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Organizational Determinants of Services, Quality and Cost of Care in Hospitals

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AFTER MORE THAN A DECADE of research on the structural features of organizations (Blau and Schoenherr, 1971; Pugh, Hickson, Hinings et al., 1968 and 1969), researchers are turning their attention from the determinants to the consequences of organizational structure. In particular, attention has recently been focused on the effects of structure on organizational effectiveness and efficiency (Child, 1974 and 1975; Goodman and Pennings, 1977; Price, 1972; Steers, 1977). Good examples of the latter variables are provided by quality (effectiveness) and cost (efficiency) of health care in hospitals. These variables are also of great interest to policy makers because of the recent rapid increases in hospital costs and uneven quality of hospital care in this country.

A large number of studies have examined factors associated with quality or cost of care in hospitals, but only a small number have examined both simultaneously, and an even smaller number have attempted to relate them to structural features of hospitals (Cohen, 1970; Morse, Gordon and Moch, 1974; Neuhauser, 1971; Rushing, 1974; and Shortell, Becker and Neuhauser, 1976). Results from these and related studies have not been clear or persuasive. Important limitations of previous work include: 1) a lack of effective techniques for taking into account differences among patients that

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affect both the cost and the quality of care observed; and 2) a lack of attention to the development of output measures that distinguish the outcome of care received from the quantity or costs of services delivered or from the potential to provide care implied by the elaborateness of facilities and the qualifications of health care personnel.[1] We designed our research approach to deal with both of these difficult issues. To handle the first issue, we adjusted the measures of services and outcomes for hospital patients to take into account variations due to the health status of the patients being treated. To handle the second issue, we developed independent measures of quality of care, quantity of services, costs of care, and structural measures of the potential of the organization to provide care, and examined their interrelationships. Based on this research, we examined in a related paper (Flood, Scott, Ewy et al., 1978) the relations among measures of the average quantity of services delivered and the average quality of outcomes achieved by patients in a hospital. In this paper we focus on a set of structural characteristics of hospitals as predictors of variations in the average intensity and duration of services provided to patients, the average amount of expenditure for patient care, and the average quality of outcomes experienced by patients in the hospital.

Methods

Data Sources

Data used in this study were drawn from 17 acute care hospitals. The hospitals had all previously participated in the prospective study of our research team concerning the organizational factors affecting quality of outcome following surgery (Stanford Center for Health Care Research, 1974). Although some of the data on organizational characteristics was used in our previous study, the patient data in our current study are based on a much broader spectrum of patients, including both surgical and medical patients, and employ information obtained entirely from abstracts of patient records. The study

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[1]Strengths and limitations of the various classes of measures employed to assess care quality are discussed in Donabedian (1966) and Scott (1977).

hospitals were selected from a roster of 1377 hospitals participating as of 1972 in the Professional Activities Study (PAS) of the Commission on Professional and Hospital Activities (CPHA), a hospital abstracting system collecting and summarizing selected information on all patient discharges from its member hospitals. Thirty-two hospitals were selected randomly from a stratified sample of all short-term voluntary hospitals participating in PAS; of these 32, 16 agreed to participate in the research and a 17th, administratively linked to one of the 16, volunteered to participate at its own expense. Stratification variables included size, teaching status, and expenses. The 17 hospitals are not completely representative of all short-term acute care hospitals in this country. In particular, they do not include proprietary or federal short-term hospitals. Compared to hospitals of a similar type, their average size is greater than the national average (304 vs 164 beds).[2] Six of the study hospitals (35%) were affiliated with a medical school or had an approved and active house staff program, compared to 28% of comparable U.S. hospitals. Costs of care within the study hospitals were similar to the national average: $113 average cost per patient day for our study hospitals compared to $115 for U.S. hospitals. The goal of obtaining substantial variance within the sample along these important dimensions was achieved: for the sample, size varied from 99 to 638 beds, and average costs from $77 to $154 per patient day. Ten states and all major geographic regions within the continental United States were represented.

All patient data were based on information contained in the PAS abstract record, which was available for each of the approximately 670,000 patients discharged from the study hospitals during the period, May 1970 through December 1973. The final set of study patients numbered approximately 603,000; virtually all of the excluded cases were newborns. Data from the patient abstract provided the basis for our measures of services received and outcome, including the number and types of diagnostic and therapeutic services received during the hospitalization, the length of hospital stay and the measure of patient outcome, i.e., death in hospital. In addition, we used information from the patients' abstracts (by means of a procedure to be described below) to adjust the service and outcome

[2]Study hospital and national figures are based on 1973 data.

measures for differences in patient mix and in hospitalization experience.

Data on the organizational characteristics of the hospital and medical staff came primarily from our previous study on the quality of surgical care (Stanford Center for Health Care Research, 1974). For that study, interviews had been conducted during the spring of 1974 with key hospital and medical staff personnel who acted as expert informants, describing the structure and operation of their units. Questionnaires had also been administered to the staffs of the operating room, recovery room, and surgical wards, and to selected physicians providing primary care and selected ancillary services. Data on surgeons' training and experience had been collected from either hospital records or American Medical Association (AMA) records. In addition to these data from our earlier study, information was assembled on selected hospital characteristics from the American Hospital Association (AHA) annual survey for each of the 4 years studied.

Measures of Major Variables

The principal measures in this study may be grouped into four categories: 1) outcome of hospitalization; 2) amount and type of in-hospital services; 3) actual hospital costs; and 4) hospital structure.

Measure of the Outcome of Hospitalization. The indicator of quality of care is the rate of *in-hospital mortality* adjusted for patient characteristics—a measure emphasizing the quality of outcome of care for patients.

Measures of In-Hospital Services: Rates of Service Intensity and Duration. We developed indicators to estimate the number or amount of services of varying types received by a patient during a hospital stay. Although it is not feasible to assess all of the many types of services provided by hospitals, we measured seven types of important diagnostic and therapeutic services provided to inpatients. We also assessed the duration of the services, as measured by length of stay. For purposes of this analysis, we limited our attention to a composite measure of these seven services rather than to each service measured independently. An *Index of Service Intensity* reflects the amount and variety of diagnostic and therapeutic services provided to patients, as well as the relative cost of each of these

different types of services.[3] An *Index of Service Duration* is based on length of stay. This measure weighs length of stay by the proportion of total hospital charges associated with routine nursing and hotel services provided to all patients regardless of any specific services consumed.[4] The two indexes, their component measures and weights, are summarized in Table 1.

The measures of outcome and of service intensity and duration were first computed at the patient level by detailed analysis of individual records for the 603,000 patients, to permit standardization for individual patient differences. General features of the approach are described in Appendix A; specifics are provided in Forrest, Brown, Scott, et al. (1977). Briefly, using a combination of classification by diagnosis (with 332 diagnostic groupings) and linear regression, and using indicators that characterized each patient's condition and treatment record, including diagnoses, operations, admission test findings, and socio-demographic characteristics, we computed the expected levels of service intensity, duration, and outcome for each patient, conditional on the patient's specific

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[3]Categories of therapeutic and diagnostic services measured are reported in Table 1. Costliness of services was reflected in a weight assigned to each individual category before combining them into the composite measure. These weights were based on the average proportion of total charges for a hospitalization episode associated with each category of service. The weights were obtained from data on hospital charges supplied by a non-study hospital. Thus, they are not intended to reflect the actual variations in charges among study hospitals, but were uniformly applied to all hospitals. The intent was only to reflect differences in *relative* costliness among the various categories of services provided by hospitals.

Since we were able to assess not only whether a given category of service was used by a given patient but often the amount or numbers of such services consumed as well, the actual weights applied to each service used by a patient took into account these frequencies. Thus, the final weighting for each service consisted of the proportion of total charges for each category of services, as reported in Table 1, divided by the average amount of each type of service consumed by study patients during their hospitalization. For example, since the average number of operations for study patients was 0.545, the final weight assigned was $14.27/0.545 = 26.183$, which was applied to each operative procedure received by a given patient.

[4]For some analyses not reported here, these two composite measures were combined into an overall measure of services. For this reason, a weighting of length of stay was introduced. This weighting does not alter any of the results presented in this paper, but is included to allow a comparison of the relative costliness of specific services and routine care.

TABLE 1
Components of the Service Intensity and Duration Indexes and Their Weights

Items From the PAS Abstract for Patients	Class of Services Being Estimated	Proportion of Patient Charges for Class* (%)	Weighting Factor of PAS Item for Each Patient†
Components of Index of Service Intensity:			
Diagnostic services:			
No. of radiographic procedures performed	Radiological services	7.08	32.627 per procedure
No. of blood tests	Laboratory	8.48	12.676 per test
Therapeutic services:			
No. of operative procedures	Surgery	14.27	26.183 per procedure
Administration of any blood or blood parts	Laboratory	2.83	52.407 if any blood given
Physical therapy	Therapy	2.66	52.157 if physical therapy given
No. of classes of drugs	Medical supplies	8.52	7.992 per class of drugs
Use of intensive care unit	Special care units	4.21	56.892 if special unit used
	Subtotal	48.05	
Component of Index of Service Duration:			
No. of days in hospital	Hotel services Routine nursing care	51.95	6.185 per day
	Total	100.00	

*Based on the proportion of average patient's bill attributable to a given service class using 1973 figures from a non-study hospital.

†To obtain the weighting factor, the proportion of charges for the class is divided by the mean number of corresponding services on the PAS abstract actually used by patients in the study (see footnote 3).

characteristics and physical condition at admission. For each of the three types of measures based on patients—service intensity, duration, and outcome—the expected levels reflected the pattern of utilization or outcome obtained on the average in the set of study hospitals by patients with the same type of disease and physical condition. We then calculated difference scores for each patient, which reflected the difference, whether positive or negative, between the expected level of service intensity, duration, and outcome for a patient of that type and the actual level of service intensity, duration and outcome observed for that patient. To obtain a measure for a hospital, these difference scores were then averaged for the set of all patients treated in the hospital during the study period. Thus, our measures of service intensity, duration, and outcome for each hospital are summary measures of observed departures in the experience of individual patients from expected scores based on the typical experience of similar patients treated in all of the hospitals in our sample.

Measure of Cost Based on Actual Hospital Charges. Unlike the measures of services and outcomes, the measure of cost was not based on data obtained on individual patients and then aggregated to the hospital level, nor was it adjusted for differences in patient mix among hospitals. Data on actual expenditures on, or charges to, patients were not available. Instead, the cost measure was based on data obtained from the AHA's annual survey of 1973 and consisted of the total annual expenditures of each hospital divided by the number of patients treated during that year, which provides the *average expenditures per patient episode.* We attempted to correct this measure for regional differences in cost by dividing each hospital's score by the Medicare reimbursement index for the county in which the study hospital was located. Clearly, however, because our measure of cost does not take into account differences in patient mix, its usefulness is compromised, and it will not receive much attention in our subsequent analyses.

Measures of Hospital Structure. Measures of the structural characteristics of hospitals were grouped into two categories, capacity and control, as follows:

1. *Capacity* refers to those aspects of the hospital that represent its potential to supply services. Six types of measures were used. One obviously important measure was that of hospital size or scale. Since

hospitals are organizations heavily dependent on personal services, we used as our indicator of size the *total number of personnel employed.* (This indicator was correlated 0.93 with average daily patient census.) Second, to measure the elaborateness of the therapeutic and diagnostic facilities available, we assessed the *number of different types of facilities* and the *proportion of beds devoted to intensive care* in the hospital. The third set of measures examined the intensity of the staffing, indicated by the *ratio of all staff to the average daily census* and by the *ratio of direct care nurses to average daily census.* Fourth, the teaching status of the hospital was measured by the *ratio of residents to regular medical staff.* Fifth, the qualifications of the staff were determined by several types of measures indicating training, certification, and experience. These included the *ratio of registered nurses (RNs) to other types of nurses* e.g., licensed vocational nurses (LVNs); the *average number of years in nursing* for staff nurses; the *proportion of the surgical staff that was board-certified;* and the *average number of years in practice since residency* for surgeons. A final measure assessed the unused capacity or slack resources of the institution as measured by the *occupancy rate,* the ratio of occupied beds to total bed capacity. It should be noted that occupancy rate measured capacity used.

All of the above measures of the hospital's capacity to supply services were based on data supplied by the hospital administrator for each study hospital, with the following exceptions: information on facilities and intensive care beds was obtained from the AHA annual survey, and information on the average years of nursing experience was compiled from a questionnaire distributed to all ward staff nurses in the study hospitals (average return rate, 75%).

2. *Control* encompassed several features of the organization including the distribution of power or influence over decisions and mechanisms for the control and coordination of work activities. We assessed the distribution of influence among two major sets of actors within the hospital—administrators and staff physicians, coordination at several organizational levels, and controls exercised by the surgical staff over its own members. Brief descriptions of the variables used to assess these control features follow; more detailed information on the measures employed is provided in Appendix B.

Three measures of influence were developed on responses by key hospital informants to a set of hypothetical decision questions. One measure focused on the *hospital administrator's influence on*

decisions in the administrative area; a second focused on the *chief of surgery's influence on decisions within his jurisdiction;* and a third examined the extent of *encroachment by physicians on administrative decisions.*

Coordination and control activities were assessed using measures of administrative intensity, clerical support, formalization, and frequency of communication with quality assurance personnel. Specifically, for the hospital as a whole, we assessed the *ratio of supervisory-to-direct care personnel.* At the nursing ward level, we measured the *average number of ward clerks and secretaries* present and, based on questionnaire responses from staff nurses, the *explicitness of general nursing policies.* To assess coordination by special professional units, we determined the *frequency of case discussions between physicians and pathologists* as reported by pathologists.

Finally, to assess the control exercised by the physician staff over its own members, we measured the extent of formalized *control exercised by the surgical staff over new members* as well as the *control exercised over tenured members.* These measures of formalized control were based on the rigorousness of the initial and continuing review of credentials, length of probation, and/or gradations of privileges. A third measure assessed the *proportion of contract (salaried) physicians* on the physician staff, an indicator favored by Roemer and Friedman (1971) as the best single measure of physician staff control.[5]

Predictions

In general, we expect organizational capacity to be positively associated with greater average service intensity and hence with higher average costs per patient episode. It should be noted that, since service intensity was adjusted to take into account differences in patient mix, the argument is not the conventional one that patients with more severe illnesses are more likely to be treated in larger and more elaborate facilities where they receive more services. Rather, we argue that patients served in more elaborate and more

[5]The data sources, the techniques employed to standardize service intensity, duration, and outcome measures, and all of the individual measures are described in detail in Forrest, Brown, Scott et al. (1977).

professionalized facilities are more likely to receive more services than expected, taking into account their specific condition. Such services are expected to be provided both because they are "more available" and because they contribute to other valued organizational and staff goals, such as teaching and research. There is no clear rationale for linking organizational capacity in general to duration of services, so no predictions are made concerning length of stay.

Hypotheses relating organizational capacity to quality of care are also somewhat problematic. Since the indicators of care quality vary considerably from one study to another, and since measures of structure, process, and outcome tend to be poorly correlated with one another (Brook, 1973), we restrict attention to outcome indicators of quality. There is some evidence to suggest that quality of outcomes is higher in larger hospitals (Kohl, 1955; Lipworth, Lee, and Morris, 1963; and the Commission on Professional and Hospital Activities, 1969). The relation between the average level of staff qualifications and surgical outcomes was investigated in an earlier prospective study of 9500 patients by the Stanford Center. In her analysis of these data, Flood (1976) reported that better surgical outcomes were associated with hospitals whose surgical staff had completed a greater average number of residencies (e.g., more varied postgraduate training) but, unexpectedly, poorer outcomes were associated with staffs having longer average residencies. Also unexpected was the finding that greater average specialization on the part of surgeons—measured by the types of operations actually performed—produced poorer outcomes, while the proportion of board-certified surgeons on the staff was not associated with quality of outcomes. The same study showed that better outcomes were associated with hospitals whose nursing staff had longer nursing experience, on the average.[6] Whether one should expect the average length of nurse and physician experience to be positively associated with better quality outcomes is unclear: a staff with a higher average level of experience signifies, on the one hand, more practice and exposure to varied medical problems but, on the other hand, increasing age and

[6]It should be emphasized that these results were observed at the aggregate level of analysis—i.e., using the average level of training and experience as the independent variables. Different results may be expected and have been observed when the level of analysis is shifted to the individual physician (Flood, 1976; and Flood, Scott, Ewy et al., 1977).

remoteness from training and, perhaps, from contemporary methods of care.

Turning to predictions involving control and coordination systems, we might expect to see greater controls exercised by administrators and physicians associated with reduced services to patients. Such an expectation is probably somewhat utopian since it is not at all clear that, given high influence, hospital administrators or the medical staff have much incentive to curb the services provided to patients and thus to contain the costs of medical care (Fuchs, 1974). Also, we should not expect both service intensity and service duration to be affected in the same manner by administrative and professional controls. Thus, our predictions with respect to hospital coordination and control systems and services are unsure, and we hope to learn from an examination of the empirical relations observed. By contrast, previous research suggests that better quality of medical care is positively related to administrative influence over decisions within its own domain (Flood and Scott, 1978), to coordination of work at the overall hospital and ward levels (Georgopoulos and Mann, 1962; Longest, 1974; and Neuhauser, 1971) and to the ability of the physician staff to regulate its members (Flood and Scott, 1978; Roemer and Friedman, 1971; and Shortell, Becker, and Neuhauser, 1976).

Strengths and Limitations

Before presenting the results, we should note the important strengths and limitations of the present data base and approach. Considerable confidence can be placed in our estimates of differences in services and quality of care among hospitals since they are based on a very large number of observations per hospital. Also, detailed measures of patient characteristics are used to standardize service and quality measures for differences among hospitals in patient mix. Further, unusually varied and detailed measures of the organizational characteristics of the hospitals and their medical staffs are available. These strengths are somewhat offset by several serious limitations. First, our indicator of quality of care—death in hospital—while highly reliable, is severely limited in reflecting only mortality experience. Had the data sources permitted, it would have been greatly preferable to include other outcome measures such as morbidity or

return to function,[7] as well as to include information on patient condition after discharge. Second, although detailed measures of hospital and physician staff characteristics are available, there is some discrepancy in the time at which they are measured in relation to the patient data. As noted, patient information covers the period 1970 through 1973, while on-site collection of organizational data occurred in the spring of 1974. One must allow for the possibility that basic structural changes occurred within one or more hospitals during the period under study. A further limitation: since the original data were collected for a study of surgical care, most of the measures of physician staff are based on the characteristics of surgeons and the organization of the surgical staff. Surgeons constitute, of course, only a subset of the full medical staff. Third, although the measures of services and outcomes are based on the experience of a large number of patients, we have only a small number of hospitals on which to test predictions relating hospital characteristics to these dependent variables. Clearly, in presenting these results, our mode must be exploratory, and the results must be regarded as suggestive rather than definitive.

Results

Interrelation Among Service Intensity, Quality, and Cost

Before presenting the data relating to our predictions regarding organizational factors affecting services, cost, and quality of care, we note briefly the interrelations among these aggregated dependent variables. In all cases, except costs, results are based on the standardized measures. There exists a slight negative association between service intensity and service duration (-0.27):[8] hospitals delivering more services to patients than expected tend to exhibit shorter average stays than expected. Longer average service duration

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[7]An attempt to include in-hospital complications as another indicator of care quality had to be abandoned due to the poor quality of data in this area.

[8]All correlations are Pearson product moment. The significance level adopted for these analyses is $p \leq 0.10$. For an n of 17 and a two-tailed test, an $r \geq 0.412$ is significant at this level.

was slightly associated with higher average costs per patient episode (0.37), while the average level of service intensity showed no association with average costs per patient episode (0.07). Most important, a higher than expected level of services within a hospital was significantly associated with a lower than expected mortality rate (−0.43), while longer than expected service duration was significantly associated with a higher than expected mortality rate (0.64).

Analyses of these relations reported in detail in a companion paper (Flood et al., 1978) reveal that both indexes of services and the outcome measure were strongly influenced by regional location of the hospital. When relations among these measures are examined for hospitals within regions, however, the negative association between service intensity and mortality persisted while the positive association between service duration and mortality tended to disappear. In short, it appears that the association between duration of services and poorer outcomes, which was observed for all study hospitals, is probably due to regional variations in medical practice rather than to hospital differences.

Effects of Organizational Capacity on Service Duration, Intensity, Quality and Cost of Care: Zero-Order Associations

Table 2 presents the zero-order correlations among the several measures of organizational capacity and the measures of service intensity and duration, quality, and cost of care. We note that larger hospitals having proportionately more residents and more elaborate facilities tended to provide more services than expected—both intensity and duration—and to be characterized by higher expenses per patient episode. On the other hand, these same measures of capacity were not associated with better than expected outcomes. The only exception to this general pattern was that hospitals having a higher proportion of their beds devoted to intensive care tended to exhibit shorter than expected lengths of stay and better than expected outcomes.[9] Higher labor intensity also was associated with better out-

[9]Since the indicator of quality of care used is the hospital's mortality rate adjusted for differences in patient mix, a negative correlation is indicative of better outcomes, hence, higher quality of care.

TABLE 2
Effect of Hospital Capacity on Service Duration and Intensity, Quality and Cost of Care: Zero-Order Correlations*

Hospital Capacity:	Services		Quality: In-Hospital Mortality	Costs: Expenditures per Patient Episode
	Duration	Intensity		
Size:				
Total no. of staff	0.38†	0.41†	0.00	0.62†
Facilities:				
No. of different facilities	0.16	0.39†	0.02	0.65†
Percent of beds in ICU	-0.36†	0.54†	-0.32	0.29
Labor intensity:				
Ratio of total staff to ADC	-0.29	0.19	-0.44†	-0.05
Ratio of direct care nurses to ADC	-0.17	-0.22	-0.25	-0.48†
Teaching:				
Percent of residents	0.47†	0.18	0.09	0.71†
Qualifications:				
Ratio of RNs to LVNs	-0.31	0.29	0.05	-0.03
Average yrs of experience in nursing	-0.29	-0.31	0.30	-0.26
Percent surgeons with board certification	0.05	-0.08	-0.29	0.37†
Average yrs since residency	0.57†	-0.58†	0.60†	0.19
Extent capacity used:				
Occupancy rate	0.23	0.39†	0.22	0.30

*All measures of services and quality rates have been standardized to take into account patient mix of hospitals. Note that, since quality is measured by death rate, a negative correlation reflects a lower standardized death rate and thus better quality of care. *Abbreviations:* ICU = intensive care unit; RN = registered nurse; LVN = licensed vocational nurse; ADC = average daily census.
†Significant at ≤0.1 for one-tailed test; sample size of 17.

comes, but, at the same time, it was negatively associated with expenses.

The measures of qualifications were, in general, not related to services as predicted, or to quality of care. In general, training levels for both nurses (proportion RNs) and physicians (proportion board-certified surgeons) revealed little association with services and outcomes; costs tended to be higher in hospitals served by more board-certified surgeons. Nursing experience revealed no significant associations with services and outcomes, but length of practice for surgeons was strongly associated with longer service duration, lower service intensity, and poorer than expected outcomes. Finally, we had expected that lower occupancy rates—greater unused

capacity—would be associated with higher levels of services and costs, but the data tended to be in the opposite direction: higher occupancy rates were associated with higher service intensity.

Effects of Organizational Control on Service Duration, Intensity, Quality and Cost of Care: Zero-Order Associations

The zero-order correlations among the indicators of influence, coordination, and control within the hospital and physician staff on the measures of services, quality and cost of care are presented in Table 3. Beginning with the measures of influence of administrators and the surgical chief and his staff, we note that higher influence of both groups tended to be associated with longer service duration and

TABLE 3

Effect of Hospital Control Factors on Service Duration and Intensity, Quality, and Costs of Care: Zero-Order Correlations*

Hospital Control Factors	Services		Quality: In-Hospital Mortality	Costs: Expenditures per Patient Episode
	Duration	Intensity		
Influence:				
Administrative influence in own area	0.66†	–0.27	0.54†	0.37†
Surgical chief's influence in own area	0.33	–0.02	0.28	0.69†
Encroachment by medical staff	0.39†	0.26	0.16	0.31
Coordination within hospital:				
Ratio of supervisors to direct care personnel	–0.19	0.51†	–0.38†	–0.38†
Coordination within wards:				
No. of clerks on wards	–0.29	0.57†	–0.58†	0.06
Explicitness of nursing policies	–0.41†	0.41†	–0.19	–0.13
Coordination by professional units:				
Frequency of case discussions with pathologists	–0.64†	0.36†	–0.33	–0.26
Physician staff controls:				
Control over tenured staff	0.32	–0.61†	0.42†	–0.25
Proportion of contract physicians	0.41†	–0.27	0.38†	0.33
Control over new staff	–0.19	0.10	–0.28	–0.09

*All measures of services and quality rates have been standardized to take into account patient mix of hospitals. Note that, since quality is measured by death rate, a negative correlation reflects a lower standardized death rate and thus better quality of care.
†Significant at ≤0.1 for one-tailed test; sample size is 17.

with greater expenses per patient episode. This pattern was observed both for influence measures within each role group's domain of decision-making as well as for the measure indicating physicians' encroachment on administrative decisions. Administrative influence was also associated with poorer quality outcomes.

The several indexes of coordination also revealed a rather consistent general pattern. Higher levels of coordination within the hospital generally and in the patient care wards tended to be associated with shorter length of stay and lower expenses per patient episode but with a higher level of service intensity and better care outcomes. By contrast, two of the three measures of physician staff control indicated that a higher level of staff control over its own members tended to be associated with longer service duration, lower service intensity, and, unexpectedly, with poorer quality outcomes.

Combination Effects of Selected Measures of Hospital Capacity and Control on Service Intensity, Duration, Quality and Costs of Care: Multiple Regressions

Multiple regression analysis was employed to examine the combined effects of selected variables assessing both organizational capacity and control. Variables were selected in terms of their theoretical interest, the magnitude of their association with the dependent variable, and to provide breadth of coverage of the various types of factors considered. The results of one set of regressions are presented in Table 4. These results are representative of other regressions examined employing various combinations of factors and alternative indicators. Variables in Table 4 are listed in the order obtained in a step-wise regression. In addition to the zero-order association, this table reports the individual regression coefficients (B) for each variable, which are equivalent to their regression slopes partialling out the impact of the other variables in the equation, the standard error for B, and the standardized regression coefficients, or betas (β). Results of F tests are reported, which assess the significance of each partial coefficient as well as the significance of the combination of coefficients included within each prediction equation.

Table 4 *A.* reports results using the index of average-adjusted service duration as the dependent variable. Four variables stand out as very strong predictors of average length of stay: administrators' influence, average years of practice for surgeons, and proportion of

TABLE 4

Effect of Selected Measures of Hospital Capacity and Control on Service Duration and Intensity, Quality and Cost of Care: Multiple Regressions*

Selected Measure	r	β	B	Std. Error B	F
A. Service Duration					
Administrative influence in own area	0.66	0.38	0.96	0.18	27.40†
Average yrs since residency	0.57	0.80	0.35	0.04	78.77†
Total no. of staff	0.38	0.29	0.0006	0.0004	2.79
Control over new staff	–0.19	–0.60	–0.52	0.07	48.69†
Percent of beds in ICU	–0.36	0.59	52.45	9.59	29.90†
Explicitness of nursing policies	–0.40	–0.23	–0.59	0.20	8.15†
Percent of residents	0.47	0.35	4.87	2.61	3.49
Multiple R = 0.99	R^2 = 0.98		Overall F at final step		38.25†
B. Service Intensity					
Average yrs since residency	–0.58	–0.03	–0.038	0.35	0.01
Total no. of staff	0.41	1.03	0.006	0.003	3.31
Percent of residents	0.18	–0.52	–19.24	22.73	0.72
Ratio of supervisors to direct care personnel	0.51	0.32	20.20	16.56	1.49
Percent of beds in ICU	0.54	0.47	114.35	85.61	1.78
Control over new staff	0.11	–0.24	–0.55	0.69	0.64
Administrative influence in own area	–0.27	–0.03	–0.20	1.57	0.02
Multiple R = 0.86	R^2 = 0.75		Overall F at final step		2.56
C. Quality: In-hospital Mortality					
Average yrs since residency	0.60	0.73	0.0013	0.0006	4.70*
Administrative influence in own area	0.54	0.55	0.0056	0.0026	4.62*
Ratio of direct care nurses to ADC	–0.25	–0.33	–0.0067	0.0045	2.24
Control over new staff	–0.28	–0.38	–0.0014	0.0010	1.89
Percent of beds in ICU	–0.32	0.46	0.17	0.13	1.82
No. of clerks on ward	–0.58	0.08	0.0006	0.0024	0.07
Multiple R= 0.85	R^2 = 0.72		Overall F at final step		3.04
D. Costs: Expenditures per Patient Episode					
Percent of residents	0.71	–0.09	–152.59	1432.32	0.01
Control over new staff	–0.10	–0.02	–2.44	43.27	0.003
Administrative influence in own area	0.69	0.48	151.58	100.57	2.27
No. of different facilities	0.65	0.47	12.29	15.39	0.63
No. of clerks on wards	0.06	–0.21	–47.28	68.08	0.48
Total no. of staff	0.62	0.28	0.076	0.17	0.20
Multiple R = 0.85	R^2 = 0.73		Overall F at final step		3.58†

*All measures of services and quality rates have been standardized to take into account patient mix of hospitals. Note that, since quality is measured by death rate, a negative correlation reflects a lower standardized death rate and thus better quality of care. *Abbreviations:* ICU = intensive care unit; ADC = average daily census.
†Significant at ≤0.05.

beds in the intensive care unit (ICU) were strongly associated with longer than expected service duration; control over new staff was strongly associated with shorter than expected service duration. Explicitness of nursing policies was also significantly associated with shorter than expected duration of services. Of those variables significantly associated with service duration, only proportion of beds in the ICU changed the direction of its association, its zero-order relation being negative and its partial relation becoming positive. The combined effect of these variables was strongly significant. And, in combination, these variables accounted for 98% of the variance in the average service duration.

Table 4 *B.* reports a multiple regression with the index of average-adjusted service intensity as the dependent variable. Unlike the previous equation predicting service duration, in the equation predicting average service intensity none of the individual predictor variables reached significance nor was the combination of variables significant. The strongest individual predictor was size of staff, which tended to be associated with a higher than expected level of service intensity. Proportion of beds in the ICU was the next strongest measure. Both of these measures assess hospital capacity, and the direction of their association is as predicted. Although none of the individual variables was significant, in combination the variables accounted for 75% of the variance in the average service intensity.

Table 4 *C.* reports the regression of the measure of quality—standardized mortality rate—on selected measures of hospital capacity and control. Only two of the variables were significantly associated with average mortality: average years of practice for surgeons and administrators' within-domain influence were positively associated with adjusted death rate. Two other measures—of labor intensity and control over new surgical staff—were negatively associated with death rate (that is, positively associated with better outcomes) but neither association was strong enough to be significant. The overall F at the final step measuring the significance of the combination of predictive measures did not reach significance. The combined variables accounted for 72% of the variance in average-adjusted mortality.

Table 4 *D.* reports results of the regression of average expenditures per patient episode on selected measures of hospital capacity and control. No single predictor variable attained significance, but in

combination the variables were significant at the 0.05 level. The strongest single predictor variable was administrators' within-domain influence, a measure positively associated with higher costs, but this relation was not statistically significant. The combined variables accounted for 73% of the variance in expenditures per patient episode.

Two measures tend to stand out in Table 4 and in similar regression equations examined but not reported here. They are average years of practice for surgeons and administrators' within-domain influence. Each merits further brief examination.

Average years in practice since residency for surgeons is a measure based on data obtained from the study hospital or from AMA records. To a surprising degree, this measure tends to be positively associated with both average-adjusted service duration and mortality. We should recall that these two measures were themselves strongly associated (0.64). Moreover, this measure tended to be negatively associated with a large number of indicators that were themselves negatively associated with both mortality and length of stay. These measures include frequency of case discussions with pathologists (−0.71), control over new surgical staff (−0.13), proportion of beds devoted to ICU (−0.38), ratio of total staff to average daily census (−0.29), ratio of supervisors to direct care personnel (−0.50), number of clerks on wards (−0.53), and a number of other indicators of control and coordination developed but not included in this report.[10] These indicators of control and coordination were not themselves highly intercorrelated, but the consistency of their negative association with average years of surgeon practice is striking. The question was raised earlier about the proper interpretation of this indicator: these data suggest that a higher average number of years of practice for physicians was associated with more lax control and coordination arrangements.

As described in Appendix B, the indicator of administrators' within-domain influence is based on a question assessing the relative power of hospital administrators to influence a decision regarding contracting for a service such as a laundry. Like years of surgeon ex-

[10]However, note that two measures of physician staff control are notably absent from this list: control over tenured physicians and proportion of contract physicians. These two measures were positively associated with years of physician experience (0.25 and 0.15, respectively) and, as reported in Table 3, were positively associated with service duration and mortality. As previously noted, these associations were unexpected.

perience, administrative influence was positively associated with both average-adjusted service duration and quality, even when the effect of related variables was taken into account. And like years of surgeon experience, administrative influence was negatively associated with variables that were themselves negatively related to both mortality and length of stay. For administrators, these variables included most of the measures of coordination within the hospital: administrative influence was negatively associated with ratio of supervisors to direct care personnel (−0.41), number of clerks on the wards (−0.51), explicitness of nursing policies (−0.46), and ratio of total staff to average daily census (−0.38). As might be expected, given the pattern of relationships just described, administrative influence was positively associated with years of experience for surgeons, but only moderately so (0.24). Thus, both the measure of administrators' influence and average years of surgeons' experience appeared to be related to larger complexes of coordination and control measures that help to explain their observed association with differences in average service duration and quality of care.

Summary and Conclusions

It is not easy to summarize these results relating hospital characteristics to measures of services, outcomes, and costs. The small number of hospitals studied—only 17—severely limits the confidence to be placed in any generalizations relating hospital characteristics to these dependent variables. Nevertheless, the opportunity to study structure (hospital characteristics), process (service intensity and duration), outputs (patient care outcomes), and costs in a single study encouraged us to carry out this exploratory analysis.

The prediction that hospitals characterized by greater capacity would tend to provide more services than expected received some empirical support in our analysis. Zero-order correlations showed that hospitals with larger staffs, a higher proportion of residents, and more elaborate facilities exhibited higher levels of average service intensity and duration. When the effects of other variables were controlled in multiple regressions, partials for ICU beds, and resident and staff size, tended to be associated with longer than expected service duration; and ICU beds and staff size were slightly associated

with a higher than expected service intensity. For the most part, indexes of staff qualifications were unrelated to services, with one important exception: the average number of years since residency for surgeons was positively associated with service duration but negatively associated with service intensity.

Measures of capacity to deliver services showed only a slight association with quality of care as measured by standardized mortality rates. Measures of labor intensity tended to be slightly associated with better outcomes as assessed by both zero-order and partial correlations. Again, measures of qualifications were not associated with quality of care, with the exception of average years since residency for surgeons; this indicator was negatively associated with higher quality of care.

Measures of service capacity were positively associated with costs of patient care in zero-order analyses: staff size, facilities, proportion of residents, and proportion of board-certified surgeons were all positively associated with higher costs per patient episode. The only measure of capacity negatively related to costs was an indicator of labor intensity. When examined in multiple regressions, however, none of these measures remained significantly associated with costs.

Turning to measures of coordination and control, we find that most of the measures of coordination were positively associated with better quality care, as predicted. When the effect of other variables was controlled, however, few of these measures exhibited partials large enough to be significant. Contrary to expectation, two of the measures of physician staff controls—control over tenured staff and proportion of contract physicians—tended to be associated with poorer quality care.

No predictions were developed relating coordination and control to measures of average service intensity and duration. In general, coordination measures were negatively related to duration but positively related to service intensity. The two measures of physician staff control discussed above showed just the opposite pattern.

Finally, administrators' within-domain influence was positively related to service duration and higher costs but negatively associated with quality of care.

The negative association between control over tenured physicians and between administrators' influence and quality of care was not only unexpected but is contrary to the results of our earlier

study using these same measures (Flood and Scott, 1978). Even though the hospitals and the measures of these independent variables are the same in these two studies, discrepant results are quite possible given differences in the patient populations and outcome measures employed: briefly, the earlier study was based on a small subset of surgical patients treated during 1973 and 1974 and included measures of morbidity as well as mortality in the outcomes assessed. Nevertheless, we were surprised by the inconsistent results in these two similar studies.

Although the specific associations revealed in these analyses were not as clear and consistent as we would have preferred, the general research approach employed, which combines measures of organizational structure, processes, and outcomes into a single design and which attempts to adjust process and outcome measures for differences in the types of clients served, seems to us promising. Indeed, the low and/or inconsistent associations observed among these three types of measures indicate the dangers entailed in using one type of measure as a surrogate for the others—a practice all too common in health services research specifically and, more generally, in research on organizational effectiveness.

We recommend that analyses of the type explored here be carried out in a larger sample of hospitals. Increased sample size would greatly assist in sorting out the complexities of associations that seem to characterize the relations among the types of variables considered. Of course, improved measures of costs that take into account differences in patient mix are essential. Finally, we hope that others will explore the uses of patient abstract data as a potential source of information on that most elusive of all measures in service organizations—the outcome experienced by clients.

References

Blau, P. M., and Schoenherr, R. 1971. *The Structure of Organizations.* New York: Basic Books.

Brook, R. H. 1973. *Quality of Care Assessment: A Comparison of Five Methods of Peer Review.* DHEW Publication HRA 74-3100 (July). Washington, D.C.: Bureau of Health Services Research and Evaluation.

Child, J. 1974 and 1975. Managerial and Organizational Factors Associated with Company Performance: Parts I and II. *Journal of Management Studies* 11: 175–189; 12: 12–27.

Cohen, H. A. 1970. Hospital Cost Curves with Emphasis on Measuring Patient Care Output. In Klarman, H. E., ed., *Empirical Studies in Health Economics.* pp. 279–293. Baltimore, Md.: The Johns Hopkins University Press.

Commission on Professional and Hospital Activities. 1969. *Cholecystectomy Mortality: A Study from PAS and MAP.* Ann Arbor, Mich.: Commission on Professional and Hospital Activities.

Donabedian, A. 1966. Evaluating the Quality of Medical Care. *Milbank Memorial Fund Quarterly/Health and Society* 44 (Part 2, July): 166–206.

Flood, A. B. 1976. Professions and Organizational Performance: A Study of Medical Staff Organization and Quality of Care in Short Term Hospitals. Unpublished Ph.D. dissertation, Stanford University, Department of Sociology, Stanford, Calif.

———, and Scott, W. R. 1978. Professional Power and Professional Effectiveness: The Power of the Surgical Staff and the Quality of Surgical Care in Hospitals. *Journal of Health and Social Behavior* 19 (September): 240–254.

———, ———, Ewy, W. et al. 1977. Effectiveness in Professional Organizations: The Impact of Surgeons and Surgical Staff Organizations on the Quality of Care in Hospitals. Paper presented at the meetings of the American Sociological Association, Chicago, Ill., September, 1977.

———, ———, ——— et al. 1978. The Relationship Between Intensity of Medical Services and Outcomes for Hospitalized Patients. Paper presented at the meetings of the Pacific Sociological Association, Spokane, Wash., April, 1978. (Revised, December, 1978.)

Forrest, W. H., Jr., Brown, B. W., Jr., Scott, W. R. et al. 1977. *Studies of the Determinants of Service Intensity in the Medical Care Sector.* Report to the National Center for Health Services Research, DHEW, under contract HRA 230-75-0169 (September). Stanford, Calif.: Stanford Center for Health Care Research, Stanford University.

Fuchs, V. R. 1974. *Who Shall Live? Health, Economics, and Social Choice.* New York: Basic Books.

Georgopoulos, B. S., and Mann, F. C. 1962. *The Community General Hospital.* New York: Macmillan.

Goodman, P. S., and Pennings, J. M. 1977. *New Perspectives on Organizational Effectiveness.* San Francisco, Calif.: Jossey-Bass.

Goss, M. E. W. 1970. Organizational Goals and Quality of Medical Care: Evidence from Comparative Studies of Hospitals. *Journal of Health and Social Behavior* 11 (December): 255–268.

Kohl, S. G. 1955. *Perinatal Mortality in New York City.* Cambridge, Mass.: Harvard University Press.

Lipworth, L., Lee, J. A. H., and Morris, J. N. 1963. Case-Fatality in Teaching and Non-Teaching Hospitals, 1956–59. *Medical Care* 1 (April/June): 71–76.

Longest, B. B., Jr. 1974. Relationship Between Coordination, Efficiency, and Quality of Care in General Hospitals. *Hospital Administration* 19 (Fall): 65–86.

Morse, E. V., Gordon, G., and Moch, M. 1974. Hospital Costs and Quality of Care: An Organizational Perspective. *Milbank Memorial Fund Quarterly/Health and Society* 52 (Summer): 315–345.

Neuhauser, D. 1971. *The Relationship Between Administrative Activities and Hospital Performance.* Research Series 28. Chicago, Ill.: Center for Health Administration Studies.

Price, J. L. 1972. The Study of Organizational Effectiveness. *The Sociological Quarterly* 13 (Winter): 3–15.

Pugh, D. S., Hickson, D. J., Hinings, C. R. et al. 1968. Dimensions of Organization Structure. *Administrative Science Quarterly* 13 (June): 65–91.

———, ———, ——— et al. 1969. The Context of Organization Structures. *Administrative Science Quarterly* 14 (March): 91–113.

Roemer, M. I. 1959. Is Surgery Safer in Large Hospitals? *Hospital Management* 87 (January): 35–37ff.

———, and Friedman, J. W. 1971. *Doctors in Hospitals.* Baltimore, Md.: The Johns Hopkins University Press.

Rushing, W. 1974. Differences in Profit and Nonprofit Organizations: A Study of Effectiveness and Efficiency in General Short-Stay Hospitals. *Administrative Science Quarterly* 19 (December): 474–484.

Scott, W. R. 1977. Effectiveness of Organizational Effectiveness Studies. In Goodman, P. S., and Pennings, J. M., eds., *New Perspectives on Organizational Effectiveness* pp. 63–95. San Francisco, Calif.: Jossey-Bass.

Shortell, S. M., Becker, S. W., and Neuhauser, D. 1976. The Effects of Management Practices on Hospital Efficiency and Quality of Care. In Shortell, S. M., and Brown, M., eds., *Organizational Research in Hospitals.* Chicago, Ill.: Blue Cross Association, Inquiry Book.

Stanford Center for Health Care Research. 1974. *The Study of Institutional Differences in Postoperative Mortality: A Report to the National Academy of Sciences-National Research Council.* Springfield, Va.: National Technical Information Service.

Steers, R. M. 1977. *Organizational Effectiveness: A Behavioral View.* Pacific Palisades, Calif.: Goodyear.

Appendix A
Rationale and Procedures Used to Standardize Services and Outcomes for Patient Health Status

The rationale and procedures for standardization are essentially the same for service intensity, duration, and outcome. To simplify this discussion, we use services as the primary example.

The Rationale for Standardization

Our approach makes the important assumption that patients with a given initial health status (including the disease for which they are being treated and their general condition at the time of admission) have a "need" for services which is (can be viewed as) constant across all hospitals. To estimate what types and amounts of services are needed by what types of patients, an empirical regression procedure is employed based on the experience of all patients in the study, ignoring in what hospital they are treated. Having determined what each patient "needs" in the way of services, we can also determine what services the patient has actually received in the study hospital under the assumption that the types and amounts of services hospitals actually provide will vary greatly. It is the discrepancy between what services a patient needs and what services are actually received that is the datum of primary interest.

How best to assess the need for services is a difficult question, both theoretically and empirically. Clearly, one of the most important determinants of the amount and types of services needed is the nature of the disease and the general condition of the patient on admission. A second important determinant, whether the patient undergoes surgery, increases the likelihood of receiving specific amounts and types of services—for example, the need for blood. A third determinant, complications that arise during the hospitalization (intermediate outcomes), also increases the likelihood of requiring additional services. A fourth determinant, leaving the hospital before complete recovery, clearly implies some "need" not only for more days of care but for specific types of services as well. Death in hospital is, of course, the extreme example of incomplete recovery and immediately ends the "need" for services.

To assess the four types of factors affecting need for hospital services, we defined four basic sets of standardization variables, incorporating over 40 different measures:

1. *Admission Status.* This set of variables included the major diagnosis explaining admission to the hospital using 332 diagnostic groups; several indicators of the patient's physiological status such as additional diagnoses, admission test findings, and severity of the disease; and several demographic characteristics such as age, sex, and a height-weight index.
2. *Surgical vs Medical Treatment.* For surgical patients, the indicators included the number of (non-diagnostic) operations and the severity of the operations undergone.
3. *Complications.* This set of variables included in-hospital infection as well as other complications.
4. *Discharge Status.* This set of variables included death at discharge, transfer to another facility, or discharge with incomplete recovery.

For most of the analyses reported here involving service intensity and duration, all four sets of standardization variables were used. The only exception occurred when the relation between services and outcomes was assessed and then, of course, the variables measuring death in hospital were excluded as predictors of services.

These four factors affecting the need for services were used to estimate the impact of a patient's health status on the amounts and types of services needed. But before detailing the standardization procedure, let us turn briefly to two additional considerations incorporated into our approach: the unit of analysis in assessing intensity of services, and the assumption of the independence of sets of services.

During a hospitalization episode, a patient can receive varying amounts of several different types of services. Some authors point out that the *rate* of services consumed during a single hospitalization is not constant, but varies by day of stay—usually being a higher rate at the beginning of the stay. We chose not to focus on the rate at which a patient consumed services, in defining the intensity of services. Instead, we examined two different measures summarizing the total amount of services received during the entire stay. We called the total amount of a given specific service consumed the "intensity"

of that service delivered to the patient. The total length of stay we called the "duration" of routine services. The duration of services reflects the total amount of routine nursing and hotel services consumed. (Note that intensive nursing care is treated as a specific service and variations in nurse/patient ratios are examined as a capacity measure.)

The second assumption incorporated into our approach is the independence of services consumed, for purposes of defining the "need" of the patient for each service. In defining the seven specific medical services, we took care to group interdependent services to the extent possible. Thus, categories of drugs were grouped together as one type of service; radiographic examinations for diagnostic purposes were grouped, and so on. In this manner, we have assumed that the seven types of services can be delivered independently of the other classes of services. For example, we assume that the number of drugs does not depend on blood use, etc. Therefore, the "need" for each service can be derived independently. The one major exception to this assumption was the belief that surgery (a class of service) is interdependent with the other services so that, for example, the need for intensive care, blood, and drugs does depend on whether the patient underwent surgery. We handled this interdependence by using surgery as one of the predictor sets in assessing the need for other services.

Standardization Procedure

The standardization procedure involves assessing the needs of a patient for a given service by comparing that patient with other similar patients. The first step in determining what patients are similar is to group patients into one of the 332 diagnostic categories on the basis of their final diagnosis explaining admission. Within each diagnostic group, the standardizing variables (age, additional diagnoses, operation, discharge status, etc.) are used to predict the amount of service needed by each patient. It is important to note two consequences of this procedure. The assumption of independence of need for each service (except surgery) is made only for services supplied to the same diagnostic category of patients. And the impact of each standardization variable for predicting the need for each service can vary across diagnostic groups. For example, age could be a very important predictor of intensive care for gallbladder patients,

but not so for cardiac patients. The standardization procedure described below was then performed for each of the seven specific services reported here and for duration of services separately for each of the 332 diagnostic categories, or $8 \times 332 = 2656$ times. The final index of specific service intensity was based on the seven independently adjusted measures, combined to reflect their relative costliness as detailed in the main part of this paper and in footnote 3.

In the standardization procedure, data obtained from the PAS abstracts of all 603,000 patients are pooled into one of 332 groups by final diagnosis explaining admission. Through linear regression, an estimate is obtained of the impact of each of the predictor variables on the amount of medical services of a given type received by a patient. Each estimate of the impact of the predictor variable (i.e., the unstandardized coefficient) is multiplied by the actual value of each predictor variable (e.g., age, diagnosis, number of operations, and so on) observed for a given patient. The sum of these products for a given patient provides an estimate of the amount of the service "needed" by that patient. The estimate of what is needed is based on the average experience of similar patients in the "standard hospital"—which, in this case, is simply all hospitals combined. Having determined the amount of service needed by (predicted for) the patient, we also assess the amount of service actually received. The estimate of services needed is used as the baseline for a given patient against which we can observe whether more or fewer services were actually received than expected on the basis of the patient's health status.

In a similar manner, the likelihood of dying in the hospital is calculated for each patient based on the experience of all patients having similar characteristics in the study hospitals combined, and is compared with information on whether the patient actually did die. Discrepancies are measured and, as with services, can occur in either direction. The greatest disparities occur, of course, when a patient with a low likelihood of dying actually does die and when a patient with a high likelihood of dying is discharged alive instead.

Since our primary interest is in examining the relation between structural features of hospitals and service intensity, duration, and outcome, the final step is to aggregate the standardized measures of each of these variables for all patients in each study hospital. In this paper, only a composite measure of the intensity of the specific services is examined. The composite, which combines the adjusted

measures to reflect their relative costliness, is also aggregated for all patients in the study hospitals. The measures reflect whether patients in each hospital received more or fewer services than expected, remained in the hospital a longer or shorter time than expected, and experienced a better or poorer outcome than expected in comparison with other patients with similar characteristics but treated in different hospitals.

Appendix B
Measures of Hospital Control

Influence Measures

To determine the relative influence of the administrator and the heads of the physician staff in affecting various types of decisions in the study hospitals, we asked informants in each hospital to rate, on a five-point scale, the amount of influence exercised by a given position on a specific, hypothetical decision. Responses were obtained by interview or questionnaire from the following types of informants: hospital administrators, chiefs of surgery, chiefs of anesthesia, directors of nursing, ward supervisors, head nurses, and ward nurses. Positions rated include the hospital administrators, chiefs of surgery, the director of nursing services, and physicians as a group. Ratings from all respondents in the same position were first averaged; then these position scores were themselves averaged. Respondents within hospitals exhibited a very high degree of consensus in their assessments of the influence exercised by the various positions on specified decisions.

After combining the data from all hospitals, we observed that the distribution of influence by position, as expected, varied greatly by type of issue. Based on these profiles as well as on the content of the decision items, we distinguished between the "within-domain" influence of a role group and its "encroachment" into the decision terrain of other role groups. The decision item used to assess the within-domain influence of the hospital administrator was "a decision to purchase contract services, e.g., laundry." The average rating given by the respondents in each hospital to the administrator provided the hospital's score on this indicator. The same decision

item also served to assess the extent of encroachment by the physicians on the terrain of the hospital administrator: the greater the reported influence of physicians as a group on this item, the higher the encroachment. To assess the within-domain influence of the chief of surgery, responses to three decision items were combined: "a decision to add a clinical service, e.g., an intensive care unit"; "a decision to add an ear-nose-throat specialty room in the operating suite"; and "a decision to terminate a major department head, e.g., the operating-suite nursing director." As before, responses from all respondents were combined into a single score for each hospital.

Coordination Measures

The ratio of supervisory to direct care personnel measures the number of supervisory and managerial personnel to the staff engaged in patient care activities. The latter group does not include physicians but does include all personnel engaged in technical support activities, such as in the laboratories. Data are drawn from a questionnaire completed by each hospital administrator. The measure of the average number of ward clerks and secretaries—a measure of coordination activities at the ward level—is based on data supplied by head nurses for each ward.

To assess the extent to which coordination was effected through use of formal rules, nursing respondents from each hospital were asked to rate on a five-point scale the degree to which explicit general nursing policies had been developed. The specific items included were dress or attire on the wards; returning to work after an illness; and conditions for which nurses could be requested to work overtime. For each hospital, average ratings were obtained from the ward supervisors as a group, the head nurses as a group, and from non-rotating staff nurses working on the day shift as a group. The ratings were then combined into a grand mean for each hospital.

Control Within the Physician Staff

To assess the extent of control exercised by the physician staff over new staff members, several questions were asked of the chief of surgery. The questions sought information on: 1) the existence of separately defined probationary periods for different surgical

specialties; 2) the presence of any waivers of probationary period (no waivers receiving a higher score); 3) the number of groups or positions that must review applications for staff privileges; and 4) the length of the usual probationary period. Reponses to these questions were standard-Z-scored, and then added together to provide a composite index.

A similar approach was used to assess the control exercised by the physician staff over its tenured members. The questions provided information on: 1) restrictions on the surgical privileges granted to general practitioners; 2) the use—not simply the existence—of written procedures to review the surgical privileges already granted; 3) the number of years for which privileges are granted (item reversed so that shorter periods received higher scores); and 4) the existence of explicit criteria defining who can serve as the first assistant to the surgeon. As before, all information was obtained through an interview with the chief of surgery; items were standard-scored before being combined into a composite index.

Roemer and Friedman (1971) have argued that the proportion of contract physicians on the medical staff is a good indicator of the extent to which the physician staff organization is tightly organized. Information for this measure is provided by the administrator for each hospital.

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