 1976; Kelly, 1978; Dresnick et al., 1979; Nagurney et al., 1979; Kirkland, 1979). In most instances the majority of estimates were clearly erroneous, usually on the side of underestimating the charges. Finally, since hospital care is paid largely by third-party payers, not by patients, there is no direct financial barrier to doing "the most" for the hospitalized patient.

## Hospitals Encourage Physician Ordering of Services

Although we have focused primarily on physicians and the "demand" for hospital services, the "supplier," or the hospital, also encourages ordering of services. Like physicians, hospitals have powerful financial and organizational incentives to promote use of their services. Hospitals that successfully foster physician ordering are rewarded with solvency, perceived higher quality of care, and growth (Schulz and Rose, 1973). Hospitals may not intervene directly in physician decisions, but they set a climate favorable to increased ordering.

Before the widespread availability of medical insurance, use of hospital services was restricted by patients' ability to pay and hospitals' ability to finance charity care. These limitations effectively placed a ceiling on hospital prices and utilization; violating the ceiling risked insolvency. With present broad insurance coverage for the majority of patients (over 90 percent of hospital costs are reimbursed by third-party payers), hospitals can now be assured of increased income and, in some cases, profit, for each added patient day or service ordered (Gibson, 1980; Schulz and Rose, 1973). Since hospitals are paid

largely on the basis of their costs, there is little incentive to reduce costs. Rather, at least in those states without reimbursement controls, the more hospitals expend, the more they are paid. Moreover, as the cost of providing care rises, cost-based third-party payment levels rise also. Thus, with income almost guaranteed for any clinical service ordered, it is to the hospital's financial advantage to promote hospitalization and the use of hospital services for patients.

Hospitals attract patients largely by encouraging physicians to use their facilities. Although the strength of the relation is unclear, physicians may be more likely to admit patients to hospitals that offer the most advanced services and technologies, such as computerized tomography. In fact, physicians may actively advise hospitals on equipment purchase decisions (Lewis, 1979). Both physicians and the general public perceive the availability of sophisticated equipment and services to mean better quality of care. Hospitals that grow by adding the latest technologies, special care units, and newest beds both increase their own prestige and business and enhance the reputations of their administrators.

Growth in number of beds and services also raises a hospital's fixed costs and reduces the proportion of costs controllable by management. To pay for new equipment, technical staffing, or beds, hospitals promote increased utilization. This may express itself indirectly: hospitals may make these services, which are generally well reimbursed, more attractive and convenient to use than others that are reimbursed poorly, if at all. Scheduling ease, availability of expert consultants, rapid turnaround for test results, and round-the-clock availability of tests or procedures can all be manipulated to encourage greater use of specific hospital services. Thus, the hospital's strong financial and organizational incentives provide a climate that encourages physicians to order more services for their patients.

## Can Physician Ordering Patterns Be Changed?

In response to alarm at the growing physician-determined use of hospital services, the sometimes questionable value of these services, and the abundance of powerful incentives to maintain the growth in use of services, various means to intervene in the ordering process and

to slow the rise in service ordering have been proposed and examined. Table 2 summarizes published reports concerning the four major strategies that have been assessed in hospital settings: education; audit with feedback; restrictions or rationing; and positive incentives. Most of the strategies have been tested only in teaching hospitals and on physicians in training, and in general the number of reports is small, although recently increasing.

## *Education*

Attempts to educate physicians to modify their patterns of service use generally have focused either on appropriateness of care or on cost of tests and procedures. These efforts are based on the assumption that physicians would choose to change their ordering behavior if they understood better the costs and benefits of each service. Several programs have demonstrated an initial reduction in ordering, but long-term effects on individual physicians generally have not been assessed.

Educational programs to teach physicians the indications for ordering services have yielded mixed results. Physicians learning the appropriate indications for prothrombin time and thyroid function tests temporarily demonstrated lower use of these tests than physicians who received no such education (Eisenberg, 1977; Rhyne and Gelbach, 1979). In one case, however, a six-month follow-up of the same physicians revealed that they had resumed their previous patterns (Rhyne and Gelbach, 1979). Promulgating criteria for ordering determinations of serum lactic dehydrogenase had no effect on the rate of overuse of this test (Eisenberg et al., 1977). The failure in this instance was attributed to lack of incentives for the house staff to change their ordering patterns, lack of support from attending physicians, and the limited focus of the effort. An effort to teach appropriate therapy for urinary tract infections resulted in significantly improved prescribing behavior and a 40 percent reduction in cost of care compared with a concurrent control group who received no education (Klein et al., 1980). Guidelines for ordering blood for surgery patients have been associated with major long-term declines in blood use, as much as 50 percent over an eight-year period (McCoy, 1962; Mintz et al., 1978). Medical students' knowledge of indications for ordering seems to grow when they review actual patient records; moreover, the review process appears to improve their attitudes about

TABLE 2
Summary of Research on Intervention Strategies

| Intervention | Settings | Findings |
|---|---|---|
| Education<br>• in cost of services<br>• in decision-making<br>• in ordering protocols<br>• in all of the above | Hospital, medical school, group practice clinic | Efforts focused on reducing or improving ordering of laboratory tests, X-rays, ECGs, blood and pharmaceuticals. When only one approach is employed, use may be reduced, but results are mixed. When a multidimensional approach is used, long-term effect is observed. Success may depend on senior faculty and departmental support and on continuous effort (e.g., Eisenberg et al., 1977; Rhyne and Gelbach, 1979; Klein et al., 1980; Griner, 1979). |
| Audit with Feedback | Hospital, outpatient clinic | Attempts made to reduce laboratory, pharmacy, and surgery service use and length of hospitalization were generally successful. "High-cost" and "high-use" physicians tend to reduce their ordering the most (e.g., Schroeder et al., 1973; Mitchell et al., 1975; Pozen and Gloger, 1976; Martin et al., 1980). |
| Restrictions or Rationing | Hospital | Efforts made to reduce ordering of laboratory tests only. Rationing reduces use and improves proportion of tests ordered appropriately (Dixon and Laszlo, 1974; Gray and Marion, 1973). |
| Positive Incentives | Hospital | One attempt to reduce laboratory test use. Positive incentive, in form of material reward, found to be relatively ineffective (Martin et al., 1980). |

cost control although it is not clear that it changes their behavior (Garg et al., 1979; Zeleznik and Gonnella, 1979).

Educating physicians about the cost of medical services appears to be an effective cost-containment strategy, at least in the short run. Whether in real life or in simulated situations, teaching the cost of services reduces the ordering of laboratory tests, X-rays, electrocardiograms, electroencephalograms, and hospital charges per patient (Freeman, 1976; El Khatib et al., 1977; Henderson et al., 1979). Results of all of these studies were based on comparisons with control groups. In only one reported instance, a simulation study, were any physicians found to ignore costs (Lawrence, 1979).

The most impressive results of an educational program were reported from the Strong Memorial Hospital, where an extensive educational effort appeared to curtail the use of chemistry tests and chest X-rays and reduce the rate of growth in use of hematology determinations and microbiology cultures (Griner, 1979). Over a seven-year period, laboratory, EKG, and chest X-ray use was monitored and then compared for the years 1970 and 1977. Increases in use and costs at the Strong were lower than the national average; and, for the period 1975 to 1977, use at the Strong was lower than that at a nearby affiliated teaching hospital. The lack of a concurrent comparison group for the entire period, however, makes it difficult to attribute the cause of the lower use. Other changes at the hospital acknowledged by the author, such as change in patient or physician mix, increased use of chemistry panels over individual tests, decreased reliance on particular nonautomated tests, and the elimination of the chest X-ray from the admission screening battery, in addition to the educational program, could have affected use. Nevertheless, this educational effort was unique for its broad coverage of a variety of topics, including test specificity and sensitivity, probability theory, laboratory charges, and reimbursement mechanisms. The multifaceted and ongoing nature of this approach and the personal involvement of a respected senior clinician may have contributed to the long-term reductions in use of hospital services reported.

### *Audit with Feedback*

In this intervention, physicians' use of services is reviewed by senior physicians, their performance compared with that of others, and the

results of the comparison shared with each physician. This "audit and feedback" approach is successful in reducing the ordering of laboratory tests, especially among "high-cost" or "high-use" physicians (Schroeder et al., 1973; Lyle et al., 1979). After one such audit at the George Washington University Medical Clinic, overall mean annual laboratory charges declined by 29 percent. Moreover, the previous "high-cost" physicians lowered their laboratory charges by 42 percent. A study at the Peter Bent Brigham Hospital indicates that house staff who underwent audits of their laboratory use by senior physicians ordered significantly fewer tests than either house staff in a control group or those in a group offered material rewards to lower their laboratory use (Martin et al., 1980). Similar audits of surgery cases also were effective in reducing length of stay for patients undergoing cholecystectomy. After results of an audit were presented to surgeons at one hospital, average length of stay dropped by one day; again, it was the "longer-stay" physicians who most reduced hospitalization time (Mitchell et al., 1975). Pozen and Gloger (1976) reported to physicians monthly on their ordering of laboratory tests and of three major cardiovascular medications for outpatients. The feedback on prescribing included the calculation of an index to evaluate appropriateness of the quantities prescribed. The reporting had no effect on laboratory ordering when compared with a control group, but it substantially improved the ordering of medications in appropriate quantities.

Audit and feedback also can be effective on a broader scale. One audit that examined regional differences in the performance of tonsillectomies reported a 13-fold difference in the per capita rate of tonsillectomies across thirteen regions in Vermont. After feedback of these results to the regions, tonsillectomy rates declined by 46 percent over a five-year period; again, the region with the highest previous rate reduced its rate the most (Wennberg et al., 1977).

## *Restrictions or Rationing*

Another means to reduce use of hospital services is to place limits on the number of tests or services that can be ordered or to encumber the process of ordering. Under a rationing program, medical house staff were limited to ordering a maximum of 8 chemistry and hema-

tology tests per patient day, except in cases of emergency. They reduced their use of chemistry tests significantly from a mean of 6 to a mean of 2 per day primarily by eliminating unnecessary follow-up tests (Dixon and Laszlo, 1947). House staff who were required to consult a laboratory hematology resident before ordering thrombin, prothrombin, and partial thromboplastin tests also reduced their ordering of these tests markedly (Gray and Marion, 1973). A third reported attempt to ration services at a teaching hospital was abandoned as being too difficult to maintain (E. Amador, personal communication, 1978).

### *Positive Incentives*

Comparisons of fee-for-service systems and health maintenance organizations certainly suggest that positive financial incentives can affect hospital utilization patterns in the aggregate (Luft, 1978). Little information exists, however, on the effectiveness of positive incentives in altering individual physicians' ordering behavior for hospitalized patients. The project at the Peter Bent Brigham Hospital created positive incentives, in the form of journal subscriptions and textbooks, for reducing use of specified laboratory tests. Results indicate that these incentives were not effective (Martin et al., 1980). Considering the strong effect that positive incentives exert on physicians in organized systems of medical care, it seems reasonable to assume that they could be powerful determinants of individual physician behavior in other settings as well. Results of research on the type, strength, and effect of such incentives will be eagerly received.

These four strategies for modifying physician patterns of ordering hospital services are all designed to inform or guide the physician into more clinically appropriate ordering patterns. Yet they represent strikingly different approaches to the problem and run the gamut from almost certain effectiveness (audit with feedback) to questionable feasibility (restrictions or rationing). For positive incentives especially, but also for restrictions and rationing, few published reports exist to aid in their evaluation. At some of the institutions where strategies have proved effective, a key determinant of success seems to be the participation of respected senior clinicians; the importance of this particular factor, however, has not been assessed.

## Implications for Hospital Cost Containment

Clinical decision-making and policy decision-making share an important quality: a "treatment" often must be prescribed for a problem even when its effectiveness is uncertain. In both medicine and policy, "sure cures" are neither always available nor without their own potentially deleterious side effects. In selecting therapies, however, a clinician or policy maker can do much to maximize possible benefits and to minimize costs of the treatment plan.

Leaving aside the clinical example, hospital administrators, medical educators, and state and federal policy makers increasingly are encouraging their institutions to approach the problem of hospital cost increases by developing cost-containment programs that focus on physician ordering behavior. Their motivation for doing so may stem from fear of impending federal regulation of hospital expenditures, support for the Voluntary Effort, or personal belief in the importance of cost and appropriate ordering. It should be emphasized that hospital support for any cost-containment strategy cannot be expected unless adequate incentives exist for that support. As we have shown, a number of optional strategies are available to alter physician ordering of services. The primary criterion by which to assess these options is their relative effectiveness in improving physician ordering patterns, even though, as explained above, evaluative data are incomplete. Other factors, however, affect both the costs and benefits of each strategy; hence they also must be considered. We will discuss briefly each of the four strategies according to several other factors—ease and cost of implementation, permanence of effect, and the urgency of the need for change.

Current evidence suggests that the strategy most likely to reduce ordering appears to be audit with feedback. In each of the reported trials, this strategy has reduced physician ordering levels most reliably, and it has done so for a variety of hospital services and in a number of settings. Unfortunately, although audits seem to be effective, they are expensive because of the time and effort required of physicians to review patient charts and to communicate the results. Audits with feedback also may be difficult to implement; physicians may feel that their autonomy and personal responsibility for patient care are being threatened. The precedent of utilization review committees, however, may facilitate implementation of the audit mechanism.

Education follows audit as the next most effective strategy. As noted above, physicians tend to order fewer or less expensive services when made aware of their costs. It is not known, however, how long this effect lasts. Providing physicians with patients' bills or price lists is inexpensive and relatively easy to do. If a hospital's or medical school's purpose is to imbue physicians with the knowledge and the ability to make cost-effective clinical decisions, then education in decision-making and in the specificity, sensitivity, and indications for tests may be in order. This education may or may not have an effect and, if it does occur, may dissipate over time. Success of educational efforts depends on access to capable faculty, or, at the very least, to specific educational materials. Such efforts also require substantial preparatory work in developing curricula, in gathering resource materials, and in gaining consensus for ordering criteria.

The next most reliable strategy for changing physician behavior seems to be restricting ordering or rationing services, although very few evaluations of restrictions have been reported and none have used concurrent control groups to assess impact. Where restrictions have been tested, they appear to have had an effect on ordering of services. If effective, their impact would probably be immediate and enduring as long as the restrictive policies were enforced. None of the evaluations has examined possible compensatory behaviors, however, such as ordering chest physical therapy or chest X-rays when respiratory therapy treatments are restricted. Such substitutions seem more likely with restrictions, especially arbitrary restrictions, and point up the possibly limited utility of restrictions as a cost-containment strategy. Moreover, restrictions are often odious, difficult to implement, ethically questionable, and costly to maintain. They require the capability to monitor ordering, to flag disallowed orders, and to communicate directly back to the ordering physician so that patient care will not suffer.

Not enough is known yet about the effect of positive incentives on use of hospital services. Although the cost-reducing behavior of health maintenance organizations may be motivated by positive financial incentives, their savings are attributable largely to lower hospitalization rates (Luft, 1978). It is unclear how such incentives affect physician use of services for hospitalized patients. In the only good study of positive incentives in a fee-for-service setting, the offer of rewards to physicians was ineffectual in reducing their ordering (Martin et al., 1980). More studies are needed to measure the possible

benefits of more attractive positive incentives in a range of fee-for-service hospital settings. Even if this strategy is shown to be effective, however, financial, ethical, and political considerations may hamper its implementation.

## Conclusion

Our tremendously expanded capacity to diagnose, monitor, and treat illnesses has been accompanied by a growing tendency to overuse hospital services, many of which are costly. As detailed in a number of reports, only a portion of the many tests ordered for hospitalized patients is actually used for patient management. Overuse of services contributes neither to quality of care nor to patient outcome, may well be detrimental to care in some cases, and certainly raises the cost of hospital care. These findings strongly suggest that the ordering of hospital services and the cost of hospital care may be reduced selectively without adversely affecting patient care.

Numerous incentives confronting physicians and hospitals encourage increased ordering of hospital services even when, as in the practice of "defensive medicine," patient care will not be improved. There are no strong forces in fee-for-service medicine to balance these incentives and to moderate physician ordering. Nevertheless, several strategies for modifying physician ordering patterns have been tested and found to be relatively effective, at least in the short run. Some of them, however, are costly or difficult to implement.

Audit with feedback and education appear to be the most effective strategies to reduce physician ordering. Yet each requires considerable effort to implement. Data on the effectiveness of restrictions and, especially, of positive incentives are fragmentary and preliminary, making it difficult to predict how well they might change physician ordering. They are certainly the most controversial of the four strategies. Although more research on any of these strategies would clarify their impact and feasibility, efforts to understand the benefits of restrictions and positive incentives are needed the most.

If some of the strategies discussed successfully reduce physician ordering of hospital services, their application will significantly improve the chances of controlling hospital cost inflation, at least in the short run. On the other hand, if cost-effective means to reduce un-

necessary use of hospital services are not found and then implemented, prospects for controlling hospital costs are poor. While hospital occupancy rates and length of stay may continue their present decline, ordering of ancillary and other hospital services will continue to increase, further raising the bill for a patient day as more services are administered during fewer patient days.

A successful cost-containment effort may also have a negative effect by putting some hospitals in a difficult position: their expected income will drop, and they may not be able to respond adequately by cutting costs because a large proportion of their costs will be fixed, the result of previous growth in beds and equipment. If reimbursement levels are not raised sufficiently to offset reduced volume, hospitals will feel the pinch, facing higher costs and lower revenues per patient day. For some financially weak hospitals, cost containment may spell hospital closure, a scenario that may be desired by advocates of "competition" as a solution to rising costs of medical care.

On the positive side, this situation may bring community hospitals and physicians together to decide the cost-effective allocation and use of hospital resources. Moreover, if hospital reimbursement mechanisms that limit the hospital's ability to increase reimbursement continue to spread (Biles et al., 1980), hospital administrators will have great need of strategies by which to change the pattern of physician use of services for hospitalized patients.

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*Acknowledgments:* This work was supported by grants from the California Medical Education and Research Foundation, the California Hospital Association, the Henry J. Kaiser Family Foundation, and the John A. Hartford Foundation.

We wish to thank Jonathan A. Showstack, Anne A. Scitovsky, Philip R. Lee, John Eisenberg, Albert R. Martin, Paul F. Griner, Keith I. Marton, Harold S. Luft, J.P. Myers, Elizabeth Afshari, and our colleagues at the Institute for Health Policy Studies for their assistance in the critical review and preparation of this paper.

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