Cost of Elective Surgery and Utilization of Ancillary Services in Teaching Hospitals

Steven R. Eastaugh

Measures of surgical utilization studied are the number of elective tests performed preoperatively and the total cost per case. The unit of analysis is a matched pair of patients who underwent the same elective procedure, one a Veterans Administration patient, and the other a municipal or voluntary hospital patient. Federal ownership of the hospital had the strongest impact on tests and cost per case. On average, costs for the VA patients were 52 percent more per case.

The foreign medical graduate variable had a large positive (inflationary) effect on the number of tests, but a slight downward influence in the cost regressions. The fraction of surgeons with faculty appointments had a strong negative (curtailing) impact on elective testing, but an upward influence on cost per case. Additional variables such as age, average laboratory turnaround time, and fraction of the medical school's students doing their surgical clerkship at the hospital had a slight upward influence on utilization. The three policy issues raised in the study involve changing the hospital reimbursement incentives, targeting continuing education programs to categories of staff that need it most, and redistributing faculty and students.

HOSPITALS have priced themselves into the public eye. Since 1950 the hospital sector has grown from an industry that consumed 1.1 percent of Gross National Product to one that consumes 3.5 percent of GNP[1]. The increasing proportion of governmental financing of hospital care compels accountability. Excessive number of tests and long lengths of stay are two central issues in the public debate about rising hospital costs[2]. The purpose of this study is to discover some of the factors contributing most to excessive utilization of hospital services. There has been a dramatic growth in laboratory tests per patient episode. Scitovsky found that lab tests per episode increased between 1964 and 1971 by anywhere from 25 to 33 percent for simple, well-defined diagnostic categories like simple appendicitis and acute myocardial infarction, to 90 to 110 percent for perforated appendicitis and breast cancer cases, respectively[3]. In a sample of 285 hospitals during the period 1968 to 1971, Redisch found that laboratory tests per patient day increased at an average annual rate of 9 percent[4]. Expenditures for laboratory tests and other nonpersonnel items have the highest rate of increase of any element responsible for rising hospital costs[5].

Excessive use of tests and procedures are a source of concern not only because they are costly but because they are unnecessary. Evidence that Ameri-

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Address communications and requests for reprints to Steven R. Eastaugh, Assistant Professor of Health Economics, Graduate School of Business and Public Administration, Sloan Program of Hospital and Health Services Administration, Malott Hall, Cornell University, Ithaca, NY 14853.

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can medicine has a high degree of unnecessary utilization has frequently appeared in the literature. A recent study by Neuhauser and Jonsson found that the American physician appears to use three times as many tests to decide upon a simple elective surgical diagnosis as does a comparable Swedish physician[6]. One possible explanation is that American surgeons do more testing because they are more discriminating in deciding to operate. Unfortunately, this is not consistent with the fact that the operation rate per 10,000 population is 18 percent lower in Sweden relative to the United States for inguinal hernia, and 25 percent lower for cholecystectomies and prostatectomies[6]. The Swedish patients have the same age and diagnosis-specific mortality rates as their American counterparts, so that all the additional utilization observed in American hospitals may not be considered medically necessary.

Utilization patterns are not merely a function of patient characteristics and the requirement of "good medicine." Medical care requirements can be met with different amounts of resources and length of hospitalization. How these requirements of good medicine are met depends in some part on the physician characteristics and the hospital environment. Surgical utilization is probably affected by hospital characteristics such as the laboratory turnaround time, the availability of hospital beds, the availability of a surgical suite, and the type of hospital ownership (federal, voluntary, municipal).

Physician background characteristics are also determinants of physician behavior. The duration of stay and number of tests per patient are likely to be affected by the educational background of the surgeon and the strength of the affiliation with the local medical school[7]. A causal sequence is implied here: differing combinations of physician and hospital characteristics lead to different styles of medicine, which in turn lead to different utilization patterns. For example, one might presuppose that medical school faculty members involved in patient care have a professional interest in curtailing inappropriate prescriptions, but it might not always be in the faculty members' interests to curtail all types of excessive utilization. Faculty members and attending physicians might have an interest in maximizing revenues for new equipment because of their interest in technology. Lave and Leinhardt have examined length of stay in considerable detail, but omit consideration of hospital characteristics from the analysis because their sample consists of individuals from only one hospital.[8] The authors conclude that the major reason why length of stay is so long and costs so high in the urban teaching hospital they studied "is because residents, due to their comparative youth and lack of experience, order more tests."[8] Foreign medical graduates (FMGs) might also be expected to require more tests per case because their training is not as extensive or as diagnosis-oriented as that provided by the typical American medical school[9] Presumably, an inferior education is associated with greater uncertainty and the need for more time between sequential decisions and perhaps the need for more information (more tests)[10].

Other interpretations may account for the unnecessary utilization described here. For example, one explanation for increasing lab utilization is that the American surgeon is coerced by the threat of a malpractice suit into ordering more tests. However, a survey of physician attitudes conducted by the staff of the *Duke Law Journal* suggests that the threat of malpractice had a minuscule effect on what they called

positive defensive practices, i.e., ordering excessive laboratory tests[11]. The study by Scitovsky cited previously suggests that a technological inflation in the quantity of tests and price of the procedures predates the so-called malpractice "crisis" by 20 years[3]. The problem in interpretation here is that a number of variables, some related to the patients, some to the hospital, and some to the physician, all tend to influence utilization. The way in which that interaction occurs is most complex and demands further research.

Most of the multivariate regression studies emphasize the effect of insurance coverage on various hospital output and cost measures (cost per diem, laboratory charges per episode, length of stay). These studies vary with respect to objectives and methodology. The customary approach involves an aggregate cross section of individual state or hospital observations, for each of a number of years[12]. Davis found a positive relationship between insurance and the length of hospitalization and cost per episode. Feldstein[13] and Hu and Werner[14] provide corroborative evidence that more highly insured areas have higher costs per episode and longer stays, on the average. Feldstein estimated an average length of stay equation from a cross section of the 50 states, for each of ten years. Hu and Werner studied hospital and demographic characteristics in 70 hospital regions in Pennsylvania. Price per diem and mean patient income had no effect in the Hu-Werner length of stay equation, but insurance has a length of stay elasticity of 0.41 measured at the sample mean. The finding of a positive insurance effect disagrees with the results reported by Lee and Wallace in a study of Medicare patients' length of stay within multihospital regional catchment areas[15].

Two more recent studies by Huang[16] and by Freiberg and Scutchfield[19] provide persuasive evidence that insurance does not affect length of stay. The "moral hazard" argument advanced by Freiberg and Scutchfield suggests that the more highly insured patients should have more tests and longer length of stay, because demand is less constrained by cost considerations. However, their econometric evidence rejects this hypothesis and suggests statistically insignificant negative coefficients[17]. The findings in the literature pertaining to the effects of insurance on utilization per episode are somewhat mixed. Overall, the preliminary evidence indicates that insurance does not affect length of stay but that it is a contributory factor to rising costs.

Huang[16, p. 12] provides an example of a multivariate study of the effect of physician and hospital characteristics on utilization, with the individual patient as the unit of analysis. Huang applied data on 27,210 patients discharged from six Washington hospitals in 1975 to analyze the effects of hospital characteristics on length of stay and costs per episode. For 18 medically homogeneous diagnoses Huang estimated reduced form equations for length of stay and found the dummy variable for insurance to be statistically insignificant, but three factors with significant positive impacts on length of stay and laboratory charges are whether the hospital had a) a medical student teaching program, b) a professional nursing affiliation, and c) an internship program. Huang's findings concerning the influence of affiliation on utilization corroborates earlier findings by Salkever[18]. Salkever used a principal components analysis to delineate case-mix variables for the 73 New York hospitals sampled and found that interns and residents per episode had statistically significant positive im-

pact on length of stay and costs per case.

Statistical Methods

The data for the analysis were drawn from 780 records obtained at 19 hospitals for elective herniorrhaphy, prostatectomy, and cholecystectomy patients. The 12 VA hospitals in the study represent a 9 percent random stratified sample of VA hospitals performing surgery. The 12 VA facilities were selected from the stratification of 135 VA general hospitals by bed size, average length of stay, and research budget[19]. The nonfederal hospital sample consisted of 3 municipal and 4 voluntary hospitals from the same cities as the VA hospitals. The nonfederal hospitals had approximately the same bed size and annual number of adult surgical admissions as the VA hospital in the same city. Of 9 nonfederal hospitals asked to participate in the study, 7 agreed.

The patient pairs were drawn from among two samples: 360 VA patients from 12 VA hospitals, and 420 nonfederal patients from 7 nonfederal hospitals. The 360 VA patients were drawn as a random sample, but the 420 nonfederal patients were selected in order to have patient characteristics that were as nearly similar to the federal patients as possible[20]. The research rationale was to minimize the variance in patient case-mix characteristics in order to measure the effects of staff and hospital characteristics on utilization and cost. The first step in the matching process was to select the covariables on which the two samples were to be matched. The six patient characteristics under consideration were age, sex, primary diagnosis, secondary diagnosis, socioeconomic status, and distance from the hospital. The first stage in the matching process was to have nurse record abstractors enter the nonfederal facility with information on the already selected federal patient pool and select a nonfederal sample that had the same sex, primary diagnosis, and welfare status. Stage two in the matching process was to apply Caliper matching methods based on predefined ranges of what constitutes an acceptable match, e.g., any nonfederal partner had to be within four years, plus or minus, of the federal patient's age[21]. Stage three in the sampling design involved using nearest available matching methods after the data collection stages were completed, for final pairing of the nonfederal and VA patient groups on the basis of age, secondary diagnosis, and five-digit zip code number[22]. Patients with a preadmission visit to the hospital (9 percent) had their medical record abstracts coded with a -1, so that in the matching process, only patients with equivalent preadmission workups were matched with one another. One of the explanations for the tendency of private insurance patients to have fewer tests and days of preoperative stay is that their admission was preceded by a preadmission visit, but 91 percent of the patients in our sample entered the hospital without any preadmission tests. In the final analysis, 102 VA patients remained unmatched, compared to 162 unmatched nonfederal patients, and 258 VA-nonfederal patient pairs were formed [7, Chap. 4].

The following regression approach is proposed for determining how much of the variation in tests and cost per case are patient related, hospital related, or staff related. The eight dependent variables to be studied for the sample are the ratios between pairs in 1)prostatectomy cost; 2)herniorrhaphy cost; 3)cholecystectomy cost; 4)cost per episode, for the sample of three types of elective surgery; 5)number of elective tests[27] ordered preoperatively for

prostatectomy patient pairs; 6)number of elective tests ordered preoperatively for hernia patient pairs; 7)number of elective tests ordered preoperatively for cholecystectomy patient pairs; and 8)number of elective tests ordered preoperatively for all surgical patient pairs.

Implicit in this analysis is that to do more tests or to require higher costs for producing the same product is inappropriate or wasteful behavior, i.e., the behavior is unnecessary in that the marginal benefits of more tests or days of hospitalization are minimal.

The definition of an unnecessary test in this context is one that did not make the partner better off relative to his match, undergoing the same operation, with the same outcome. Operationally, an unnecessary test is one that was provided to only one member of the pair and that Payne[23] defines as unnecessary for a partner with given case-mix characteristics, i.e., age, sex, and diagnoses. Pauly[24] has provided a more stringent definition of what is unnecessary in the context of surgery relative to "a potential partner who has at least as much knowledge and understanding of possible costs and consequences as the physician." It should be emphasized that, in this project, the criteria used to define unnecessary tests and days of stay were both professional, as Payne suggested, and normative, relative to the matched patient pair.

Operationalization of the Variables

Product definition is a most complex problem in the field of medical economics. An operational definition of a required intermediate product would be a test that was required in nearly 100 percent of the patients in the diagnostic category under study. For example, cholelithiasis is almost always confirmed in our sample of cholecystectomy patients by radiologic evidence of single or multiple gallstones, or by evidence of a nonfunctioning gallbladder by observing the movement of concentrated amounts of gallbladder dye. Some tests are elective, such as a serum amylase assay, because the majority of clinicians do not believe that this test is necessary to rule out the possibility of pancreatitis[23].

The information on costs came in two forms, depending on whether or not the hospital had a patient-based system of charges. For example, four hospitals in the sample had patient-based accounting systems for billing purposes; thus one only needed to ask for the costs and charges. Costs were assigned to the surgical department by means of the multiple apportionment algebraic method of cost allocation[25]. However, 12 VA hospitals[1] and 3 municipal hospitals in the sample had no need for itemized billing, and thus had no need for a price list or a charge-to-cost ratio. Consequently, a relative value scale for assessing imputed charges had to be developed. This was done in three ways. First, the hospital and ancillary costs were reduced to a relative value scale by averaging prevailing hospital charges in the region (see Table 1). Second, the surgeon's fee for the area was taken from the Social Security Administration Survey of Prevailing Charges[26]. Third, in the case of the 12 federal hospitals and 3 municipal hospitals, the resources utilized in the elective surgical episode were multiplied by the relative value scale and multiplied by the conversion factor measured in dollars per relative scale unit to obtain dollars per episode[25, pp. 191–193].

All patients sampled were middle-aged males eligible for Medicaid and free VA hospital care. Three patient

Table 1:
Relative Value Scale for Costing Out Elective Surgical Services at the 12 VA Hospitals and 3 Municipal Hospitals without a Schedule of Charges

	Relative Value Scale
I. Fixed Charges	
Surgeon's Fee:	
Incisional Prostatectomy	5.6
Cholecystectomy	4.2
Unilateral Inguinal Hernia	2.5
Anesthesiologist	1.75
Operating Room	1.2
Recovery Room (2–4 hours)	0.5
Anesthesia	0.26
II. Variable Charges*	
Basic Room Rate (per day)	0.75
Pulmonary Function Test	0.60
Cholecystogram	0.47
Cystourethrogram	0.40
Intravenous Pyelogram	0.35
Upper Gastrointestinal Series	0.32
Barium Enema	0.29
Sigmoidoscopy (Proctoscopy)	0.22
Chest X-Ray	0.16
Serum Amylase Assay	0.14
Creatine Clearance	0.11

*Excluding tests necessary for admission at all 15 hospitals, and the 4 voluntary hospitals.

characteristics are included in the regression analysis as independent variables:

- P_1 Distance from hospital to home in miles
- P_2 Dummy variable for lack of unmatched secondary diagnoses, between pairs
- P_3 Patient age.

The independent variables selected for inclusion in this study were chosen for reasons of either past performance in other studies or future relevance for public policy. For example, a dummy variable for affiliation with a medical school and the percentage of physicians with more than ten years of clinical experience were omitted from this study because they were considered poor proxy measures for our medical school student and faculty variables.

The list of independent variables, which will also be expressed as a ratio of the nonfederal patient value for the data item divided by his matched federal partner's value, includes the following three physician-staff characteristics:

- S_1 Fraction of surgeons (excluding anesthesiologists) at the facility who are FMGs
- S_2 Fraction of the attending physicians on the surgical service with actual teaching faculty appointments at the local medical school who receive

salary from the school (intended as an index of the hospital's dependence on the medical school for physicians)

S_3 Fraction of the affiliated medical school's students who did their required core clinical clerkship on the hospital surgical service (intended as an index for the school dependence on the hospital as a trainingground).

As described in the literature review, Huang[16] and Salkever[18] have suggested a strong positive association between the teaching function and more frequent utilization of tests and hospital days. The fraction of the medical school's students depending on the individual hospital as a source of clinical education is intended as a proxy measure of the school's dependency on the hospital. One might suggest that if the school is highly dependent on a hospital for teaching cases, the students, interns, residents, and attending physicians, acting as agents of the school's interest, would have added reason to increase length of stay in order to maximize the number of teaching days available and to maximize tests and cost per case in order to serve a technological interest in maximizing revenues for new equipment[27].

Three hospital characteristics included in the list of independent variables are

H_1 Laboratory turnaround time on the average for seven basic tests

H_2 Hospital occupancy rate

H_3 Federal ownership of the hospital (in this specification, the equation intercept).

Nonoptimal use of tests and unnecessary costs presumably may be due to the inadequacies of the hospital in providing ancillary laboratory support or surgical suites. Inappropriate utilization can be attributed to both a "systems" failure of the institution and/or a staff behavior problem. The research question then becomes one of asking how much staff improvement can be expected for a given change in the independent variables holding the following factors constant: patient age, sex, primary and secondary diagnoses, welfare status, distance from the hospital (six patient characteristics), bed availability (occupancy), and lab turnaround time. Unless one considers all these factors simultaneously, one really is not measuring the variance truly attributable to staff characteristics.

This model is estimated by the ordinary least-squares method by taking the natural logarithms of all variables. This double-log form is commonly employed because the estimated regression coefficients are the elasticities of the independent variables with respect to the independent variables. Conceptually, 258 patient pairs producing 258 paired ratios of nonfederal to federal data is equivalent to 258 first differences of logs. By matching patient pairs, instead of having 516 observations with $9+m$ independent variables (where m is the additional number of variables needed to measure the constructs captured in the matching process, such as primary diagnosis, sex, welfare, urban-rural differences), one is left with 258 log differences and only 9 independent variables.

Results

The results of the regression analysis for cost per case, displayed in Table 2, indicate that federal ownership had the largest elasticity. The dummy variable coefficient implies that federal hospital cost per matched surgical case was 52.3 percent higher than nonfederal hospital care, *ceteris paribus* (the estimated co-

efficient is 0.4231 which equals 1n(1 + 0.523). The average total cost per case was $3,174 in federal hospitals, $1,980 in municipal hospitals, and $2,217 in voluntary hospitals (Table 3). The average per-diem cost was $198 in federal hospitals, $187 in municipal hospitals, and $216 in voluntary hospitals. The finding that the voluntary hospital per diem is 9 percent higher than the federal per diem is consistent with a National Academy of Sciences study finding, using almost the same group of hospitals, and 1975 prices. The NAS study group found that on the average the nursing costs per diem for voluntary hospital surgical patients exceeded federal surgical per diems in nursing by 19.8 percent[16]. But expressed in terms of nursing costs per surgical case, the federal hospitals were $262 more costly than voluntary hospitals. Nursing costs represented only 30 percent of total per-episode costs.

The two diagnoses in columns two and three of Table 2, treated by general surgeons and nonspecialty surgical residents, had the largest coefficients for the federal ownership variable. Whereas, transurethral prostatectomies, which were always done by either urologists or urological residents, had the smallest coefficients for the federal ownership variable. For example, federal costs per case exceeded nonfederal costs, on the average, by 72.1 percent in the case of cholecystectomies and 69.6 percent in the case of prostatectomies. Specialists appear to be increasingly autonomous from the institutional variable of federal ownership. Additional empirical support for this expectation is provided by the elective test regressions in Table 4. On the average, the number of elective tests for federal patients exceeded the number for nonfederal patients by 184 percent in the case of hernias and 116 percent in the case of cholecystectomies, but the percentage difference was only 18 percent in the case of prostatectomies. Finally, the regressions were run with linear and double-log logit specifications. No significant changes in the signs or significance of the coefficients were observed, but the fit was inferior. A dummy variable for strength of affiliation (whether the hospital was a member of the Council of Teaching Hospitals) was omitted from the analysis because this variable was insignificant and interacted with the student and faculty variable to make each less significant (but still significant at the 0.10 level for a two-tailed test).

The following five findings summarize the results obtained in comparing utilization efficiency between different hospitals producing the same product.

1. The federal ownership hospital characteristic was consistently the most significant variable in explaining the variance between matched patient pairs in tests utilized and cost per case. On the average, VA patients had 104 percent more preoperative elective tests performed per case, all else being equal in the equation. VA patients also had 52 percent higher costs per elective surgical case for the same operation, *ceteris paribus*. One policy implication of these results is that shifting surgical patients from federal to nonfederal facilities seems cost effective and may also prove quality-beneficial according to the National Academy of Sciences study of VA hospitals[19].

2. The size of the coefficient for the federal ownership variable was much smaller when the surgery is done by a specialist, compared to the sample of surgical cases treated by nonspecialists. However, the federal ownership variable was still the most statistically significant variable in all the regressions. The finding that the federal ownership coefficient was five to nine

Table 2:
Cost Equation Regression Results (*t* Values in Parenthesis)

Type of Surgery	**Transurethral Prostatectomies**	**Unilateral Inguinal Hernias**	**Cholecystectomies**	**Elective Surgery (Columns 1–3)**
Type of Surgeon	**Specialist**	**Generalist**	**Generalist**	**Specialist or Generalist**
Sample Size (Patient Pairs)	109	99	50	258
R-Squared	0.8145	0.5199	0.7300	0.6441
Elasticity Coefficients for the following 9 independent variables:				
Staff Characteristics				
1. Fraction of Surgeons that are FMGS	−0.117* (4.09)	−0.081* (2.02)	−0.088* (2.04)	−0.097* (4.25)
2. Fraction of Surgeons with Faculty Appointments at a Medical School	0.198* (5.72)	0.076* (1.99)	0.167* (2.69)	0.063* (4.74)
3. Fraction of the Medical School's Students Doing Their Core Clinical Clerkship in Surgery at the Hospital	0.311* (11.31)	0.108* (2.89)	0.285* (5.48)	0.213* (9.70)

Hospital Characteristics				
1. Laboratory Turnaround Time (hours)	0.073* (7.74)	0.105* (7.70)	0.083* (3.16)	0.092* (11.69)
2. Occupancy Rate	−0.207* (4.85)	−0.064† (1.70)	−0.100* (1.10)	−0.063* (2.05)
3. Federal Ownership of the Hospital‡	0.134* (3.43)	0.696* (7.01)	0.721* (1.98)	0.523* (8.17)
Patient Characteristics				
1. Distance from Hospital to Home (miles)	0.073* (6.55)	0.044* (3.13)	0.055* (2.48)	0.060* (6.87)
2. Lack of Unmatched Secondary Diagnoses, Present or Absent, between Pairs	−0.085* (2.04)	−0.079† (1.79)	−0.044 (0.54)	−0.049† (1.65)
3. Patient Age	0.009 (0.07)	0.339 (0.99)	0.044 (0.14)	0.155† (1.69)

*$p<0.05$, *two-tailed test.*

†$p<0.10$, two-tailed test

‡The coefficients imply a VA/nonfederal percentage differential of 14.3%, 69.6%, 72.1%, and 52.3%, respectively.

Table 3:
Average Number of Elective Tests Done, Cost per Case, and Length of Stay by Hospital Ownership

Type of Surgery	Transurethral Prostatectomies	Unilateral Inguinal Hernias	Cholecystectomies	Elective Surgery (Columns 1–3)
Type of Surgeon	**Specialist**	**Generalist**	**Generalist**	**Specialist or Generalist**
I. Average Number of Elective Preoperative Tests				
a. VA Patients	5.1 (109)	1.8 (99)	6.0 (50)	4.4 (258)
b. Municipal Hospital Patients	4.2 (47)	0.6 (41)	2.2 (23)	2.5 (111)
c. Voluntary Hospital Patients	4.4 (62)	0.7 (58)	2.4 (27)	2.9 (147)
II. Average Cost (in dollars)				
a. VA Patients	$3,299	$2,628	$3,469	$3,074
b. Municipal Hospital Patients	2,823	1,456	1,758	1,930
c. Voluntary Hospital Patients	2,932	1,660	2,021	2,117
III. Average Length of Stay (in days)				
a. VA Patients	17.0	13.2	18.1	16.0
b. Municipal Hospital Patients	14.5	8.0	11.3	10.6
c. Voluntary Hospital Patients	14.2	7.6	10.8	10.3

times larger in cases of nonspeciality surgery, compared to specialty surgery, suggests that the specialist was more independent of the effects of working in a federal facility than his nonspecialist colleague. In other words, the specialist was more likely to exhibit the same utilization patterns, independent of whether he operated in a federal, municipal, or voluntary institution. The issue of professional autonomy is a vast and complicated problem, but some descriptive observational studies suggest that the nonspecialist is much more likely to adjust his style of medicine to reflect the more predictable, slower-paced, federal schedule for getting things done[28]. Our findings suggest that the specialist is also affected, but to a lesser extent, by working within the framework of a federal institutional base.

3. The fraction of the medical school's students doing their required clinical clerkship in surgery at the hospital proved to be the second most significant factor in the regressions and had the expected positive impact on excessive utilization. One possible explanation for this finding is that as dependency of the school on the hospital for teaching beds increases, the school's need to help the hospital maximize patient days, admissions, and revenues (or budgets in the case of VA hospitals) also increases. The coefficients suggest that a 25 percent decline in students would be associated with a 6.2 percent decline in elective tests per case, and a 5.3 percent decline in cost per case.

4. The third and fourth most significant variables in the regressions were, respectively, the percentage of FMGs and faculty members on the surgical service. If the value of these coefficients were confirmed on a broader scale, and over a more complete collection of diagnoses, the predicted impact of a 10 percent increase in faculty participation on the surgical service would be a 2.2 percent decline in tests performed, but a 1.3 percent increase in cost per case. It is indeed heartening to learn that the most educated manpower category, the board-certified full time teaching faculty member, had some propensity to emphasize parsimony in the utilization of ancillary tests. Faculty may have required fewer tests to treat the same matched case, but they had a significantly higher demand for longer periods of patient hospitalization in the postoperative phase of care. The percentage of FMGs was also an important variable in explaining the variance in tests and cost per case. There is always the possibility that there was some selection bias in case severity that was not covered in the traits used in matching, e.g., the patient pairs were not matched by marital status. There might have been some within-hospital selection bias, e.g., specialist FMGs got more serious cases than specialist USMGs or nonspecialist FMGs got easier cases than nonspecialist USMGs. Problems of intrastaff-class correlation remain a subject for future research. The issue of FMG utilization of hospital resources has received somewhat less attention than the more emotional debate about the quality of FMG care. In contrast to the highly educated faculty members, the FMG manpower pool of attending surgeons utilized more tests, but fewer days of hospitalization for the same case mix, with the net effect being a slightly lower average cost per case. The estimated impact of a 25 percent decline in FMGs on the typical surgical service would be a 6.5 percent decline in the average number of tests, but a 2.4 percent increase in costs per case. The FMG and faculty staff characteristics explained nearly 40 percent of the variance in tests and costs per case.

Table 4:
Number of Tests Regression Results (*t* Values in Parenthesis)

Type of Surgery	Transurethral Prostatectomies	Unilateral Inguinal Hernias	Cholecystectomies	Elective Surgery (Columns 1–3)
Type of Surgeon	**Specialist**	**Generalist**	**Generalist**	**Specialist or Generalist**
Sample Size (Patient Pairs)	109	99	50	258
R-Squared	0.7655	0.6256	0.7239	0.6374
Elasticity Coefficients for the following 9 independent variables:				
Staff Characteristics				
1. Fraction of Surgeons that are FMGS	−0.322* (6.48)	−0.211* (3.16)	−0.232* (2.88)	0.255* (6.26)
2. Fraction of Surgeons with Faculty Appointments at a Medical School	0.157* (2.61)	−0.200* (2.30)	−0.213* (2.15)	−0.218* (4.43)
3. Fraction of the Medical School's Students Doing Their Core Clinical Clerkship in Surgery at the Hospital	0.359* (7.54)	0.070† (1.83)	0.512* (6.14)	0.244* (6.23)

Hospital Characteristics				
1. Laboratory Turnaround Time (hours)	0.073* (4.51)	0.236* (10.42)	0.104* (2.48)	0.156* (11.02)
2. Occupancy Rate	0.197* (2.66)	0.271* (3.04)	0.342* (2.36)	0.029 (.48)
3. Federal Ownership of the Hospital‡	0.165* (2.52)	0.609* (11.10)	0.769* (2.40)	0.712* (6.83)
Patient Characteristics				
1. Distance from Hospital to Home (miles)	0.032† (1.67)	0.030† (1.78)	0.013 (0.36)	0.017 (1.09)
2. Lack of Unmatched Secondary Diagnoses, Present or Absent, between Pairs	−0.295* (3.88)	−0.361* (3.22)	−0.375* (2.91)	−0.295* (4.57)
3. Patient Age	0.963* (4.24)	1.008† (1.89)	0.752† (1.77)	0.382* (2.07)

*$p<0.05$, two-tailed test

†$p<0.10$, two-tailed test

‡The coefficients imply a VA/nonfederal percentage differential of 18.2%, 184%, 116%, and 104%, respectively.

5. Age was the most significant patient characteristic in the analysis. Age had its predicted positive impact on utilization. On the average, the 60 year old man also had 19 percent more preoperative tests than his 40 year old counterpart, with the same condition. It has been suggested that older men need more testing per admission. Some of the elective tests are recommended by the Payne process criteria standards on a nonelective basis if the patient is over the age of 50[23]. For example, Payne considers ECG to be necessary for a cholecystectomy patient over the age of 50.

Study Limitations

The major limitations of the study can be readily listed: 1) data obtained from record abstraction are limited by the accuracy and completeness of the medical record; 2) the hospitals sampled are predominantly federal; 3) the patients are of below average income, and 4) the diagnoses studied are limited in scope to three simple elective surgical cases. Discussions of study limitations are important because it is hoped that they can be eliminated in future research. On the positive side, three points should be made: 1) the record abstractors were four times more reliable than the average PAS abstractor[29], 2) the cases were selected on the basis of predetermined criteria, and 3) there was 100 percent physician cooperation during the affiliation survey.

One of the basic strengths in the study design is the assignment of staff and hospital characteristics to the entire surgical service. Previous studies have treated the individual patient and one individual physician as the unit of analysis and, consequently, little variation has been explained. However, all of the phases of care from admission to discharge are not in the hands of one physician; the decisions are in the hands of a group of physicians. For example, an FMG measure should not consist of a dummy variable (equal to one if an FMG did the surgery), but rather should be equal to the fraction of surgeons on staff that are FMGs. The surgeon characteristics are probably producing superior empirical results when expressed for the group instead of the individual surgeon because cost and testing decisions are a function of both the surgeon and the collective decisions of the surgeons. Pauly's rationale is that surgeons in a collective way affect the choice of the level of inputs that are common to all or to many patient subgroups (elective versus nonelective)[30]. One could argue that the surgeons as a group influence the policies and resources in the surgical suites, but not in the other clinical departments. Consequently, medicine is affected by the characteristics of the internal medicine collective, whereas a shared department like pathology may be affected by the characteristics of all physicians at the hospital.

The information that appears on the medical record can seldom be attributable to the judgment of one or two persons. In most instances, though the legal responsibility may rest in the name of one physician, the actual care is attributable to a number of residents, interns, attending physicians, medical students, and medical school faculty members. Knowledge of each member of the treatment team and which member of the physician pool made which decision, would improve the accuracy of the independent variables in our analysis. One could question whether the improvement in precision would justify the increased research costs involved in linking every decision to a physician.

Policy Implications

Multiple regression analysis provided considerable insight into the roles of specific independent variables in explaining differences between hospitals along the two utilization measures (tests, costs). The increasing concern for curtailing rapidly rising hospital costs, and renewed interest in reducing the number of hospital beds[31], makes it increasingly important for health services researchers to learn more about how to affect physician behavior in a direction that increases hospital efficiency. Replication of this study in medical service settings and for nonelective surgical cases would seem to be worthy in view of the cost implications of maintaining 174 VA hospitals. Because surveys indicate that 83 percent of VA patients lack any form of public or private hospital insurance coverage[32], one would anticipate that the passage of national health insurance might attract some of the VA patients into nonfederal facilities. A previous study done by the author suggested that the most comprehensive national health insurance bill sponsored by Senator Kennedy might decrease the surgical patient census in VA hospitals by as much as 24 percent and decrease the annual number of surgical admissions by 50 percent, thus leaving the federal hospitals with the longer staying chronic cases[33].

The physician is influenced in patient management decisions by the economic advantage of actions to him, or his hospital, or perhaps to his medical school. We should guard against overutilization that results from physician pursuit of less explicit forms of economic advantage than income maximization tendencies under a fee for service system of reimbursement[34]. The subtle incentives to overutilize are much more insidious and affect salaried and private entrepreneur physicians equally. For example, surgeons may overtly or subconsciously overutilize in pursuit of any number of economic and personal objectives: to win favor with the surgical service chief, to win prestige, to maximize revenues or budgets to the surgical service. The incentives are certainly interrelated, and they favor overutilization as a means of accomplishing other objectives. The surgeon has an interest in increasing utilization as a way to maximize budgets so as to maximize the capital funds available for the tertiary care equipment, so as to maximize the individual surgeon's future income.

If we presume that the surgeon wishes to maximize prestige or popularity within the profession, rather than overutilize for the sake of overutilization, then the problem for policy makers becomes one of framing a set of incentives that make prestige maximization incompatible with overutilization. Federal and voluntary hospital reimbursement incentives do not favor cost-effective clinical decision making. In fact, any education program that tries to reduce cost per case or number of tests is doomed to fail because of the reimbursement incentives. One can expect only professional intransigence in the face of a federal PSRO plan that asks hospitals to reduce their budgets by curtailing utilization. If the reimbursement incentives were changed, so that a hospital was provided with a fixed dollar amount for a given diagnostic group, then the physician who minimizes unnecessary care maximizes the capital funds that are useful in the pursuit of prestige maximization. The physician would still not have an incentive to underutilize, because any form of underutilization that has a detrimental effect on quality would injure the physician's prestige and image among his peers.

Stuart and Stockton[35] have suggested that the administrative cost of utilization review and continuing physician education programs could easily be higher than the potential savings to society. To counterbalance the potential inflationary impact of such quality assurance activities requires a targeting of resources to those facilities with the highest chance of benefiting from the programs. The study results indicate that PSRO utilization review efforts might be targeted to those surgical services in federal hospitals, or in nonfederal teaching hospitals that provide over 10 percent of the local medical school's students with a required clinical clerkship in surgery. A continuing education program that emphasizes reduced ancillary utilization might best be targeted to surgical services with a high percentage of FMGs or high percentage of students. Although PSROs do not specifically fund continuing education programs, the facilities with an abundance of excessive utilization relative to the norms would seem most in need of continuing education programs.

The high statistical significance of both affiliation measures suggests that it is conceptually false to view the school, hospital, and physician staff as independent entities providing services in functionally segmented medical markets. The fact that the coefficients for the faculty variable are inelastic and negative for tests per surgical case suggests that dispersal of faculty members to less affiliated hospitals would decrease the average amount of excessive testing. However, the surgical student variable has a positive inelastic coefficient, suggesting that it is better to concentrate students on surgical rotation in as few hospitals as possible in order to minimize the regionwide impact that this factor has on tests per case and costs per case. For example, if a medical school shifts 1 percent of the surgical clerkships from a hospital serving 20 percent of their students to a hospital serving 5 percent of their students, the marginal increase in utilization (tests, dollars, days) at the hospital going from 5 percent to 6 percent students is greater than the marginal decrease in utilization at the hospital going from 20 percent to 19 percent.

Summary

The study focused on identifying the physician and hospital characteristics that explain excessive utilization of tests and dollars. The fraction of surgeons who are FMGs (including residents and attendings) had a strong positive effect on tests but a negative impact on cost per episode. The fraction of surgeons with faculty appointments had a strong negative impact on curtailing tests per elective surgical episode but a positive effect on cost per episode. Federal ownership of the hospital had the strongest positive impact on increasing testing and costs per episode in all regressions. The federal ownership coefficient is five to nine times larger if the sample is restricted to nonspeciality surgery (hernias and gallstones). To further explore the generalizability of these results, similar analyses of excessive or inappropriate utilization should be carried out for a sample of nonpoor patients and for a wide range of diagnoses.

END NOTE

[1] The VA hospital cost accounting system has been criticized as grossly inaccurate by a number of independent audits (e.g., the recent study by Peat, Marwick, Mitchell and Company [26]).

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