REGULATING THE DIFFUSION OF HOSPITAL TECHNOLOGIES*

LOUISE B. RUSSELL †

I
INTRODUCTION

In order to evaluate the effect of regulation on technological innovation and diffusion in an industry, we need two benchmarks—a notion of how the industry ought to behave and a notion of how it would behave in the absence of regulation—so that we can judge the extent to which regulation brings it closer to the ideal or pushes it farther away.

In much of the regulation literature the standard of ideal behavior is the competitive market. Regulation is considered appropriate when the unregulated industry departs from the competitive ideal in important ways, which are labelled "market failures." More precisely, the competitive standard requires that decisions be made so that benefits (measured by price) are equal to costs at the margin. Regulation is then judged by whether it brings the industry closer to the standard than it could get by itself. In Brookings' review of the Ash Council's proposals for improving regulation, for example, Noll states: "the performance of regulatory agencies is judged herein by the extent to which their actions correct for the market failures that were the motivation for establishing regulation."[1]

I bring up this basic point because the usual standards, both for how the industry ought to behave and how it would behave in the absence of regulation, do not apply to the medical care sector, particularly the hospital industry, which is the subject of this article. The reason for the lack of application is that before regulation was introduced the industry was subjected to extensive intervention reflecting a deliberate, although imperfectly understood, choice to reject the market standard in medical care. Since the objectives for medical care have been established as different from those of the usual market, it is unreasonable to criticize regulation for its inability to correct the resulting market failure. In fact, the usual sorts of regulation, which have been

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† Senior Fellow, Economic Studies. The Brookings Institution.

1. R. NOLL, REFORMING REGULATION: AN EVALUATION OF THE ASH COUNCIL PROPOSALS 15 (1971).

brought in recently, are not intended to correct the most important of these failings, at least not yet.

The crucial intervention has been the development of third party financing, first through private insurers, and then through the government in the form of Medicare and Medicaid. National health insurance would extend it further, but even now over 90 percent of all hospital costs are paid by third party payers.[2] High levels of third party payment effectively remove the budget constraint from the industry's customers, and indirectly, from the industry itself. In the absence of regulation, decisions are made to purchase care, not whenever the benefit is greater than the cost, but whenever the benefit is greater than zero, i.e., whenever it is "needed." After all, the costs facing the decision makers—patient and doctor—are zero. This is not true in every case, of course, but it is a close enough approximation to give an accurate picture of how the industry works.

Technically speaking, this is market failure on a grand scale, but this market failure has been consciously and deliberately induced. Further, it is still very popular and few people will suggest openly that it should be changed. The rhetoric of need—all medical care that is needed should be provided —still dominates the discussion of medical care issues. Hardly anyone will argue that the usual standard, marginal benefits equal to marginal costs, should be the rule for hospital care.

What then is regulation supposed to accomplish in the hospital industry? The primary purpose of regulation is to minimize the cost of care, while holding to the principle that all care that is needed should be provided. The belief that regulation can be helpful is based on two assumptions. The first is that the industry by itself is not doing a reasonable job of minimizing costs. Without a budget constraint, hospitals have no incentive to minimize costs, but unless they have objectives that do not parallel the "needed care" objective, neither do they have any particular incentive to do otherwise. If other objectives exist and are important, then considerable extra cost may be incurred. The second assumption is that the regulatory process can improve matters—that it can root out inefficiencies and unnecessary costs—and that the cost of the regulatory process will be less than the savings it brings. Thus, current regulation of hospitals in general and of technologies in particular is based on notions of technical, rather than economic, efficiency.

In Section II of this paper, I will discuss further the effects on technological diffusion of the preregulation intervention in the hospital industry. Preregulation intervention includes major government programs in medical research and education as well as third party financing. Section II will outline

2. Gibson and Fisher, *National Health Expenditures, Fiscal Year 1977*, SOC. SECURITY BULL., July 1978, at 3.

a more detailed picture of the conditions regulation must deal with and the crosscurrents in federal policy.

In Section III, I will describe the major forms of hospital regulation and, where possible, their effects on technological diffusion. The United States' objectives and approaches to regulating technological diffusion in hospitals are similar to those of several European countries I have studied, yet different from one. I will review this experience briefly.

Section IV of the article will compare some of the attitudes of hospital regulators with those of other industries. Finally, I will summarize my conclusions.

II

THE INDUSTRY BEFORE REGULATION

Third party financing is an important source of revenue for all parts of the medical care sector, but it is most important for hospitals. In 1977, it supplied 94 percent of hospital revenues, 61 percent of physicians' revenues, 59 percent of nursing home revenues, and smaller proportions of amounts spent on other care.[3] It has two effects on the adoption of technologies. Because third party payment reduces the cost of an action to industry decision makers, technologies are adopted more quickly, more frequently, and more extensively than they would be in its absence. Because third party payment is highest for hospitals, it creates a "bias" in favor of hospital–based technologies.

We would thus expect to find evidence that technological diffusion proceeds more quickly and reaches a higher level where third party payment is higher. This is a difficult phenomenon to demonstrate statistically because the data on third party payment—especially historical data—are not detailed enough to reflect the differences faced by individual hospitals when they made their decisions about particular technologies.

In my statistical analyses of the adoption of technologies by metropolitan hospitals, fragments of evidence turned up:[4] cobalt and electroencephalography have been adopted more readily where the level of insurance in the early 1960s was higher, and where it grew more rapidly over the years that followed. The percent of a hospital's beds allocated to intensive care, and again the adoption of cobalt, are higher in areas where Medicare pays a higher proportion of hospital costs. Open–heart surgery has been adopted more widely where insurance growth has been greater. Because the data for third party payment are so poor, these results cannot be considered precise, only indicative.

Analysis of national trends showed that the diffusion of several

3. *Id.* at 7.
4. L. RUSSELL, TECHNOLOGY IN HOSPITALS 64, 97, 128–29 (1979).

technologies increased in smaller hospitals—always the last to adopt a new technology—after the introduction of Medicare and Medicaid in the mid-1960s.[5] Further, Feldstein has demonstrated the general effect of insurance on the equilibrium price set by hospitals, although his work does not link this effect to technological diffusion statistically.[6]

There is, however, another test. With the level of third party payment so high, one would expect to find hospitals investing in technologies to the point that marginal patient benefits are zero. This phenomenon is strikingly demonstrated when the evidence about the costs and benefits of specific technologies is examined. Over and over again, the pattern appears: large investments have been made and are being made in technologies whose benefits are small, approaching, and occasionally passing, zero.[7]

Kidney dialysis is an interesting example because it is possible to follow the process as it happened. In 1967, when equipment, staff, and money were limited, a national committee recommended that dialysis be limited to people 15 to 45 years of age who had no serious disease other than chronic kidney failure. Using these criteria, there would have been about 35 new dialysis patients per million population each year.[8] By 1977 Medicare had assumed most dialysis costs and the committee's restrictions had been dropped—people of all ages and in all states of health (including the terminally ill) were accepted for dialysis. The current estimate is that new dialysis patients will soon level off at close to 60 per million per year.[9] Liberal financing has extended the technology to people for whom the benefits are less than those for whom the committee recommended priority. Similarly, dialysis at home has lost ground rapidly to dialysis in outpatient centers. The benefits of center dialysis accrue to the patient's family, which is freed of the time-consuming chore of helping with dialysis, but at considerable expense to the taxpayers. Dialysis for the terminally ill and outpatient dialysis deliver small benefits at high costs. The system provides them because the benefits are greater than zero.

Intensive care is an important example because of its great expense. I have reported elsewhere that it accounts for at least 15 percent of total hospital costs.[10] New data show that past American Hospital Association (AHA) surveys give an incomplete count of intensive care beds and that the estimate should be revised upward to 17 or 18 percent, still a lower bound.[11] By 1972

5. Russell, *The Diffusion of Hospital Technologies: Some Econometric Evidence*, 12 J. HUMAN RESOURCES 482 (1977).

6. Feldstein, *Hospital Cost Inflation: A Study of Nonprofit Price Dynamics*, 61 AM. ECON. REV. 853, 870 (1971).

7. RUSSELL, *supra* note 4, at 65–70, 78–79, 106, 108–10, 114–15.

8. *Id.* at 112.

9. *Id.* at 113.

10. *Id.* at 157.

11. Until the 1977 survey, the American Hospital Association asked only about beds in mixed intensive care units and coronary care units. The 1977 survey included neonatal units for the

most hospitals had at least one intensive care unit and the number of beds allocated to intensive care continues to grow rapidly.[12] Beds in mixed intensive and coronary care units grew 39 percent between 1972 and 1977, while total beds grew only 10 percent.[13] Yet studies of the effect of intensive care on patient outcomes produce evidence of only modest benefits, such as fewer complications. Many studies find no reduction in mortality rates with intensive care, although this has been supposed to be its major benefit for conditions such as heart attack and stroke.

These two are not the only examples. Whenever enough information was available to permit a general judgment of this sort, the pattern appeared, but the details varied in keeping with the individual nature of each technology. Specifically the pattern appeared for respiratory therapy, diagnostic radioisotopes, cobalt radiotherapy, and open–heart surgery.[14]

The statistical analysis was able to show more about the effects of a hospital's teaching and research responsibilities than about the effects of third party payment. These functions are as legitimate as patient care and the federal government has increased hospitals' workloads in both areas. Since hospitals use new technologies for teaching and research as well as for patient care, government policies added indirectly to the drive to acquire technologies at the same time that they further loosened financial constraints on acquisition.

Since World War II[15] the federal government has increased enormously the funds available for biomedical research. In 1950 national expenditures were $161 million (the federal government supplied $73 million of that amount). By 1975 the national total was $4.6 billion (the government's share was $2.8 billion). The largest chunk of this money, almost $2 billion in 1975, goes to the National Institutes of Health (NIH), which distributes most of it to universities, medical schools, and hospitals.

The adoption of two technologies—intensive care and diagnostic radioisotopes—was affected significantly by the amount of NIH grant funds awarded to hospitals.[16] Hospitals in metropolitan areas that received the largest amounts of grant dollars committed close to one more bed per hundred to intensive care (the average in metropolitan hospitals was 5 per 100)[17] and adopted diagnostic radioisotopes over a year sooner than hospitals in

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first time. Beds in postoperative recovery rooms are not counted, and those in other specialized types of intensive care units are apparently still not measured by the survey.

12. RUSSELL, *supra* note 4, at 41–43, 50.

13. Data for short term general and other special hospitals from AMERICAN HOSPITAL ASSOCIATION, HOSPITAL STATISTICS, 1977, at 12, 129 (1978); AMERICAN HOSPITAL ASSOCIATION, HOSPITAL STATISTICS, 1972, at 34, 205 (1973).

14. RUSSELL, *supra* note 4, at 82–84, 102–06, 108–10.

15. U.S. DEP'T OF HEALTH, EDUC. AND WELFARE, BASIC DATA RELATING TO THE NATIONAL INSTITUTES OF HEALTH 2 (1978); U.S. DEP'T OF HEALTH, EDUC. AND WELFARE, BASIC DATA RELATING TO THE NATIONAL INSTITUTES OF HEALTH, 4 (1970).

16. RUSSELL, *supra* note 4, at 60, 92.

17. The analysis considered only beds in mixed intensive and coronary care units.

areas that received no funds. Both technologies are widely used, but remain scientifically prestigious. Thus the statistical results agree with the nature of the technologies.

Since the mid–1960s the federal government has devoted increasing funds to raise the output of medical schools and other schools for professional health support. With the growing number of medical schools (there were 88 schools in 1965, 114 in 1975) and legislation tying school subsidies to annual increases in class size, the number of medical students grew 71 percent between 1965 and 1975, from 32,835 to 56,244.[18] As these students graduated, the number of residents in training increased from 41,357 in 1965 to 62,326 in 1974, the latest year for which data are available.[19]

Both affiliation with a medical school, which includes an orientation toward research as well as a commitment to train undergraduates, and residency programs, have been significant factors in the adoption of technologies. Virtually all the technologies I examined were influenced strongly by both factors. A particularly striking example is that medical school affiliation and a large number of residents raised the probability that a hospital would adopt open–heart surgery by 0.6, on a scale of zero to one.[20]

Table I shows the distributions in 1965 and 1975 of a subgroup of the hospitals I used in my study by affiliation with a medical school, residency program size, and number of beds. The hospitals are those in metropolitan areas that answered the AHA questionnaire in at least ten of the fourteen years between 1961 and 1975. In addition, they answered the questions about affiliation and residents in the 1965 and 1975 surveys. Thus, among others, this group excludes recently built hospitals, since a sufficient history could not be constructed for them. The intervals for each factor are those I used in my analysis.

Table I confirms that hospitals have become larger in this period, that more are affiliated with medical schools, and that more have medium–sized or large residency programs. It also shows the results of policies by the Liaison Committee on Graduate Medical Education to improve the quality of residency programs and reduce the number of marginal programs. Proportionately fewer hospitals reported one to nine residents per 100 beds in 1975 than in 1965, and more reported no program. This was an unlooked-for help in countering the effect of federal programs aimed at medical education since, as my analyses show, even small residency programs create additional pressures for technology.

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18. Data for 1965 are from Staff of the Council of Medical Education, *Medical Education in the U.S.* 198 J.A.M.A. 847, 851, 864 (1966); 1975 data from Staff of the AMA Group on *Medical Education in the U.S. 1977–78*, 240 J.A.M.A. 2809, 2822 (1978).

19. AMERICAN MEDICAL ASSOCIATION LIASON COMMITTEE ON GRADUATE MEDICAL EDUCATION, DIRECTORY OF ACCREDITED RESIDENCIES, 1975–76, at 22 (1976).

20. RUSSELL, *supra* note 4, at 52.

TABLE I
DISTRIBUTIONS OF METROPOLITAN HOSPITALS BY NUMBER OF BEDS, MEDICAL SCHOOL AFFILIATION, AND RESIDENTS PER 100 BEDS, 1965 AND 1975

	Percent of hospitals		*Change between*
	1965	1975	1965 *and* 1975
Number of beds			
under 100	36.3	28.0	−8.3
100–199	23.6	23.2	−0.4
200–299	16.8	17.6	+0.8
300 or more	23.3	31.2	+7.9
Medical school affiliation			
no	87.4	75.1	−12.3
yes	12.6	24.9	+12.3
Residents per 100 beds			
none	63.5	69.1	+5.6
1–9	26.3	16.8	−9.5
10–19	6.9	8.0	+1.1
20 or more	3.3	6.2	+2.9

Note: The 1975 numbers are based on data for 2,780 hospitals. The 1965 numbers are based on data for 2,975 hospitals in the case of beds, 2,954 hospitals in the case of medical school affiliation, and 2,927 hospitals in the case of residency programs.

SOURCE: American Hospital Association 1965 and 1975 surveys.

Table II shows the estimated effects of these changes on the adoption of three technologies. The effects are largest for open–heart surgery, with medical school affiliation and larger residency programs accounting for a +3.63 increase in the percentage of hospitals with units. These two factors increased the percentage of hospitals with cobalt by +1.87. The percentage of beds in intensive care was raised by a very modest 0.13 of a point.[21] As my results for the speed of diffusion show, these factors also create pressures for the more rapid diffusion of technologies. The estimates in Table II are crude, but they are useful as indicators of some indirect and heretofore unmeasured effects of federal policies.

The federal government's policies toward medical education are in the process of convulsive change. The health manpower legislation passed in 1976 dropped the requirement that class sizes be increased in order to get subsi-

21. The overall percentages of hospitals in the group with these three technologies should have been computed for 1975, to provide a basis for judging the importance of the estimated effects; unfortunately, they were not. The percentages for 2,772 metropolitan hospitals selected solely on the basis of data from the 1975 survey are available and should be a reasonably accurate set of reference points. This second group of hospitals differs from the group used for Tables I and II in a number of ways, the major one being that it includes hospitals built too recently to be included in the first group. In 1975, 18 percent of these 2,772 hospitals reported open-heart surgery, 24 percent reported cobalt radiotherapy, and they allocated an average of 5 beds per 100 to mixed intensive and coronary care units.

TABLE II
ESTIMATED EFFECTS ON THE ADOPTION OF SELECTED TECHNOLOGIES OF THE CHANGES IN THE DISTRIBUTIONS OF METROPOLITAN HOSPITALS BY NUMBER OF BEDS, MEDICAL SCHOOL AFFILIATION, AND RESIDENTS PER 100 BEDS BETWEEN 1965 AND 1975

	Estimated Effect		
Factor producing change	Percent of beds in intensive care	Percent of hospitals with open-heart surgery	Percent of hospitals with cobalt radiotherapy
number of beds	+.0538	+2.25	+3.86
medical school affiliation	+.0871	+2.75	+1.41
residents per 100 beds	+.0473	+0.88	+0.46

SOURCE: Derived from Table I and the regression equations (including third party payment) reported in RUSSELL, TECHNOLOGY IN HOSPITALS (1979) (tables 3-6, 5-2, and 5-3).

dies.[22] The Administration is trying to eliminate the subsidies altogether. It is meeting with some success in Congress on this score, and has announced its preference for a *reduction* in medical school classes. But there is a good deal of inertia in the system and neither the direct nor the indirect effects of these policies will be reversed immediately. The largest medical school classes have yet to graduate, yet to enter their residency training, and yet to exert their full influence on technological diffusion.

III
REGULATING THE DIFFUSION OF TECHNOLOGIES

On the premise that the phenomenon of rising hospital costs is due primarily to technical inefficiency, the government has subjected the industry to an array of regulatory mechanisms during the last fifteen years. These attempts at regulation are not, however, as coherent as my statement suggests. Because the attempts are based on a misunderstanding of the causes of rising costs, a schizophrenic strain runs through them. In virtually every case, they have been charged simultaneously with improving the quality of care as well as reducing its cost.

But the goal of efficiency and cost reduction has received the most emphasis in recent years. Taking this as the primary goal, we should judge these efforts at regulation on their own grounds. The first question is not whether they have moved the industry toward the competitive ideal, but whether they have succeeded in reducing the cost of providing hospital care—the level of care being set by forces outside the regulatory process—below what it would

22. Health Professions Educational Assistance Act of 1976, 42 U.S.C. § 295f-1 (1977).

be in their absence. There is fragmentary evidence on this point. It is impossible to tell from the evidence whether costs actually have been reduced for a given level of services or whether some degree of nonprice rationing has been introduced, intentionally or unintentionally. The second question is whether the savings are greater or smaller than the cost of the regulatory process itself. There is even less evidence on this point.

The emphasis on reducing costs is recent and it is interesting to see how quickly the conventional wisdom about technological diffusion in hospitals has changed. It used to be believed that hospitals were undesirably slow to adopt new technologies, that because so many of them are nonprofit they did not have the incentive to adopt technologies as quickly as they should from the point of view of patient benefits. In fact, however, if one applies the crude test of comparing the speed of diffusion of hospital technologies with the speed of technological diffusion in other, profit-motivated, industries there is no evidence that hospitals have ever been slower.[23]

The belief that the government needed to encourage the adoption of new technologies led to the creation of the Regional Medical Program (RMP) by the Heart Disease, Cancer, and Stroke Amendments of 1965.[24] The RMP divided the country into approximately sixty areas and financed programs within each to promote the use of new techniques for the care of heart disease, cancer, and stroke patients.[25] In 1970, kidney disease was added to the list.[26] As a secondary purpose, these programs were supposed to encourage regional cooperation, in order to make the new techniques as widely available as possible, and to reduce costs by eliminating duplication of services.

It was not long before the climate changed and the belief that hospitals adopted technologies too slowly gave way to the belief that they adopted them too quickly, and that too many hospitals adopted them. Nevertheless, there was enough time for the early efforts of the RMP to have an effect before it got caught in the cross fire. When the RMP program began, intensive care was relatively new, although well accepted, and was applied to treatment of two diseases under the program's jurisdiction: heart disease and stroke. Many area programs actively promoted this technology, primarily through training programs.[27] Their efforts were effective. By 1975, hospitals in those metropolitan

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23. RUSSELL, *supra* note, at 493–95.

24. For a history of the Regional Medical Program, see SENATE COMM. ON LABOR AND PUBLIC WELFARE, NATIONAL HEALTH PLANNING AND DEVELOPMENT AND HEALTH FACILITIES ASSISTANCE ACT OF 1974, S. REP. NO. 1285, 93D Cong., 1st Sess. 13–18, *reprinted in* [1974] U.S. CODE CONG. & AD. NEWS 7842, 7854–58.

25. *Id.* at 7855. The areas were not mutually exclusive or exhaustive. In some cases a county was not included in any of the regional programs. In others it was included in more than one.

26. Heart Disease, Cancer, Stroke, and Kidney Disease Amendments of 1970, 42 U.S.C. § 299 (1977).

27. N. Kay, The Regional Medical Programs: Contributions to Technological Diffusion (1977) (unpublished paper).

areas—approximately half of the total—where the programs had the most money to spend, committed 0.4 more beds per 100 to intensive care than other hospitals.[28] This represents an almost 10 percent increase over the average for areas with lower-funded programs. It is impossible to determine whether the percent was higher in low-funded regions than it would have been without the RMP, hence whether the effect of the programs was even greater than the regressions show, because there were no regions without funds to serve as a control group.

The RMP was launched simultaneously with a second regulatory mechanism that was more attuned to cost concerns. The certificate of need (CON) mechanism originated with the states. New York was the first; its law went into effect in 1965. Connecticut and Rhode Island passed laws later in the 1960s and a large number of states followed suit in the early 1970s.[29] Under these laws, hospitals wishing to make a new capital investment, or to introduce or drop a service, must apply for state approval. If the state review board agrees that the investment or change is desirable—that it is needed—it grants a certificate of need and the hospital may proceed with its plans. State laws vary in their requirements. Some exempt certain kinds of medical facilities (particularly private doctors' offices) or projects that cost less than a certain amount.

Certificate of need laws have intertwined at every stage of their development with programs for area planning of medical resources. The comprehensive health planning programs, set up by 1966 legislation,[30] helped to get state CON laws passed and often served as advisors to the state boards about applications from their jurisdictions.[31] These programs, some 200 in all, were replaced by a stronger planning network created by the National Health Planning and Resources Development Act of 1974 (P.L. 93–641), which set up health systems agencies (HSAs) in their place. In many cases, the old Comprehensive Health Planning (CHP) agency evolved fairly smoothly into the new HSA. The major new source of strength is that the 1974 law requires all states to pass CON laws that meet certain minimum requirements set by the Department of Health, Education and Welfare (HEW). The ultimate decision is made by the state, but the HSA is the first level of review[32]

These laws and the agencies that administer them are directly concerned with the diffusion of new technologies. In order to acquire an expensive new technology, a hospital must get the approval of the state board (sometimes it

28. RUSSELL, *supra* note 4, at 65.
29. *Id.* at 38–39.
30. The Comprehensive Health Planning and Public Health Services Amendments of 1966, 42 U.S.C. § 246 (1977).
31. S. REP. NO. 1285, *supra* note 24, at 5–13.
32. National Health Planning and Resources Development Act of 1974, 42 U.S.C. § 300o–2 (1979).

is possible to get around the review process by buying services rather than equipment, for example, or by splitting the project into parts, each of which costs less than the amount for which review is required).[33] In the past, the review boards focused their efforts on applications for additional beds in the belief that total spending was directly proportional to the number of beds and that most areas already had more beds than necessary. New technologies were given only the most cursory review.[34] Recently, boards have begun to appreciate the independent role new technologies play in costs and have given them more attention. The objective, however, is still to provide everything that is needed, but at minimum cost. For example, the four Washington, D.C. area HSAs recently reviewed available and required resources for open-heart surgery in the metropolitan area. At the outset, they accepted that the surgery should be provided to all who needed it (need being a matter for the physician to decide) and focused on deciding what was the minimum number of facilities necessary to meet that goal.[35]

What effect has certificate of need had on diffusion? We have only the early experience with state laws on which to base an answer. My work shows that these laws discouraged the adoption of specific technologies. In states with laws that went into effect between 1965 and 1969—New York is by far the largest of the three—certificate of need had two substantial effects. It reduced the proportion of hospitals with open-heart surgery in 1975 by 0.09 (on a scale of zero to one),[36] and it reduced the number of beds per 100 allocated to intensive care by 0.7 to 0.9 (recall that the average allocation was 5 per 100). In states with laws effective between 1970 and 1973, the proportions of hospitals adopting cobalt and open-heart surgery were reduced somewhat. My data on technologies end with 1975, so more recent laws had no chance to show an effect.[37]

Salkever and Bice examined the effect of certificate of need on hospitals' investment in additional beds and on their investment in assets per bed.[38] The

33. The guidelines set by HEW require that all investments of $150,000 or more be reviewed. The state may set a lower limit. 42 C.F.R. § 122.304 (1977).

34. Lewin and Associates, Evaluation of the Efficiency and Effectiveness of Section 1122 Review Process, Part 1, 1-11 (1975).

35. The report stated that: "Ideally, an estimate of the future use of specialized cardiac care services should be based on the local incidence and prevalence of heart disease, an assessment of the number of individuals who are most likely to require these services, and physician diagnostic and treatment philosophies (i.e., the continuum of current physician attitudes about the use of cardiac catheterization and open-heart surgery.)" For lack of information to estimate future use in this way, a projection was based on past trends in use for the area. "Metropolitan Tertiary Care Task Force and its Technical Advisory Panel on Cardiac Surgery and Catheterization, A Report on Cardiac Care Services in the Metropolitan Washington, D.C., Area 20" (1978).

36. Restating this in terms of percentages, to maintain consistency with Table II, certificate of need reduced the proportion of hospitals with open-heart surgery by 9 percent.

37. RUSSELL, *supra* note 4, at 65, 121, 128.

38. Salkever & Bice, *The Impact of Certificate-of-Need Controls on Hospital Investment*. 54 MILBANK MEMORIAL FUND Q. 185 (1976) [hereinafter cited as *The Impact of Certificate-of-Need Controls*]. This

latter measure includes the acquisition of new technologies. Using data for the period 1968–1972, they concluded that certificate of need reduced the growth in numbers of beds, but increased investment in assets per bed. Thus, total hospital investment was no different in states with CON laws than in states without them, but the pattern of investment changed.

Their data end earlier than mine—1972 rather 1975—making possible three alternative interpretations of our combined results: (1) they are hopelessly at odds; (2) my results suggest a further redirection of investment, away from technologies that the reviewers scrutinized closely and suspiciously and toward others; (3) their results are dominated by the effects of the earlier belief that controlling beds was the key to controlling costs, while mine reflect the more recent realization that individual technologies must be watched as well. We agree, however, in the overall conclusion that certificate of need has changed the pattern of hospital investment. Salkever and Bice find that it has directed investment away from additions to beds.[39] I find that it has directed investment away from equipment-based technologies. It has the potential for directing investment away from particular technologies altogether (or at least expensive equipment–based technologies) since it focuses on these to the exclusion of other ways of spending. There is, for example, no corresponding review of hiring decisions.

Salkever and Bice find that the effect of certificate of need on costs is negligible.[40] Given that the process itself costs money, this implies that it has so far failed to achieve its own objective—it costs more than it saves. My results are for individual technologies and cannot answer this question. Any reduction of expenditures for intensive care beds or cobalt may have been outweighed by expenditures for other kinds of resources.

The certificate of need mechanism is, however, currently being tried more energetically than ever and there is increasing emphasis on the importance of closely reviewing technologies. As noted earlier, the federal government now requires that all states have a certificate of need law. Further, the 1974 federal law requires HEW to set national guidelines for the new HSAs to use in developing their plans and ultimately in making decisions about certificate of need applications. The first guidelines were set in 1978 and included a number of technologies.[41] What effect these guidelines will have remains to be seen: they emphasize occupancy rates and minimum numbers of cases per facility rather than more easily applied—and less easily evaded—ratios of facilities to population. In a process that involves as much discretion on the part of

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work has been expanded and reported more recently in Salkever & Bice, *Hospital Certificate–of–Need Controls: Impact on Investment, Costs, and Use*, (American Enterprise Institute for Public Policy Research, 1979) [hereinafter cited as *Hospital Certificate–of–Need Controls*].

39. *The Impact of Certificate–of–Need Controls, supra* note 38, at 197.
40. *Hospital Certificate–of–Need Controls, supra* note 38, at 73.
41. 43 Fed. Reg. 13,040 (1978) (to be codified in 42 C.F.R. § 121).

the regulators as certificate of need, the increasing emphasis on technologies may portend new and quantitatively more important restraints on the diffusion of many technologies.

For completeness, another new review mechanism, the Professional Standards Review Organizations (PSROs), must be mentioned. PSROs are designated physician groups in local or regional areas. Their job is to ascertain that hospital services provided to Medicare and Medicaid patients are necessary and of good quality—that is, that they represent "best practice."[42] These groups potentially could affect the use, hence the adoption, of a number of technologies—including technologies based primarily on people or drugs, or other resources that do not fall under the jurisdiction of certificate of need boards.

In practice, because of the concern with costs, they have concentrated on reducing "unnecessary" hospital admissions and "unnecessarily long" hospital stays. So far, evaluations of their effectiveness are most useful for what they suggest about the benefit–cost ratio of such an efficiency approach. The second annual evaluation of the PSROs by HEW found that inpatient days per 1000 Medicare enrollees were lower, other things constant, in areas with working PSROs. Counting Medicare's savings, the report concluded that PSROs did a bit better than break even—the ratio of savings to costs was 1.1.[43] In re-evaluating the evaulation, the Congressional Budget Office (CBO) made a number of changes in the analysis. Most importantly, the CBO estimated the savings to the entire system by subtracting the additional fixed costs shifted to other payers from the savings to Medicare. By this standard the programs fell well below the break-even point—the ratio of savings to costs was 0.7.[44]

We can look to a wider field of experience than our own for examples of regulatory approaches aimed at improving technical efficiency in medical care. Of the three European countries whose policies toward hospital technologies I examined—Sweden, France, and Great Britain—two appear to be similar to the United States in trying to control costs through efficiency rather than rationing.[45] Sweden has a regional system of hospitals intended to reduce the number of specialized facilities to the minimum needed to provide everyone with care. Patients are moved to the appropriate hospital if the nearest one is not adequately specialized. In France, a 1970 law set up a process whereby hospitals must get government approval before acquiring certain

42. Goran, Roberts, Kellogg, Fielding, Jessee, *The PSRO Hospital Review System*, 13 MED. CARE, April 1975 (Supp.), at 1.

43. DEP'T OF HEALTH, EDUC. AND WELFARE, HEALTH CARE FINANCING ADMINISTRATION, PROFESSIONAL STANDARDS REVIEW ORGANIZATION: 1978 PROGRAM EVALUATION, at iv (1979).

44. U.S. CONG. BUDGET OFFICE, THE EFFECT OF PSROS ON HEALTH CARE COSTS: CURRENT FINDINGS AND FUTURE EVALUATIONS, at 38 (1979).

45. RUSSELL, *supra* note 4, at 142–43, 149–53.

kinds of equipment—e.g., dialysis machines and CT scanners. The government's decision is based in part on national standards—set by the Ministry of Health—for the appropriate number of facilities per million population.[46]

The approaches are similar and so are the results. The measure commonly used to compare the costs of national medical care systems is the percent of its gross national product each country spends. In 1975, the most recent year for which international data are available, the United States devoted 8.4 percent of its GNP to medical care. In the same year, the percentages for Sweden and France were 9.2 and 8.1, respectively.[47]

Britain, at 5.4 percent, is obviously different. Britain is unique among the four countries in having an explicit policy that it cannot and will not provide everything that might be of benefit in medical care. While it tries to encourage technical efficiency, rationing is an accepted part of the system. The limit is set by the overall budget of the National Health Service, which has always been less than enough to provide all the care that doctors and patients would like to have. The total budget translates into restrictive budgets for individual hospitals. The results are clear for particular technologies as well as for medical care in general: Britain has fewer CT scanners per million population than the United States or Sweden, fewer new patients put on dialysis each year (per million population) than the United States, Sweden, or several other European countries, and a long waiting list for admission to hospitals.[48]

The cost containment bills proposed by the Carter Administration in the last two Congressional sessions in some ways resemble the British system of setting hospital budgets. These bills propose to limit the rate of increase in hospital revenues to less than the rate of recent years—in some versions of the bill, considerably less. Although the rhetoric is still that of technical efficiency, the permitted rate of increase is set without regard to the opportunities hospitals might have to add new services of benefit to the patient. The current version explicitly adds only one point to the proposed rate to allow for new services in 1979, and makes no allowance for new services in 1980, although the average increase due to new services has been more than 6 percent annually over the last dozen years.[49]

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46. Law of Dec. 30, 1970, [1971] D.S.L. 56 (Fr.); [1971] J.C.P. III No. 10, 37577.

47. Unofficial federal estimates published in Cohn & Milius, *They Make Good by Making Well*, Wash. Post, Jan. 7, 1979, § A, at 1, col. 1.

48. RUSSELL, *supra* note 4, at 145–49; Dombey, Sagar, Knapp, *Chronic Renal Failure in Nottingham and Requirements for Dialysis and Transplant Facilities*, 2 BRIT. MED. J. 484 (1975) give dialysis data for the United Kingdom, Sweden, and several other European countries, but not for France. Also, *Waiting-lists Lengthen*, 1 LANCET 152 (1977), reprinted in 34 MED. CARE REV. 188 (1977). Jonsson & Newhauser, Letter to the Editor, 299 NEW ENGLAND J. MED. 665 (1978). France has fewer CT scanners than Britain, but this due to its import restrictions on computers rather than medical care policy.

49. DEP'T OF HEALTH, EDUC. AND WELFARE, PRESIDENT CARTER'S LEGISLATIVE PROPOSAL FOR HOSPITAL COST CONTAINMENT 24 (1979). Historical data from DEP'T OF HEALTH, EDUC. AND

If a bill like the proposed one becomes law, it would have major implications for the future diffusion of hospital technologies. Without admitting it explicitly, it would introduce rationing into the system again. Much of the current regulatory machinery would become at least partly redundant; if it was nonetheless left in place, it might still affect the pattern of technological diffusion, producing results different from the budget system alone or from the regulatory process that exists now.[50]

IV
HOSPITAL AND OTHER REGULATORS

For their protection and that of the industry they regulate, regulators develop views that shape their decisions.[51] These often have implications for the adoption of technologies. In this Section, I will reflect on the differences and similarities in the views of hospital regulators compared to more traditional regulators.

Noll states that regulators believe that in return for the constraints they impose, they should "reduce as much as possible the uncertainty faced by regulated firms."[52] I do not think hospital regulators feel much need to protect hospitals from uncertainty. The general view is that they are subject to very little uncertainty as it is. Whatever they decide to do, third party payers will pay for it. However bad their choices, they will not suffer financially for them. In fact, part of the regulators' job is to introduce some of the restraint that firms in less protected markets would feel naturally, and regulators are supposed to—and sometimes do—go so far as to close a hospital.

Regulators in other industries suffer from the "sunk cost obsession", they "abhor abandoning a capital investment . . . as long as it is in good working order."[53] Hospital regulators employ a variation of this obsession that colors their view of potential entrants to the market. Their concern is not that the new entrant or service will drive out an established hospital or service, but that it will not. Together, neither will be used to capacity and third party payers will end up paying higher costs because of the "unnecessary duplication."

WELFARE, DIVISION OF MEDICARE COST ESTIMATES, MEDICAL BENEFIT ESTIMATES: 1980 BUDGET ASSUMPTIONS (1979) (Table III).

50. I should mention that there is a great deal of regulation of the industry in the interests of safe and high-quality care. Radiologic facilities are regulated for the safe handling and shielding of radioactive substances. Construction requirements are intended to minimize the damage that fires can cause in an institution where the inhabitants are helpless. Institutions that must cooperate in patient care are required to have formal transfer agreements. Accreditation of hospitals by the quasi-private Joint Commission on Accreditation of Hospitals (JCAH) requires certain facilities and standards. This involves a large number of regulatory agencies, separate from those discussed in this paper, and sometimes working at cross purposes.

51. The common views held by non-hospital regulators are based on NOLL, *supra* note 1, at 15–32.

52. *Id.* at 26.

53. *Id.* at 25.

Other regulators have introduced extensive cross-subsidization in many industries.[54] In the hospital industry they had only to champion the cross-subsidization that already existed. Again, this has influenced their views toward new entrants. For years, long before hospital regulation became extensive, the view was that nonprofit community hospitals had to provide a "full range" of services, some of which were not able to cover their full costs. These services had to be subsidized by others that more than covered their costs. The growth of third party payment has blurred the distinction between services that do and do not cover their own costs, but prejudices remain against potential entrants who are seen as trying to "skim the cream," that is, provide only the profitable services and leave existing hospitals with the unprofitable ones. This prejudice is strong against hospitals operated for profit and against specialized facilities like outpatient surgery centers. In the latter case, regulators prefer that an outpatient center be associated with a hospital rather than "freestanding," and carry some of the hospital's overhead costs. This prejudice can restrict the spread of technologies associated with them. It has probably done so in the case of outpatient surgical centers. In any other industry, the argument for the new setting would be that it would replace more expensive ways of doing the same thing and reduce costs; but hospital regulators may be justifiably cautious. The general view in the hospital industry is that nothing ever replaces anything; everything is a net addition to the total.

Regulators in other industries are accused of inhibiting the diffusion of new technologies.[55] By and large hospital regulators are *supposed* to inhibit diffusion. The view is that diffusion is too fast and extensive now and, as argued earlier, it is certainly faster and more extensive than it would be in a less heavily subsidized market. Regulators are in something of a bind here since they are not charged, at least not yet, with preventing the acquisition of a technology if it would have positive benefits for patients. As discussed earlier, that leaves them a very narrow margin within which to work.

V

CONCLUSIONS

The effect of hospital regulation on the diffusion of new medical technologies cannot be judged by the degree to which it causes that process to diverge from the competitive ideal. Before regulation appeared, the growth of third party payment had already, and quite deliberately, moved the industry miles away from that standard. Further, there is still wide agreement among policymakers and the public that medical care should not be subject to

54. *Id.* at 17–18.
55. *Id.* at 23 *passim*.

the usual economic tests. The belief is that cost–benefit calculations in this sector are immoral: instead everything that is needed, that is, everything with a benefit greater than zero, should be provided.

Regulatory mechanisms have been superimposed on this system in recent years and asked to control costs, not by limiting services, but by eliminating technical inefficiency due to "underuse" and "unnecessary duplication." This puts the bulk of the cost problem beyond regulatory control. Nonetheless, certificate of need—the most important of the new regulatory mechanisms —has influenced the diffusion of certain technologies in carrying out its charge. In individual states, the diffusion of intensive care, open–heart surgery, and cobalt radiotherapy has been discouraged. But Salkever and Bice's results suggest that, at least in the early years, the net effect of these actions was to rearrange investment patterns in certificate of need states, not to reduce costs. Judging certificate of need by its own objectives—the reduction of costs through the improvement of technical efficiency—one has to conclude that it has yet to save more money than it spends.

Perceptions and goals in medical care have been changing so fast that it would be premature to conclude that hospital regulation will continue to limit itself to this narrow margin of the cost problem. In the 1960s there were many who argued that technology was not spreading fast enough. Most of the programs of that decade were aimed at stimulating diffusion and expanding the use of services, with costs only a secondary concern. Rising costs have made the full implications of the philosophy that care should be provided whenever it is needed painfully obvious. As a result, costs have become the primary concern, and although the rhetoric about services has not changed much, the reality may be changing. If the Administration's cost containment bill is the wave of the future, rationing of some sort may be a fact of life again in the medical care system of the 1980s.

The regulatory process allows considerable discretion on the part of the regulators. With the regulatory climate changing as fast as it is in medical care, regulation's past effects may not predict its future effects. Current indications are that future changes will be in the direction of a more general dampening effect on the diffusion of technologies. Whether these changes are judged desirable will depend on the future objectives of the system, the success of the regulatory process in meeting them, and the costs it incurs in doing so.