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# Competition and the Cost of Hospital Care, 1972 to 1982

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Using 1982 data from 5732 US hospitals, we found that costs were substantially higher in hospitals operating in more competitive local environments than in hospitals in less competitive environments. After controlling for wage rates, patient case mix, state regulatory programs, and hospital teaching role, average costs per admission were found to be 26% higher in hospitals in the most competitive markets (more than ten hospitals within a 24-km radius) than in hospitals with no competitors within a 24-km radius. Average costs per patient-day were 15% higher in the most competitive markets than in hospitals with no neighbors. These findings on the cost implications of nonprice competition among hospitals suggest that the new modes of hospital payment will have a greater disruptive impact on hospital behavior in areas with many, rather than few, hospitals. In anticipating the effects of new modes of payment on hospital behavior, policymakers should consider the nature of quality competition as well as price competition within local markets.

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THE CONTINUING high rate of inflation in hospital care costs<sup>1</sup> and the meager results obtained by regulatory cost-containment efforts<sup>2,3</sup> have contributed to a large number of proposals for market-oriented strategies to control hospital spending. Such strategies seek to control hospital costs by encouraging competition among providers and among delivery systems, such as insurers and health maintenance organizations. Several states including California have adopted market strategies,<sup>4,6</sup> and a variety of proposals have been considered at the national level.<sup>7</sup> Underlying all these proposals is the standard economic model of market behavior, which predicts that increased competition among providers will lead

to lower prices and, ultimately, adoption of more efficient and less costly methods of production.

Most discussions of market-oriented cost-control programs, however, have ignored the importance of nonprice, as opposed to price, competition in relations among hospitals. Nonprice competition means that providers compete on the basis of perceived quality of care and amenities offered as well as by the prices charged. That is, for those medical services where the choice of hospital is in the patients' hands, such as maternity care, hospitals compete vigorously with each other based on the availability of "alternative" birthing suites, prenatal programs for siblings, and other nonprice characteristics of interest to patients. In many cases, however, the principal decisions concerning hospital admissions are made by the community-based physicians with whom patients have ongoing relationships, rather than directly by the patients themselves. To compete for these admissions, hospitals

vie for physician affiliations through the provision of services that physicians appreciate. These include both personal amenities such as convenient parking, office space, and clerical services and, more importantly from an economic perspective, the acquisition of state-of-the-art clinical technologies and support staffs.

It is our hypothesis that hospitals in more competitive local environments have been forced to provide higher levels of both patient- and physician-oriented services than hospitals whose access to patients is less threatened. This nonprice competition directly raises the total cost of providing care. Such competition may increase the quality of care in terms of the clinical outcomes of hospital treatment. Many amenities that play important roles in nonprice hospital competition are only tenuously linked to clinical outcomes, however, and are valued by patients because they improve the nonclinical dimensions of the medical encounter (eg, physical surroundings) or by physicians since they increase professional income and enhance prestige. Hospital competition in these dimensions will increase both consumer and provider satisfaction as well as costs, but will not influence morbidity and mortality statistics. In fact, nonprice competition that results in duplication of clinical services among hospitals and correspondingly low volumes of procedures (or cases) in each hospital could conceivably lower clinical quality by reducing experience-related expertise among the hospital and physician staff.<sup>8-12</sup>

Little empirical evidence currently exists concerning hospital competition, but available studies have produced findings consistent with our hypothesis

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that, at least until recently, nonprice competition has exerted an important influence on hospital behavior. Joskow<sup>13</sup> found that hospitals in more competitive environments maintain lower bed occupancy rates than hospitals in less competitive environments. Wilson and Jadow<sup>14</sup> reported that hospitals in competitive markets are less efficient in the provision of nuclear medicine services than hospitals in less competitive markets. Luft et al<sup>15</sup> found that, for the majority of the 29 services studied, the probability of a hospital possessing a service is positively associated with the number of neighboring hospitals. Farley<sup>16</sup> studied a sample of 400 hospitals and found that those with many neighbors experienced higher costs than those with no neighbors. Using 1972 data on 5013 hospitals, we found that average costs per admission and per patient-day were higher in hospitals operating in more competitive areas than in hospitals in less competitive areas.<sup>17</sup> The study presented herein is the first to report on the influence of such competition on costs for all US community hospitals during the period just before the implementation of Medicare's prospective payment system.

## METHODS

### Data on Hospitals

This study used data on average expenses per patient admission and per patient-day in 5732 nonfederal short-term general hospitals in the United States, as reported in the 1982 American Hospital Association (AHA) annual survey. Other hospital characteristics recorded by the AHA included average annual earnings for hospital nurses, average earnings for nonnursing hospital employees, number of beds, annual number of outpatient visits, type of ownership (public, private nonprofit, or for profit), number of residents and interns, annual number of admissions, average length of patient stay in days, affiliation with a medical school, and membership in the Council of Teaching Hospitals. For comparison purposes, 1972 data on average expenses per patient admission and per patient-day were obtained for 5037 hospitals from the 1972 AHA annual survey.

The AHA survey also contained information on each hospital's case mix in the form of the percentage of annual inpatient days accounted for by each of 27 broad diagnostic or treatment categories. These data were especially useful for studies of cost differences among hospitals since they included both types of care likely to be associated with especially high average costs (eg, intensive care) and types of care likely to be

associated with especially low average costs (eg, subacute care). The 27 categories included five types of general medical and surgical care (adult, pediatric, psychiatric, obstetric, and other acute); nine types of intensive care (medical and surgical, cardiac, neonatal, neonatal intermediate, pediatric, burn, psychiatric, other special, and other intensive); seven types of subacute care (skilled nursing long-term, psychiatric long-term, other long-term, mental retardation, sheltered care, self-care, and other subacute); rehabilitation; tuberculosis and other respiratory diseases; chronic disease; hospice; alcoholism and chemical dependency; and other care. Annual number of births was also included as a measure of case mix.

As an additional control on the possibility that measured differences in average costs across hospitals were due to differences in case-mix severity, we analyzed separately a subset of 737 hospitals for which patient abstract data were available from the Commission on Professional and Hospital Activities. For these hospitals we computed the percentage of admissions during 1982 accounted for by 18 medical and surgical diagnoses (abdominal aortic aneurysm, acute myocardial infarction, cirrhosis, fracture of the femur, peptic ulcer disease, respiratory distress syndrome, subarachnoid hemorrhage, head injury, cardiac catheterization and angiography, appendectomy, coronary artery bypass graft surgery, cholecystectomy, inguinal hernia repair, hysterectomy, intestinal operations, stomach operations, total hip replacement, and transurethral prostatectomy). We used these 18 measures in addition to the 28 measures derived from the AHA survey to control for case-mix severity differences.

### Data on Hospital Markets

Information on the sociodemographic characteristics of the hospital's county was obtained from the area resource file for 1982. These variables included median income per capita, practicing physicians per 1000 population, inpatient hospital days per 1000 county residents, population per square kilometer, total population, and average annual earnings for manufacturing workers employed in the county. Region of the nation (northeast, midwest, southeast, and west) was also included.

The structure of the local hospital market, and hence the degree of competition, was measured within a 24-km radius around each hospital. Using the county or metropolitan area as the market area would have introduced problems due to patient border crossing and

the fact that some large counties, such as Los Angeles, include many hospitals that are not in competition with each other. The underlying reasoning for this 24-km distance is that active competition between two hospitals for the allegiance of practicing physicians (in contrast to physicians first establishing a practice) requires an ability by the physicians to shift admitting patterns easily between the two institutions. Physicians may visit patients at two locations, traveling between them for daily rounds and their offices. The emphasis is clearly on physician mobility, since patients are often willing to travel much longer distances for treatment. Geographic distance is employed as a proxy for travel time. Williams et al<sup>18</sup> found that in rural areas actual travel distance exceeds straight-line distance by 20% to 25%, but that there is little dispersion around this average figure. The 24-km radius creates a local market of approximately 1820 km<sup>2</sup>.

Calculation of the number of neighbors began by matching the zip code of each of the short-term general hospitals in the nation to the latitude and longitude of the main post office for its zip code. Using a computer algorithm, we then searched for all other hospitals within a 24-km radius around each hospital in the sample. (In an analysis of California hospitals, we found that using the exact location of the hospital rather than the main post office gave nearly identical results for the number of neighboring hospitals.) The number of hospital neighbors was then categorized as: zero, one, two to four, five to ten, and more than ten neighbors within 24 km. Using these categories to define each hospital's potential competitors, 26.5% of the entire sample of 5732 hospitals had no competitors, 18.3% had one competitor, 18.8% had two to four competitors, 11.4% had five to ten competitors, and 25.0% had 11 or more competitors.

Economic studies of competition conventionally use a Herfindahl index as their measure of market structure. This index is based on the distribution of market shares (here, hospital beds) held by the firms (hospitals) in the industry, rather than the number of competing firms itself. To facilitate comparison of our results with results from these other studies, we also calculated a Herfindahl index for each local hospital market, using the distribution of beds among all hospitals within the 24-km radius.

### Analytic Techniques

To obtain unadjusted mean costs per admission and per patient-day, hospi-

tals were sorted according to the number of neighboring hospitals within 24 km, using no neighbors, one neighbor, two to four neighbors, five to ten neighbors, and more than ten neighbors as categories. Sample means were then computed separately for the hospitals in each category.

Multiple regression techniques (ordinary least squares) were used to estimate the independent effect of market structure on hospital costs after controlling for characteristics of the hospital, patient case-mix severity, population characteristics, and wage rates. Costs per patient admission and per patient-day were first regressed against the bed size variables, number of outpatient visits divided by inpatient beds, two ownership variables, number of house staff per bed, average length of stay, number of admissions per bed, average nurse wage rate, average non-nurse employee wage rate, Council of Teaching Hospitals membership, medical school affiliation, 28 case-mix variables, income per capita, manufacturing worker wage rate, number of physicians per 1000 population, population per square kilometer, total population, number of inpatient-days per 1000 residents, and region variables, in addition to the categorical variables indicating the number of neighbors in the local market. The cost per admission and cost per day regressions were then recalculated substituting the Herfindahl index measure of market structure for the measures based on number of competitors. For the subset of 737 hospitals for which the Commission on Professional and Hospital Activities patient abstract data were available, the regressions were also recalculated including the 18 diagnosis- and procedure-specific measures of patient case mix.

Sample mean values of the independent variables were multiplied by the corresponding regression coefficients to obtain adjusted cost figures for hospitals with no neighbors. Regression coefficients from the number of neighbor variables were then added to this base to obtain adjusted cost averages for each of the categories of hospital market, ie, those with one neighboring hospital, those with two to four, those with five to ten, and those with more than ten.

To compare rates of hospital-cost inflation across different market structures, unadjusted average costs per admission and per patient-day for each market size category for 1972 were compared with the corresponding figures for 1982. Cost changes were calculated both as absolute cost increases and as percentage cost increases.

## RESULTS

Figure 1 presents adjusted average costs per admission by number of neighbors. The numbers in Fig 1 represent the average costs per admission that would be expected if a hospital typical of all US hospitals should find itself isolated in a community with no neighboring hospitals, one neighboring hospital, two to four neighboring hospitals, five to ten neighboring hospitals, or more than ten neighboring hospitals. Hospitals with more than ten neighboring hospitals within 24 km report average costs per admission 26% higher ( $P < .0001$ ) than hospitals with no neighbors but with similar institutional and environmental characteristics.

Figure 2 presents adjusted average costs per patient-day by number of neighbors. Hospitals with more than ten neighbors report average costs per patient-day 15% higher ( $P < .0001$ ) than hospitals with no neighbors but with similar institutional and environmental characteristics.

These figures may actually understate the true cost differences, since some factors at least partly controlled by the hospital, such as nurse and other employee wage rates and patient length of stay, are included as independent variables in the regression. If these variables are omitted, costs per admission are 35% higher ( $P < .0001$ ) in hospitals with more than ten neighbors than in hospitals with no neighbors, and costs per patient-day are 16% higher in hospitals with more than ten neighbors than in hospitals with no neighbors.

The findings obtained using the full hospital data set and number of neighboring hospitals to measure local market competition were reproduced using the alternative measures of case-mix complexity and market competition. The inclusion of 18 additional case-mix variables for the subset of 737 hospitals for which patient abstract data were available did not materially influence the measured association between competition and costs. The Herfindahl measure of market structure produced a competition-cost relationship very similar to the more easily interpretable number of neighbors measure. These results are available on request from the authors.

The Table presents absolute and percentage differences in average cost per admission and average cost per patient-day between 1972 and 1982, by number of neighboring hospitals in the local market. Using the absolute differences, average costs per admission are observed to increase faster in hospitals operating within more competitive local markets. The average increase in cost

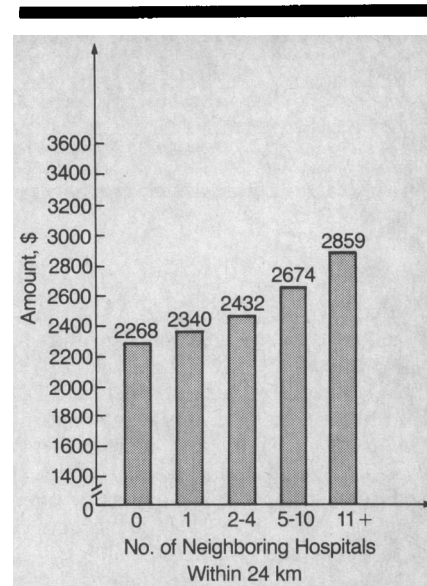


Fig 1.—Adjusted average cost per patient admission for 1982.

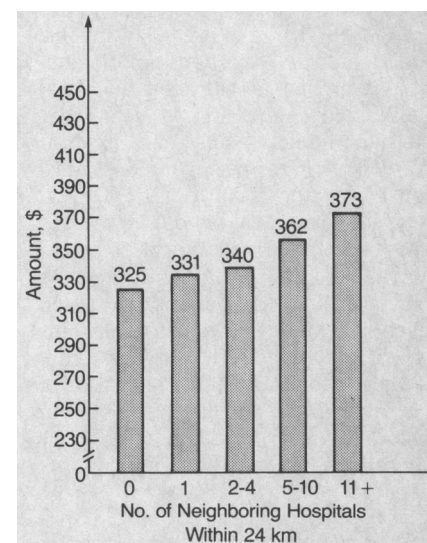


Fig 2.—Adjusted average cost per patient-day for 1982.

per admission over the decade ranged from \$1365 in hospitals with no neighbors to \$2604 in hospitals with more than ten neighbors. Using the percentage differences presented in the second row of the Table, no consistent correlation between hospital market structure and rate of growth in costs is observed. However, the rate of growth in costs for hospitals in the highest cost category, those with more than ten neighbors, is somewhat lower than that for hospitals in other market environments.

The third and fourth rows of the Table present absolute and percentage differences for the 1972 to 1982 period in

No Neighbors	1 Neighbor	2-4 Neighbors	5-10 Neighbors	11+ Neighbors
<b>Average Cost Increase per Patient Admission, Dollars (%)</b>				
1365 (278)	1397 (263)	1637 (269)	2137 (272)	2604 (256)
<b>Average Cost Increase per Patient-Day, Dollars (%)</b>				
210 (300)	213 (284)	236 (288)	292 (286)	330 (266)

average cost per patient-day. As in the case of cost per admission, absolute costs per patient-day increased substantially faster in hospitals operating within more competitive markets than in hospitals within less competitive markets. The percentage rates of increase in cost per patient-day show no consistent differences across markets except, once again, in the case of hospitals with more than ten neighbors, where the rate of cost inflation is lower than elsewhere.

### COMMENT

The data presented in this article indicate that average hospital costs per admission and per patient-day in 1982 were substantially higher in more competitive than in less competitive local hospital markets. This is consistent with the "medical arms race" hypothesis, which suggests that, at least until recently, competition in the hospital sector took the form of cost-increasing acquisition of new technology attractive to physicians and patients rather than cost-decreasing changes in production efficiency. The data are also consistent with earlier analyses of our data from 1972, which found greater duplication of clinical services<sup>15</sup> and higher costs<sup>17</sup> in hospitals operating within more competitive local markets than in hospitals in less competitive markets.

The comparison of 1972 and 1982 figures reveals that percentage rates of change in cost per admission and cost per patient-day did not differ markedly according to the structure of the local hospital market. This indicates that nonprice competition was not driving costs in competitive and monopoly markets further apart. On the other hand, no strong self-correcting mechanisms or regression-to-the-mean effects were observed either. This suggests that the cost-increasing effects of nonprice competition on costs were already well in place by 1972 and that the following decade was not one of major change in the hospital system.

The identification of the important cost-increasing effect of nonprice competition among hospitals suggests that a degree of caution be exercised in predicting cost-reducing effects of re-

cent "market-oriented" policy initiatives. While price competition among hospitals seeking contracts with health maintenance organizations, preferred provider systems, and Medicaid programs can be expected to reduce costs, nonprice competition is likely to continue to play an important role in hospital relations. Policies that deregulate hospital markets may increase the intensity of nonprice competition while they stimulate price competition. On the positive side, however, the continued role of nonprice competition may moderate any tendencies for hospitals to reduce the quality of care as a means toward lowering their prices. Physicians and patients will continue to make their choices among alternative hospitals on the basis of perceived quality of care as well as price. Hospitals in competitive environments will thus be under pressure to adopt state-of-the-art techniques and technologies as well as to hold down charges.

In determining the ultimate effect of hospital competition on costs, the relative importance of the two strategies in hospital marketing decisions will be crucial. Here, some useful lessons may be learned from the experiences of other industries. Price competition appears to occur more frequently than nonprice competition when the buyer can directly assess the quality of the product. Textbook cases of price-sensitive commodities are agricultural and industrial products that can be accurately graded according to quality (size, weight, and tensile strength). Nonprice competition becomes increasingly important as consumer uncertainty about product quality at the time of purchase grows. Hotels, banks, and automobile manufacturers emphasize the comfort, security, and reliability of their products as well as their economy.

It is difficult to imagine a product the quality of which is more a source of consumer concern and consumer uncertainty than hospital care. Patients are unsure of both the nature of their illness and of the medical profession's ability to do anything about it. While changes in health insurance coverage are leading patients to care about charges in a manner that they have not in the past,

the increasingly competitive environment may also cause patients to seek reassurance that they receive good-quality care.

The importance of nonprice competition is also emphasized in the economic literature on markets with more than one but not a large number of competitors.<sup>19</sup> Firms in such medium-sized markets tend to compete strongly in nonprice as well as price dimensions. Product differentiation and advertising are central elements of competition in such markets. Nonprice marketing strategies raise overall costs and at least partially offset the gains in efficiency that result from price competition. In this context it is important to note that 48% of US hospitals have one to ten neighbors.

Through selective contracting with hospitals, organized delivery systems (such as health maintenance organizations and preferred provider organizations) hold the potential for fostering price competition, at least in large urban hospital market areas. These delivery systems will in turn be forced to compete for membership among employee groups who enjoy multiple-choice health-benefit packages. Given continuing consumer uncertainty as to the diagnostic and therapeutic quality of alternative provider groups, this competition for membership could take primarily nonprice forms. Experience to date in northern California, one of the areas with greatest penetration by organized delivery systems, suggests that rival plans often set a similar premium level and then compete for membership on the basis of the perceived quality and convenience of their services.

The finding of higher costs for hospitals with more neighbors may affect the impact of Medicare's prospective payment system on hospital care costs, at least in comparison to the effect of increased price competition in the private sector. Given the geographically limited nature of hospital markets, price competition will not act directly to equalize cost levels across different markets, although it will tend to equalize cost levels among hospitals within each market. The low-cost monopoly hospitals identified in this study cannot move their location to enter and influence high-cost markets in the manner by which a low-cost airline can challenge high-cost airlines by adding new routes to its system.

Prospective payment by a major third-party payer such as Medicare, on the other hand, does have the potential for equalizing costs among hospitals in different markets. The transition by

Medicare to a national reimbursement rate will exert disproportionately strong incentives to alter performance on those hospitals with initially high costs. While concern to date has focused on special costs borne by teaching institutions and rural facilities, the results in this article suggest that hospitals in competitive local markets will also be among the most severely affected. The greater economic stress of Medicare's prospective payment system for hospi-

tals in more competitive areas will be magnified if nonprice competition takes the form of difficult-to-reverse commitments to costly clinical technologies. Ironically, success enjoyed by Medicare in reducing hospital revenues in competitive local markets will limit the potential for classic price competition in those markets, as hospitals are forced to raise prices charged to privately insured patients. Future analyses of the new competitive environment in health

care should examine both price and nonprice strategies in the context of local market structures.

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