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Implications of Managed Care for Teaching Hospitals

Comparisons of Traditional and Managed Care Medical Services within a Single Institution

David Meltzer, Frederick L. Hiltz, and David Bates

8.1 Introduction

The spread of managed care presents important challenges to teaching hospitals. Perhaps most importantly, the downward pressures on health care prices associated with the spread of managed care are forcing teaching hospitals to attempt to decrease their own costs. Yet the traditional independence of academic physicians and the rapid turnover of housestaff in teaching hospitals make many of the methods used by managed care to control costs—such as provider capitation, utilization review, and active management of care using critical pathways and other algorithms—especially difficult for teaching hospitals to implement.

The need to make these major changes in the operation of teaching hospitals comes at a time when changing physician workforce needs present a new set of educational challenges for teaching hospitals. Widespread belief that there is a growing surplus of physicians has led to national calls to decrease the number of physicians in training. Because of this belief that the numbers of physicians in training should be reduced, and because of the developing challenges to the solvency of the Medicare trust fund, the traditional revenue that academic medical centers have received from the federal government for graduate medical education is clearly in jeopardy. Moreover, at the same time, a growing demand for primary care

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physicians, also driven by managed care, is forcing teaching hospitals to move housestaff from specialty and inpatient-oriented training to ambulatory and generalist training. Within residency programs in internal medicine, this is exemplified by the new Residency Review Commission requirement that at least 30 percent of training time being spent in the ambulatory setting (ACGME 1997).

With all of these challenges facing teaching hospitals, there are serious concerns about their ability to maintain their academic mission and financial viability. While prominent medical journals have devoted a great deal of attention to speculation concerning how teaching hospitals will and should meet these challenges related to the spread of managed care, there is surprisingly little empirical evidence about the effects of managed care on academic medical centers. In this paper we examine the experience of one large academic medical center and its relationship to a single large managed care organization. Although the institution in question represents, of course, only one institution, it is interesting to examine in some detail the role that managed care has come to play in that institution.

Section 8.2 describes the institutional context for this study, focusing on the different incentives of the traditional and managed medical services in the hospital. Section 8.3 provides some summary statistics that describe the populations in these two services, including data on the mix of patients by diagnosis and severity of illness. This provides preliminary data on costs and some insight into the ways in which a managed care service can affect the educational experience provided by the teaching hospital. Section 8.4 examines costs on the traditional and managed care services, including both differences in costs and causes of those differences. Although the ability to measure severity of illness with these data is limited, the results suggest that the managed care services do indeed have substantially lower costs than the traditional services, and that the lower costs are largely attributable to a decrease in length of stay. Section 8.5 examines this difference in length of stay within the context of house officer workload and summarizes results we have reported elsewhere concerning how differences in workload on the traditional and managed care services can affect length of stay and costs (Meltzer, Hiltz, and Bates 1997). A formal model of attending physician incentives and behavior that provides a potential mechanism for understanding these results is then presented in section 8.6. In focusing on the behavior of physicians as agents functioning within an incentive system structured by the hospital, the analysis is most similar in spirit to the work of Harris (1977) on the internal organization of hospitals. However, in emphasizing nonpecuniary incentives for physicians, and in suggesting that hospital production is inefficient, it has important connections to the broader literature on not-for-profit hospitals (i.e., Newhouse 1970, and Pauly and Redisch 1973). Section 8.7 concludes.

8.2 Institutional Context

The hospital we examine is one of the primary teaching hospitals of a major academic medical center (AMC). The managed care organization (MCO) is a local managed care organization with several hundred thousand covered lives. The two organizations have been closely linked since the establishment of the MCO approximately 30 years ago, with all of the faculty of the MCO holding faculty appointments at the academic medical center associated with the hospital. Nevertheless, until the 1980s, the MCO ran its own independent hospital. At that time, the MCO decided that it could decrease costs by closing its own hospital and contracting with the teaching hospital to provide inpatient care for its patients, with the physicians of the MCO maintaining primary control of those patients admitted to the hospital. The terms of this arrangement have varied over time. However, throughout the period covered by the data in this study (March 1994 to August 1995), the MCO compensated the hospital purely on a per diem rate independent of diagnosis or costs.

This study examines the 14,878 admissions to the internal medicine services during this period. Care on these services is divided among six services that constitute general internal medicine and subspecialty internal medicine care in the hospital (table 8.1). Physician staffing on these services generally follows a common pattern. Each service is divided into two teams, each of which is staffed by two interns, one resident, and one attending physician. On each service, each intern is on call every fourth night, so that one of the four interns from the two teams that constitute a service is on call every night. The on-call intern both admits new patients and provides "cross cover" for emergencies that arise among the patients usually cared for by the other three interns on the service. The residents across several services use a pooling arrangement so that the interns have supervision and assistance even when the usual resident from their team is not in the hospital.

Table 8.1 **Medicine Services**

Service	Description	No. of Patients during Study Period
Teams 1/2	Traditional general medicine service	2,519
Teams 3/4	Traditional hematology/oncology service	2,086
Teams 5/6	Managed care medicine service	2,472
Teams 7/8	Mixed traditional and managed care service	2,460
Teams 9/10	Traditional medicine service	2,455
Cards B1/B2	Traditional cardiology service	2,886
Total		14,878

Table 8.2 **Distribution of Patients by Payer among Medicine Services**

Service	Medicare	Other	Managed Care	Total
Teams 1/2	1,245	1,194	80	2,519
Teams 3/4	1,148	572	366	2,086
Teams 5/6	80	179	2,213	2,472
Teams 7/8	596	613	1,251	2,460
Teams 9/10	1,105	1,208	142	2,455
Cards B1/B2	1,338	1,541	7	2,886
Total	5,512	5,307	4,059	14,878

This basic model holds on all six services. However, the services also have important differences. Teams 1/2 and 9/10 are traditional general medicine services. As seen in table 8.2, a large portion of patients on these services are Medicare patients. The "other" category is diverse, including a mixture of patients with traditional indemnity insurance, insurance from smaller managed care plans, Medicaid, or no insurance. As in most teaching hospitals, care on the traditional services is supervised by academic medicine attendings employed by the teaching hospital. This is true on both the general medicine and specialty services. On those teams, the attending is responsible both for patient care and for teaching the housestaff and medical students. The majority of managed care patients are on teams 5/6. On those teams, teaching is provided by an attending employed by the managed care service who has no direct patient care responsibilities, while management of the patients remains under the control of attendings from the individual health centers of the managed care organization. A smaller number of managed care patients are cared for on the other services (especially teams 7/8, which later became a managed care service run along the model of teams 5/6). On these teams, patient care decisions for the managed care patients are made by the managed care attendings, while traditional attendings perform the majority of teaching.

There are important differences in the incentives of housestaff and attendings on the two services. While the analysis that follows will focus on financial incentives to minimize resource utilization, it should be noted that both attendings and housestaff have strong incentives to provide high-quality care. All are informally but closely evaluated by their peers for the quality of care they provide, and both the AMC and MCO have reputations for patient care of extremely high quality that they do not want to jeopardize. On the traditional services, the evaluation of housestaff is more formal, with a written evaluation prepared by the attending physician at the end of each month. While these evaluations generally will not have a large effect on a house officer, the opinions of attendings concerning a house officer may have important effects on their ability to obtain a desirable fellowship position or job following residency. Perhaps because pa-

tient care on the managed care service is divided among the attendings from the different health centers, evaluation on that service comes only from the teaching attending, who has relatively little opportunity to observe the house officer in direct patient care. Financial incentives play no significant role in determining the quality of care provided by the housestaff. They are paid a fixed salary for their work and are responsible for caring for all the patients who come onto their service on the days they admit until either the patients are discharged or the end of the month, at which time the house officer switches services and the care of the patient is passed on to the next house officer on the service.[1]

Attendings on both the traditional and managed care services also have important reputational concerns, but they may also face financial incentives to decrease resource utilization. Certainly this is true for their employers; the teaching hospital is paid a prospective rate per hospitalization for the majority of its patients (mostly by Medicare under the Prospective Payment System), and the MCO pays the teaching hospital a per diem rate. Thus, both organizations have strong incentives to accelerate the discharge of patients, while the teaching hospital may also have an incentive to decrease the total cost of hospitalization by decreasing other costs such as radiology, pharmacy, and so forth. The MCO may, in fact, have opposite incentives concerning some radiological procedures. If a patient requires a procedure that could be done on an inpatient or outpatient basis, the MCO may prefer to have it done as an inpatient when it will be included in the per diem, as long as it does not result in an increased length of stay.

While both the teaching hospital and MCO may wish to decrease length of stay, the attendings on the two services face very different incentives. On the traditional services, the incentives of attendings to decrease resource utilization are weak. Attendings are given no financial incentives to discharge patients sooner, and during the time period examined in this study, they did not even receive regular feedback concerning their length of stay or costs compared to those of other attendings. In contrast, on the managed care service services, the physicians from the individual health centers who are responsible for direct patient management receive direct feedback concerning length of stay. Moreover, their centers are partially compensated by the MCO based on their ability to control length of stay and costs. Therefore, as members of relatively small centers, the earnings of both the attendings and their colleagues are related to the resource utilization of the patients they have cared for. This can generate strong incentives for accelerated discharge on the managed care service. To rein-

1. The possibility of shirking work by leaving patients for the next house officer does not seem to be important in practice. In fact, there is extra work involved in signing out a patient to the incoming house officer and a strong set of social pressures not to sign out an unnecessarily large service to a colleague.

Table 8.3 Characteristics of Traditional and Managed Care Patients

	Traditional	Managed Care	Total
Number of patients	10,819	4,059	14,878
Age	58.4	56.5	57.9
Male (%)	46	52	48
DRG weight	1.50	1.26	1.43
Mortality (%)	2.8	2.5	2.7
Length of stay	6.54	4.54	6.00
Total charges	15,981	10,824	14,574
Admit day load	9.42	8.11	9.07

force these efforts to accelerate discharge, patients on the managed care service are assigned nurse managers who assist with efforts to muster the inpatient and outpatient resources required for discharge.

8.3 Patient Characteristics

Table 8.3 provides summary statistics for the differences in demographic characteristics, severity of illness, health outcomes, and costs between the traditional and managed care services. Patients on the managed care service are younger and more likely to be male. They are also less ill as measured by diagnosis-related group (DRG) weight. All of these differences are statistically significant ($p < 0.0001$). Although the managed care service has a lower crude mortality rate, this difference is not statistically significant even at $p < 0.1$.[2] Length of stay on the managed care service is substantially shorter than on the traditional service (4.54 versus 6.54 days), and charges per admission are approximately $5,000 lower ($10,824 versus $15,981), with these differences both significantly different from zero at $p < 0.0001$. The substantially shorter length of stay on managed care services may have negative effects on housestaff education, since evaluations for acute conditions are often completed on an outpatient basis. For example, a patient admitted with chest pain may be discharged prior to an exercise tolerance test so that the decision making that follows that test is now passed back to the referring physician and is not part of the educational experience of the housestaff.

One factor that may also affect the way the presence of the managed care organization influences the educational experience provided by the teaching hospital is the distribution of diagnoses among the patients. Table 8.4 describes this for the traditional and managed care service. Despite the breadth of these categories, it is interesting to note that many

2. It is also not statistically significant in a multivariate logistic regression that controls for patient age, sex, race, and DRG weight.

Table 8.4 Distribution of Diagnoses on Traditional and Managed Care Services

Diagnosis-Related Group Name	Traditional	Managed Care	Total
Acute & subacute endocarditis	27	7	34
Abortion w/ D&C, aspiration curettage, or hysterotomy	4	0	4
Acute adjustment reaction & disturbances of psychosocial dysfunction	16	5	21
Acute leukemia w/o major O.R. procedure age >17	45	5	50
Acute major eye infections	0	1	1
Admit for renal dialysis	4	0	4
Adrenal & pituitary procedures	2	0	2
Aftercare w/o history of malignancy as secondary diagnosis	16	3	19
Aftercare, musculoskeletal system & connective tissue	0	1	1
Alcohol/drug abuse or dependency, detoxification or other symptoms treated w/ cc	23	12	35
Alcohol/drug abuse or dependency, detoxification or other symptoms treated w/o cc	7	5	12
Alcohol/drug abuse or dependence, left against medical advice	3	0	3
Allergic reactions age >17	9	4	13
Amputation of lower limb for endocrine, nutritional, and metabolic disorders	1	0	1
Amputation for circulatory system disorders except upper limb & toe	3	1	4
Anal & stomal procedures w/ cc	3	1	4
Anal & stomal procedures w/o cc	0	1	1
Angina pectoris	151	75	226
Appendectomy w/ complicated principal diagnosis w/ cc	1	0	1
Arthroscopy	1	1	2
Atherosclerosis w/ cc	62	19	81
Atherosclerosis w/o cc	9	0	9
Back & neck procedures w/ cc	7	4	11
Back & neck procedures w/o cc	0	1	1
Benign prostatic hypertrophy w/ cc	4	0	4
Bilateral or multiple major joint procedures of lower extremity	1	0	1
Biliary tract procedure except only cholecystectomy w/ or w/o common duct exploration w/ cc	4	0	4
Biopsies of musculoskeletal system & connective tissue	4	3	7
Bone diseases & specific arthropathies w/ cc	12	0	12
Bone diseases & specific arthropathies w/o cc	2	2	4

(continued)

Table 8.4 (continued)

Diagnosis-Related Group Name	Traditional	Managed Care	Total
Bone marrow transplant	3	0	3
Breast biopsy & local excision for non-malignancy	1	0	1
Bronchitis & asthma age >17 w/ cc	125	46	171
Bronchitis & asthma age >17 w/o cc	152	87	239
Cardiac arrhythmia & conduction disorders w/ cc	256	71	327
Cardiac arrhythmia & conduction disorders w/o cc	126	68	194
Cardiac congenital & valvular disorders age >17 w/ cc	21	2	23
Cardiac congenital & valvular disorders age >17 w/o cc	6	2	8
Cardiac pacemaker device replacement	12	1	13
Cardiac pacemaker revision except device replacement	24	8	32
Cardiac valve procedures w/ cardiac cath	141	13	154
Cardiac valve procedures w/o cardiac cath	20	3	23
Cellulitis age >17 w/ cc	122	26	148
Cellulitis age >17 w/o cc	21	13	34
Cellulitis age 0–17	0	1	1
Cesarean section w/ cc	2	2	4
Chemotherapy w/acute leukemia as secondary diagnosis	47	4	51
Chemotherapy w/o acute leukemia as secondary diagnosis	457	86	543
Chest pain	547	294	841
Cholecystectomy except by laparoscope w/o common duct exploration w/ cc	12	2	14
Cholecystectomy except by laparoscope w/o common duct exploration w/o cc	2	2	4
Cholecystectomy w/common duct exploration w/ cc	0	1	1
Chronic obstructive pulmonary disease	183	123	306
Circulatory disorders except acute myocardial infarction, w/ cardiac catheterization & complex diagnosis	376	66	442
Circulatory disorders except acute myocardial infarction, w/ cardiac catheterization w/o complex diagnosis	255	69	324
Circulatory disorders w/ acute myocardial infarction & cardiovascular comp disch alive	80	35	115
Circulatory disorders w/ acute myocardial infarction w/o cardiovascular comp disch alive	105	66	171
Circulatory disorders w/ acute myocardial infarction; expired	11	3	14

Table 8.4 (continued)

Diagnosis-Related Group Name	Traditional	Managed Care	Total
Cirrhosis & alcoholic hepatitis	40	15	55
Coagulation disorders	46	3	49
Complicated peptic ulcer	13	4	17
Complications of treatment w/ cc	16	6	22
Complications of treatment w/o cc	4	0	4
Concussion age >17 w/ cc	1	0	1
Connective tissue disorders w/ cc	44	31	75
Connective tissue disorders w/o cc	37	8	45
Coronary bypass w/ cardiac catheterization	266	78	344
Coronary bypass w/o cardiac catheterization	33	10	43
Cranial & peripheral nerve disorders w/ cc	18	2	20
Cranial & peripheral nerve disorders w/o cc	3	1	4
Craniotomy age >17 except for trauma	11	6	17
Craniotomy for trauma age >17	1	2	3
D&C, conization & radio-implant, for malignancy	1	0	1
D&C, conization except for malignancy	1	0	1
Deep vein thrombophlebitis	10	9	19
Degenerative nervous sytem disorders	5	2	7
Dental & oral disorders except extractions & restorations, age >17	7	3	10
Dental extractions & restorations	3	1	4
Diabetes age >35	78	22	100
Diabetes age 0–35	26	13	39
Digestive malignancy w/ cc	46	17	63
Digestive malignancy w/o cc	3	1	4
Disequilibrium	26	12	38
Disorders of liver except malignancy; cirrhosis, alcoholic hepatitis w/ cc	51	22	73
Disorders of liver except malignancy, cirrhosis, alcoholic hepatitis w/o cc	6	1	7
Disorders of pancreas except malignancy	193	91	284
Disorders of personality & impulse control	1	0	1
Disorders of the biliary tract w/ cc	30	19	49
Disorders of the biliary tract w/o cc	10	9	19
Ear, nose, mouth, & throat malignancy	6	2	8
Endocrine disorders w/ cc	18	3	21
Endocrine disorders w/o cc	10	1	11
Epiglottitis	1	2	3
Epistaxis	8	3	11
Esophagitis, gastroenteritis, & misc. digestive disorders age >17 w/ cc	214	82	296
Esophagitis, gastroenteritis, & misc. digestive disorders age >17 w/o cc	80	21	101
Esophagitis, gastroenteritis, & misc. digestive disorders age 0–17	0	1	1

(*continued*)

Table 8.4 (continued)

Diagnosis-Related Group Name	Traditional	Managed Care	Total
Extensive O.R. procedure unrelated to principal diagnosis	45	12	57
Extracranial vascular procedures	7	3	10
Fever of unknown origin age >17 w/ cc	62	26	88
Fever of unknown origin age >17 w/o cc	5	3	8
Fractures of hip & pelvis	6	2	8
Fracture, sprain, strain, & dislocation of forearm, hand, foot age >17 w/ cc	0	1	1
Fracture, sprain, strain, & dislocation of forearm, hand, foot age >17 w/o cc	2	0	2
Fracture, sprain, strain, & dislocation of upper arm, lower leg except foot age >17 w/ cc	6	1	7
Gastrointestinal hemorrhage w/ cc	182	91	273
Gastrointestinal hemorrhage w/o cc	30	22	52
Gastrointestinal obstruction w/ cc	23	15	38
Gastrointestinal obstruction w/o cc	4	3	7
Hand procedures for injuries	2	0	2
Heart failure & shock	434	151	585
Heart transplant	15	0	15
Hepatobiliary diagnostic procedure for malignancy	2	0	2
Hepatobiliary diagnostic procedure for non-malignancy	2	0	2
Hernia procedures except inguinal & femoral age >17 w/ cc	1	1	2
Hip & femur procedures except major joint age >17 w/ cc	17	4	21
Hip & femur procedures except major joint age >17 w/o cc	1	0	1
HIV w/ extensive O.R. procedure	5	4	9
HIV w/ major related condition	160	129	289
HIV w/or w/o other related condition	37	31	68
Hypertension	25	14	39
Inborn errors of metabolism	9	0	9
Infections, female reproductive system	4	3	7
Inflammation of the male reproductive system	8	3	11
Inflammatory bowel disease	37	21	58
Inguinal & femoral hernia procedures age >17 w/ cc	1	0	1
Interstitial lung disease w/ cc	14	2	16
Interstitial lung disease w/o cc	7	2	9
Intraocular procedures except retina, iris, & lens	1	0	1
Kidney & urinary tract infections age >17 w/ cc	126	57	183

Table 8.4 (continued)

Diagnosis-Related Group Name	Traditional	Managed Care	Total
Kidney & urinary tract infections age >17 w/o cc	48	15	63
Kidney & urinary tract infections age 0–17	1	0	1
Kidney & urinary tract neoplasms w/ cc	1	1	2
Kidney & urinary tract signs & symptoms age >17 w/ cc	6	1	7
Kidney & urinary tract signs & symptoms age >17 w/o cc	3	0	3
Kidney, ureter, & major bladder procedure for non-neoplasm w/ cc	11	2	13
Kidney, ureter, & major bladder procedures for neoplasm	3	0	3
Knee procedures w/ cc	3	0	3
Laparoscopic cholecystectomy w/o common duct exploration w/ cc	10	0	10
Laparoscopic cholecystectomy w/o common duct exploration w/o cc	3	1	4
Lens procedures with or without vitrectomy	1	0	1
Local excision & removal of internal fixed devices except hip & femur	1	2	3
Local excision & removal of internal fixed devices of hip & femur	0	1	1
Lower extremity & humerus procedure except hip, foot, femur age >17 w/ cc	4	2	6
Lymphoma & leukemia w/ major O.R. procedure	14	8	22
Lymphoma & non-acute leukemia w/ cc	61	13	74
Lymphoma & non-acute leukemia w/ other O.R. procedure w/ cc	13	10	23
Lymphoma & non-acute leukemia w/ other O.R. procedure w/o cc	1	0	1
Lymphoma & non-acute leukemia w/o cc	24	6	30
Major cardiovascular procedures w/ cc	65	18	83
Major cardiovascular procedures w/o cc	11	5	16
Major chest procedures	27	12	39
Major joint & limb reattachment procedures of lower extremity	21	4	25
Major joint & limb reattachment procedures of upper extremity	1	0	1
Major shoulder/elbow procedure, or other upper extremity procedure w/ cc	0	1	1
Major skin disorders w/ cc	20	2	22
Major skin disorders w/o cc	1	1	2
Major small & large bowel procedures w/ cc	38	7	45
Major small & large bowel procedures w/o cc	3	1	4

(continued)

Table 8.4 (continued)

Diagnosis-Related Group Name	Traditional	Managed Care	Total
Malignancy of hepatobiliary system or pancrease	51	15	66
Malignancy, female reproductive system w/ cc	6	0	6
Malignancy, female reproductive system w/o cc	1	0	1
Medical back problems	34	8	42
Menstrual & other female reproductive system disorders	2	0	2
Minor bladder procedures w/ cc	1	1	2
Minor skin disorders w/ cc	11	5	16
Minor skin disorders w/o cc	10	4	14
Miscellaneous ear, nose, mouth, & throat procedures	0	1	1
Mouth procedures w/o cc	1	0	1
Multiple sclerosis & cerebellar ataxia	1	2	3
Myeloproliferative disorders or poorly differentiated neoplasms w/ major O.R. procedures w/ cc	4	1	5
Myeloproliferative disorders or poorly differentiated neoplasms w/ other O.R. procedures	6	1	7
Nervous system infection except viral meningitis	15	10	25
Nervous system neoplasms w/ cc	25	24	49
Nervous system neoplasms w/o cc	3	2	5
Neurological eye disorders	2	1	3
Neuroses except depressive	1	0	1
Non-extensive burns w/ skin graft	1	0	1
Non-extensive O.R. procedure unrelated to principal diagnosis	19	3	22
Non-specific arthropathies	3	2	5
Nonspecific cerebrovascular disorders w/ cc	3	3	6
Nonspecific cerebrovascular disorders w/o cc	1	0	1
Nontraumatic stupor & coma	4	2	6
Nutritional & misc. metabolic disorders age >17 w/ cc	159	60	219
Nutritional & misc. metabolic disorders age >17 w/o cc	32	12	44
O.R. procedure w/ diagnoses of other contact w/ health services	2	0	2
O.R. procedure for infectious & parasitic diseases	20	7	27
Orbital procedures	1	0	1
Organic disturbances & mental retardation	20	4	24
Osteomyelitis	9	6	15

Table 8.4 (continued)

Diagnosis-Related Group Name	Traditional	Managed Care	Total
Other permanent cardiac pacemaker implant or automatic implantable cardioverter defibrillator lead or generator procedure	134	33	167
Other antepartum diagnoses w/ medical complications	13	11	24
Other antepartum diagnoses w/o medical complications	1	2	3
Other cardiothoracic procedures	29	5	34
Other circulatory system diagnoses w/ cc	137	52	189
Other circulatory system diagnoses w/o cc	20	15	35
Other circulatory system O.R. procedures	16	5	21
Other digestive system diagnoses age >17 w/ cc	48	14	62
Other digestive system diagnoses age >17 w/o cc	1	4	5
Other digestive system O.R. procedures w/ cc	11	2	13
Other digestive system O.R. procedures w/o cc	1	2	3
Other disorders of nervous system w/ cc	18	8	26
Other disorders of nervous system w/o cc	5	1	6
Other disorders of the eye age >17 w/ cc	3	0	3
Other disorders of the eye age >17 w/o cc	3	0	3
Other ear, nose, mouth, & throat diagnoses age >17	9	6	15
Other ear, nose, mouth, & throat diagnoses age 0–17	1	0	1
Other ear, nose, mouth, & throat O.R. procedures	2	0	2
Other endocrine, nutritional, & metabolic O.R. procedure w/ cc	4	0	4
Other endocrine, nutritional, & metabolic O.R. procedure w/o cc	2	0	2
Other factors influencing health status	34	4	38
Other hepatobiliary or pancreas O.R. procedures	4	0	4
Other infectious & parasitic diseases diagnoses	28	4	32
Other injury, poisoning, & toxic effect diagnoses w/ cc	2	1	3
Other injury, poisoning, & toxic effect diagnoses w/o cc	4	0	4
Other kidney & urinary tract diagnoses age >17 w/ cc	64	7	71
Other kidney & urinary tract O.R. procedures	14	5	19

(*continued*)

Table 8.4 (continued)

Diagnosis-Related Group Name	Traditional	Managed Care	Total
Other kidney & urinary tract O.R. procedures	29	6	35
Other male reproductive system diagnoses	2	0	2
Other male reproductive system O.R. procedures except for malignancy	1	0	1
Other multiple significant trauma	2	1	3
Other musculoskeletal system & connective tissue O.R. procedure w/ cc	1	3	4
Other musculoskeletal system & connective tissue O.R. procedure procedure w/o cc	1	0	1
Other musculoskeletal system & connective tissue diagnoses	7	3	10
Other myeloproliferative disorder or poorly differentiated neoplasm diagnosis w/ cc	7	1	8
Other myeloproliferative disorder or poorly differentiated neoplasm diagnosis w/o cc	2	2	4
Other O.R. procedures for injuries w/ cc	5	3	8
Other O.R. procedures of the blood and blood forming organs	2	1	3
Other respiratory system O.R. procedures w/ cc	50	15	65
Other respiratory system O.R. procedures w/o cc	4	1	5
Other respiratory system diagnoses w/ cc	19	4	23
Other respiratory system diagnoses w/o cc	6	1	7
Other skin, subcutaneous tissue, & breast procedures w/ cc	5	1	6
Other skin, subcutaneous tissue, & breast procedures w/o cc	0	2	2
Other vascular procedures w/ cc	64	14	78
Other vascular procedures w/o cc	2	1	3
Otitis media & upper respiratory tract infection age >17 w/ cc	35	9	44
Otitis media & upper respiratory tract infection age >17 w/o cc	11	3	14
Pancreas, liver, & shunt procedures w/ cc	21	3	24
Pancreas, liver, & shunt procedures w/o cc	3	1	4
Pathological fractures & musculoskeletal & connective tissue malignancy	68	35	103
Percutaneous cardiovascular procedures	664	160	824
Peripheral & cranial nerve & other nervous system procedures w/ cc	1	3	4
Peripheral & cranial nerve & other nervous system procedures w/o cc	1	0	1
Peripheral vascular disorders w/ cc	99	44	143
Peripheral vascular disorders w/o cc	65	54	119
Peritoneal adhesiolysis w/ cc	1	1	2

Table 8.4 (continued)

Diagnosis-Related Group Name	Traditional	Managed Care	Total
Permanent cardiac pacemaker implant w/ acute myocardial infarction, heart failure, or shock	7	0	7
Pleural effusion w/ cc	20	5	25
Pleural effusion w/o cc	4	0	4
Pneumothorax w/ cc	4	5	9
Poisoning & toxic effects of drugs age >17 w/ cc	88	28	116
Poisoning & toxic effects of drugs age >17 w/o cc	36	17	53
Postoperative & post-traumatic infections	10	3	13
Postpartum & post abortion diagnoses w/o O.R. procedure	9	4	13
Primary iris procedures	1	1	2
Prostatic O.R. procedure unrelated to principal diagnosis	1	0	1
Psychoses	4	2	6
Pulmonary edema & respiratory failure	5	3	8
Pulmonary embolism	42	26	68
Radiotherapy	19	7	26
Red blood cell disorders age >17	196	44	240
Renal failure	70	20	90
Respiratory infections & inflammations age >17 w/ cc	120	58	178
Respiratory infections & inflammations age >17 w/o cc	15	6	21
Respiratory neoplasms	58	21	79
Respiratory signs & symptoms w/ cc	37	10	47
Respiratory signs & symptoms w/o cc	28	17	45
Respiratory system diagnosis with ventilator support	67	19	86
Reticuloendothelial & immunity disorders w/ cc	134	33	167
Reticuloendothelial & immunity disorders w/o cc	13	7	20
Retinal procedures	2	0	2
Seizure & headache age >17 w/ cc	32	19	51
Seizure & headache age >17 w/o cc	9	11	20
Septic arthritis	5	2	7
Septicemia age >17	98	33	131
Signs & symptoms of musculoskeletal system & connective tissue	23	9	32
Signs & symptoms w/ cc	22	10	32
Signs & symptoms w/o cc	6	4	10
Simple pneumonia & pleurisy age >17 w/ cc	330	145	475

(*continued*)

Table 8.4 (continued)

Diagnosis-Related Group Name	Traditional	Managed Care	Total
Simple pneumonia & pleurisy age >17 w/o cc	77	39	116
Skin graft &/or debridement for skin ulcer or cellulitis w/ cc	11	4	15
Skin graft &/or debridement for skin ulcer or cellulitis w/o cc	1	0	1
Skin grafts & wound debridement for endocrine, nutritional, & metabolic disorders	2	1	3
Skin ulcers	14	3	17
Soft tissue procedures w/ cc	4	2	6
Soft tissue procedures w/o cc	1	1	2
Specific cerebrovascular disorders except transient ischemic attack	42	88	130
Spinal procedures	5	0	5
Splenectomy age >17	4	0	4
Sprains, strains, & dislocations of hip, pelvis, & thigh	0	1	1
Stomach, esophageal, & duodenal procedures age >17 w/ cc	13	5	18
Stomach, esophageal, & duodenal procedures age >17 w/o cc	0	1	1
Subtotal mastectomy for malignancy w/ cc	2	1	3
Syncope & collapse w/ cc	77	43	120
Syncope & collapse w/o cc	56	33	89
Tonsil and adenoid procedure, except tonsillectomy &/or adenoidectomy only, age >17	2	1	3
Tendonitis, myositis, & bursitis	16	8	24
Testes procedures, for malignancy	1	0	1
Thyroid procedures	1	0	1
Total mastectomy for malignancy w/ cc	2	0	2
Tracheostomy except for face, mouth, & neck diagnoses	45	8	53
Tracheostomy for face, mouth, & neck diagnoses	4	2	6
Transient ischemic attack & precerebral occlusions	11	24	35
Transurethral procedures w/ cc	3	2	5
Transurethral prostatectomy w/ cc	2	0	2
Trauma to the skin, subcutaneous tissue, & breast age >17 w/ cc	6	0	6
Trauma to the skin, subcutaneous tissue, & breast age >17 w/o cc	1	0	1
Trauma injury age >17 w/ cc	4	0	4
Traumatic injury age >17 w/o cc	2	0	2
Traumatic stupor & coma, coma <1 hr age >17 w/ cc	2	2	4
Traumatic stupor & coma, coma >1 hr	1	0	1

Table 8.4 (continued)

Diagnosis-Related Group Name	Traditional	Managed Care	Total
Uncomplicated peptic ulcer w/ cc	2	0	2
Uncomplicated peptic ulcer w/o cc	3	2	5
Upper limb & toe amputation for circulatory system disorders	1	0	1
Urinary stones w/ cc, &/or extracorporeal shock wave lithotripsy	6	4	10
Urinary stones w/o cc	1	1	2
Uterine & adnexal procedure for non-malignancy w/ cc	6	1	7
Uterine, adnexal procedure for non-ovarian/adnexal malignancy w/ cc	1	0	1
Vagina, cervix, & vulva procedures	2	0	2
Vaginal delivery w/ complicating diagnoses	2	1	3
Vaginal delivery w/ sterilization &/or D&C	1	0	1
Viral illness & fever of unknown origin age 0–17	0	2	2
Viral illness age >17	32	10	42
Viral meningitis	15	8	23
Wound debridement & skin graft except hand, for musculoskeletal & connective tissue disorder	12	2	14
Wound debridements for injuries	4	1	5

Note: cc = Complicating conditions.

DRGs occur only a few times over the period of somewhat more than a year even in such a large teaching hospital. In this respect, the sheer volume of patients brought in by managed care may be its greatest contribution to the teaching experience available for housestaff. This might be less of a contribution, however, if the managed care services are more likely to admit patients with very common diagnoses than are the traditional services, where more rare conditions might be more frequently admitted as "teaching" cases. Figure 8.1 plots the fraction of patients in DRGs of varying frequency who come from managed care services, and finds no support for that hypothesis. Because we have not compared the frequency of admissions for the DRGs in this institution to those occurring nationwide, we cannot say that either service necessarily emphasizes common or rare diagnoses. Nevertheless, the managed care service does not seem to decrease the diversity of diagnoses.

Another commonly discussed set of hypotheses concerning managed care patients is that they are less ill on average when admitted because they tend to be drawn from a healthier population than traditional patients. This is consistent with the lower average DRG weight on the managed care service reported in table 8.3. Alternatively, others speculate that

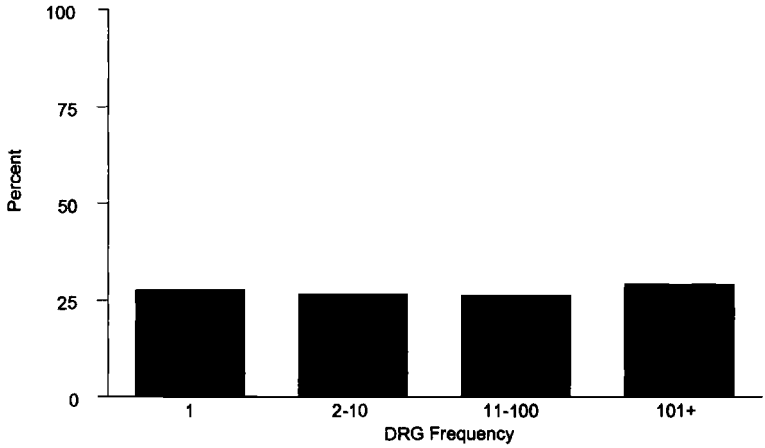

Fig. 8.1 Percentage of managed care patients by DRG frequency

the managed care patients admitted with a given diagnosis may be more ill on average than the traditional patients because there is a higher threshold for admission to the hospital. One way to examine this is to look at admissions for individual DRGs with and without complicating conditions. Though we found a slightly higher percentage of managed care patients in those DRGs without complications than we found in DRGs with complications (0.29 versus 0.23), this difference is not statistically different from zero.

8.4 Differences in Costs

This section examines the difference in costs on the traditional and managed care medical services. The data on costs are generated from a cost accounting system that imputes costs using cost-to-charge ratios. For those patients for whom no actual detailed bill is generated (i.e., Medicare or capitated or per diem managed care), charges are assigned based on utilization in the same way they would be for a patient billed under traditional insurance.

Table 8.5 reports regressions that examine the effect of managed care on costs controlling for managed care status, age, sex, race, and DRG weight (WT95). Regression 1 suggests that costs are approximately $2,800 lower per hospitalization for patients on the managed care service controlling for these covariates. Regression 2 suggests one major reason for this reduction in costs—namely, that length of stay is approximately 1.3 days shorter on the managed care service controlling for these same covariates. Regression 3 includes length of stay in the total cost regression. The partial effect of managed care now becomes insignificantly different from zero. This suggests that managed care exerts most or all of its effect on

Table 8.5 **Cost and Length-of-Stay Regressions**

Dependent Variable	1 Total Charge	2 Length of Stay	3 Total Charge	4 Pharmacy Charge	5 Pharmacy Charge	6 Lab Charge	7 Lab Charge	8 Radiology Charge	9 Radiology Charge	10 Room Charge	11 Room Charge
Managed care	−2,798***	−1.34***	233	−490***	−17	−609***	−223***	23	187***	−969***	284***
	(399)	(0.13)	(279)	(84)	(71)	(77)	(68)	(30)	(25)	(128)	(49)
Age	−37***	0.005	−48***	−34***	−35***	5***	−4**	−2***	−3***	5	1
	(10)	(0.003)	(7)	(2)	(2)	(2)	(2)	(2)	(1)	(3)	(1)
Male	−492	−0.32***	242	−245***	−130**	489***	583***	−100***	−60***	−340***	−36
	(356)	(0.11)	(248)	(75)	(63)	(69)	(61)	(26)	(23)	(115)	(44)
White	1,842***	−0.04	1,928***	633***	646***	485***	496***	23	28	−103	−67
	(391)	(0.12)	(272)	(82)	(70)	(76)	(67)	(29)	(25)	(126)	(48)
DRG weight	10,731***	2.71***	4,602***	1,234***	278***	2,155***	1,375***	432***	100***	3,461***	924***
	(113)	(0.04)	(92)	(24)	(24)	(22)	(23)	(8)	(8)	(36)	(16)
Length of stay			2,263***		353***		288***		123***		937***
			(18)		(5)		(4)		(2)		(18)
Constant	1,143*	2.39***	−4,263***	1,779*	935***	−381***	−1,070***	340***	47	338	−1,900***
	(661)	(0.21)	(462)	(139)	(118)	(128)	(113)	(49)	(42)	(213)	(82)
N	14,878	14,878	14,878	14,878	14,878	14,878	14,878	14,878	14,878	14,878	14,878
Adjusted R^2	0.39	0.29	0.70	0.17	0.40	0.41	0.55	0.15	0.38	0.39	0.91

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

costs through a decrease in length of stay in this setting. Since the managed care organization compensates the hospital on a per diem rate, this is perhaps not surprising.

The remaining regressions examine specific components of costs. Regressions 4 and 5 show a similar story for pharmacy costs as for total cost: a decrease for managed care patients that is eliminated after controlling for length of stay. Regressions 6 and 7 show a decrease in lab charges under managed care that is substantially reduced to only about $200 by controlling for length of stay. Regressions 8 and 9 show no effect of managed care on radiology costs without controlling for length of stay. After controlling for length of stay, radiology costs are about $200 higher on the managed care service. Not surprisingly, regressions 10 and 11 show a large effect of managed care on room charges that is eliminated by controlling for length of stay. In fact, the difference reverses, with higher average costs for managed care controlling for length of stay, presumably because managed care patients spend a larger fraction of their days in intensive care for any length of stay for a diagnosis. This is consistent both with the incentives of the managed care organization, which pays a fixed rate per diem, and the MCO's relative expertise in moving patients from a nonintensive hospital bed to home.

Overall, the results of this section suggest that the managed care organization in this institution accomplishes the majority of its cost saving through a decrease in length of stay. This suggests that examining the effects of incentives on mechanisms that affect length of stay may be particularly fruitful. The following sections discuss a specific set of management decisions that have effects on length of stay.

8.5 Effects of Workload on Length of Stay

In previous work (Meltzer, Hiltz, and Bates 1997), we used discrete time logistic hazard models and Monte Carlo simulation to examine the effects of house officer workload on length of stay and found significant effects of workload on discharge probabilities over the hospital stay which differed between the traditional and managed care services. On both the traditional service and the managed care service, increased workload was found to decrease discharge probabilities during the first four days of a hospitalization. This is consistent with congestion effects when housestaff are simply too busy to complete their work quickly enough to permit the most rapid possible discharge of patients. From days 5 through 8, there is no effect of workload on length of stay. After day 8, however, there is a positive effect of workload on discharge probabilities on the traditional service, but not the managed care service. This is consistent with a dumping effect in which busy house officers discharge patients who are not necessarily in acute need of hospitalization in order to decrease their work-

load. It is possible that this is not evident on the managed care service because the strong incentive for attendings to discharge on that service implies that all of the patients on that service who remain in the hospital are there because they absolutely cannot be safely discharged.

On the traditional service, these two opposing effects of increased workload net out to suggest a very small decrease in length of stay with increased workload. On the managed care service, however, with a significant congestion effect and no dumping effect, the net effect of increased workload is to increase length of stay. Our estimates suggested an increase in costs of approximately $125,000 per year from a 20 percent decrease in housestaff, which would save less than $125,000 per year in salary.

8.6 Differences in Staffing on the Services

These differing effects of workload on length of stay on the traditional and managed care services suggest that there might be greater benefits to higher staffing on the managed care service. The average daily workload on the two services reported in table 8.3 confirms that there is indeed higher staffing on the managed care service. It seems, then, that the hospital is responding in some sense to the differing incentives with respect to housestaff workload on the two services. To understand better how it is that the differing incentives for staffing on the two services may exist, it is useful to examine the effects of attending incentives in the two services on the optimal house officer staffing decision.

To model the hospital's house officer staffing decision, we assume that hospitals choose staffing and attending salary to maximize profit (Π) subject to: (1) attending discharge incentives and (2) attending participation constraints.

In order to model attending discharge decisions, we assume that attendings care about quality of care (Q) and income (I), where $Q = Q(L,n)$, so quality depends on length of stay (L) and staffing level (n), where $Q_L > 0$, $Q_n > 0$. As described above, attending discharge incentives differ on the two services in that physician's pay rises with lower resources utilization, and especially length of stay on the managed care service. Thus, physician income can be modeled as $I = I_0 - iL$, so that income is a baseline level I_0 minus an incentive, i, to decrease length of stay.

Subject to these incentives, attendings choose L to maximize $Q(L,n) + I_0 - iL$ so that:

$$Q_L(L,n) - i = 0. \tag{1}$$

This is the attending incentive compatibility constraint, and it describes how long an attending will choose to keep a patient in the hospital given staffing (n) and incentive (i).

To compete for attendings, hospitals must offer attendings a compensation package including quality of care and total income that is at least as good as the competitive level of utility for attendings at other hospitals (U_0). Specifically, assume that attendings choose a hospital based on financial compensation and quality to maximize their utility:

$$U_{\text{attending}} = Q(L,n) + I_0 - iL \geq U_0.$$

If this is the case, then hospitals must provide attendings a base compensation (I_0) of at least

$$I_0 = U_0 - Q(L,n) + iL. \tag{2}$$

This is the attending participation constraint.

Given these constraints, hospitals choose staffing (n) to maximize profit (Π)

$$\Pi = P(Q(L,n)) - (I_0 - iL) - kn - cL,$$

where $P(Q(L,n))$ is the price received for care of quality Q, $I_0 - iL$ is total physician compensation, kn is the cost of staffing level n (k per staff position), and cL is the cost per day of hospitalization, subject to the attending incentive compatibility (1) and participation (2) constraints.

Substituting the participation constraint into the profit equation generates the LaGrangian:

$$\mathrm{L} = P(Q(L,n)) + Q(L,n) - U_0 - kn - cL + \lambda[i - Q_L],$$

which is then maximized over n, L, and λ to yield:

$$\text{FOC } n: \quad [P_Q + 1]Q_n - k - \lambda \times Q_{Ln} = 0,$$

$$\text{FOC } L: \quad [P_Q + 1]Q_L - c - \lambda \times Q_{LL} = 0,$$

$$\text{FOC } \lambda: \quad Q_L(L,n) - i = 0.$$

If $[P_Q + 1]\, Q_L - c < 0$ so that hospitals want to decrease length of stay at the margin and if $Q_{LL} < 0$ so that there are diminishing returns to length of stay, then $\lambda > 0$. If better staffing has a larger effect on quality when length of stay is shorter, so $Q_{Ln} < 0$, then $[P_Q + 1]\, Q_n - k > 0$, which implies that staffing (n) would be higher for any length of stay.

To be strict in determining the effect of incentives on staffing, we can totally differentiate and solve for

$$\frac{dn}{di} = \frac{\lambda[Q_{LLL}Q_{Ln} - Q_{LLn}Q_{LL}]}{[DET]}$$

the sign of which will be the same as the sign of the term in brackets in the numerator if $\lambda > 0$ and since the denominator is greater than zero by

second-order conditions. The sign of this term cannot be determined in general, but if it is positive, optimal staffing would rise with attending discharge incentives. This will be the case if, as stated above, hospitals want to decrease length of stay at the margin, there are diminishing returns to length of stay, and better staffing has a larger effect on quality when length of stay is shorter.

8.7 Conclusion

This paper presents some preliminary observations concerning the role and functioning of a managed care medicine service in a single teaching hospital. Although the results are clearly preliminary, the suggestion is that the managed care service is able to decrease resource utilization compared to the traditional service, and to do so largely by achieving reductions in length of stay. It is possible that this is a peculiarity of the managed care service in this institution, particularly given the fact that it is rewarded for reductions in length of stay because it pays the hospital a per diem rate. However, the ease of monitoring length of stay and high cost associated with staffing a hospital bed make it likely that reductions in length of stay are a common mechanism for reducing costs under other payment systems as well.

With the ease of monitoring length of stay, it is interesting that the traditional service has not adopted mechanisms to provide attendings more powerful incentives to cut length of stay. Indeed, more powerful incentives for attendings are beginning to find their way into academic medical centers. For example, the desire to provide stronger incentives to control inpatient costs is probably an important reason for the strong interest in academic medical centers in shifting responsibility for inpatient care to "hospitalists"—physicians who specialize in inpatient care (Wachter and Goldman 1996). Because of their higher patient volume and greater responsibility for inpatient care, these hospitalists can presumably be compensated more directly for their success in controlling costs and may be in a better position to control costs.

In the absence of such innovative approaches, the lower staffing on the traditional service and the empirical and theoretical result that this lower staffing might be an alternative mechanism to encourage early discharge suggest that the teaching hospital may implicitly employ other methods to control length of stay. Similarly, the presence of higher staffing on the managed care service is accompanied by other efforts to decrease length of stay, such as the use of nurse managers. The presence of these multiple incentive mechanisms and other means of controlling resource use within the institution suggest a potential difficulty in studying the effects of incentives on behavior within organizations as complex as teaching hospitals. This may prove important as changing educational needs and financial

realities tempt teaching hospitals and regulators to experiment with new financial arrangements.

As for the effects of managed care on the educational objectives of teaching hospitals, this paper has even more limited ability to draw conclusions. In this institution, the managed care service appears to admit a substantial number of patients with diagnoses that vary significantly in severity of illness and frequency. This suggests that the managed care service is making a positive educational contribution. Moreover, the experience of observing how physicians working under managed care are able to accelerate discharge may be a valuable lesson in its own right. While there may be truth in the frequently cited concern that with shorter lengths of stay, housestaff may not have as much opportunity to learn from their patients, examination of that hypothesis will require data on what housestaff learn from their training that we do not currently possess. In previous work (Meltzer, Hiltz, and Bates 1997), we have found some evidence that managed care also takes some of the decision making out of the hands of the housestaff, which may also compromise their educational experience. Examining this hypothesis will also require richer data than is currently available.

Though the spread of managed care presents challenges to teaching hospitals, it is clear that they cannot remain financially viable unless they learn to work with managed care. This will be an important challenge in the years ahead.

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Comment on Chapters 7 and 8

Laurence Baker

The growth of managed care over the past two decades has brought many new questions to the forefront of health policy research in the United States. Among the most fundamental is the effect that managed care has on the provision of medical care and, particularly, the quality of health care. Of course, managed care could influence health care provision and quality in a variety of ways. Perhaps the most important is through the financial incentives and central oversight imposed on providers, which can have strong impacts on the health care delivered to patients enrolled in managed care organizations. Patients and their advocates have long feared that financial incentives to treat less and the utilization of review processes that limit care would lead to the underprovision of quality in health care. As pressure from employers has grown and competition between plans has intensified, so have fears that managed care could compromise quality in pursuit of financial gain.

These fears have generated a strong demand for information about the quality of care in managed care plans, to which the research community has responded by generating a large and steadily increasing body of work examining the health care provided to patients enrolled in managed care plans. But because of the complexity of these questions, much remains to be understood about the care provided by managed care organizations. The papers by Sarah Feldman and David Scharfstein and by David Meltzer, Frederick L. Hiltz, and David Bates explore two of the areas in need of further research.

Questions about the quality of health care are at the forefront of many current health care policy discussions, but the available information about quality is far from complete. Even the concept of "quality" is difficult to define in practice. Beyond defining quality, the methodological hurdles to doing research on quality are formidable. The prototypical quality studies have compared patients with traditional indemnity insurance plans who receive (more or less) fee-for-service health care to managed care patients (Miller and Luft 1997). But these studies have suffered through imperfect measures of quality, data difficulties, and questions about the interpretation of differences in those things that can be measured.

Most attempts at quality measurement have tended to fall into three categories: measurement of health outcomes, analyses of the processes by which care is produced, and surveys of consumer satisfaction. Analyses of health outcomes, a common approach to studying quality in managed care plans, typically rely on large administrative databases like hospital discharge abstracts collected by state regulators or databases containing

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insurance claim records. These databases provide information on some baseline characteristics of the patients and basic information about their medical condition and the treatments they received. It is often possible to link these data to mortality records or other databases to provide information about the outcome of their care. But administrative databases often provide only a limited set of outcomes for analysis, and the available outcomes are often relatively rare events, leading to difficulties with small samples; for many health problems, studying differences in mortality rates can be difficult. Moreover, using nonrandomized data to study outcomes forces investigators to deal with variations in illness severity or health status across patients that can be difficult to observe. In many cases, sufficient data to fully control for severity differences across patients that influence their health outcomes as well as, say, their choice of insurance are not available, leaving results subject to substantial bias.

Other studies examine processes of care, such as determining whether patients with diabetes received appropriate follow-up care and periodic retinal examinations and asking whether the processes of care for managed care and non–managed care patients are similar. These studies are also potentially interesting, but they tend to require burdensome data collections, making it difficult to conduct broadly based process studies. As a practical matter, process measures can only focus on a relatively small number of items, which also limits their applicability—knowledge about vaccination rates for children may be of little use to an adult picking a health plan. The use of satisfaction surveys, while useful, captures information from the patient's perspective. While this information is often of crucial importance to patients, it is not clear that it always reflects the actual health outcomes of interest.

Against a backdrop of numerous helpful but imperfect attempts to study quality, Feldman and Scharfstein's focus on care volume offers a new perspective on quality measurement. The use of volume as a quality measure is based on the literature that reports a positive correlation between the number of procedures performed by health care providers and the outcomes for patients (the so-called volume-outcome relationship). Volume has also been used by other groups as an indicator of quality. For example, various specialty groups, state governments, and other accreditation agencies have considered the implementation of rules that would force providers offering some services to demonstrate that they have performed at least a minimum number of procedures per year, basing their argument on volume-outcome studies.

Feldman and Scharfstein's finding that there is wide variation in provider volumes between health plans and generally strong differences between managed care and fee-for-service plans signals the possibility of variations in the quality of care provided by managed care plans and, following the volume-outcome relationship, raises the possibility that out-

comes for managed care patients may not be as good as outcomes for fee-for-service patients. The results also highlight the fact that quality may vary from service to service within a plan, something that could significantly complicate broad assessments of quality across plans. For physician volume, Feldman and Scharfstein find that plan A has the highest volumes for breast cancer surgery and for gynecologic cancer surgery but is among the plans with the lowest volumes for colorectal cancer surgery. Conversely, the surgeons used by plan F had the highest volumes for colorectal cancer surgery but were among the lowest for volume of breast and gynecologic cancer surgery. A goal of many quality-measurement efforts is the construction of a small number of measures that can be used to characterize quality across plans and can be made understandable to patients making complex choices across plans. But the large differences across plans suggests that a small set of indices may fail to capture important variations for individual procedures, or that the creation of a small set of indicators that are truly representative may be impossible.

In highlighting the provocative differences in volume across plans and between managed care and traditional insurers, this work also prompts a series of more detailed questions about the interpretation of volume differences and about the degree to which they could be more widely used as indicators of quality. First, additional attention to the shape of the relationship between volume and outcomes would strength the interpretation of these results. While studies of the relationship between volume and outcomes suggest that increases in volume go with improvements in outcomes, it is not clear that this relationship is linear. Many volume-outcome studies suggest that outcomes improve with volume over some range of volumes, but that once sufficiently high levels of volume have been reached, the benefits to additional increases in volume are limited. Feldman and Scharfstein make the case that the volumes of providers seen by managed care patients are often lower than volumes of providers seen by traditionally insured patients, but we must be somewhat cautious in inferring that outcomes are worse; if we are on a flat part of the volume-outcome curve, reductions in volume may have small or no impact on outcomes.

Second, it would be interesting to expand the analysis of the appropriate set of procedures to include when volumes are computed. In spirit, the question is, What makes a surgeon good at what she or he does? Is it the number of surgeries within a broad group of procedures that determine outcomes for a specific procedure? Or should we count only the specific instances of surgeries exactly like the one in question? Similar questions could be asked at the hospital level, where the crucial question is the ability of the hospital to take good care of patients after surgery, which may or may not depend on the specific procedures done for the patients.

A third set of questions begins with the mechanisms that drive the rela-

tionship between volume and outcomes. Do increases in volume bring about improvements in outcomes, say, through learning by doing? Or do higher volumes reflect the underlying skill or other attributes of providers—that is, do some surgeons have high volumes because they have good outcomes or other attributes that attract patients? In an environment where managed care plans can influence the volume of services performed by physicians, the answers to these questions will have a strong bearing on the usefulness of volume measures, particularly over time. Suppose, for example, that an HMO were to send all of its gynecologic cancer surgery cases to a surgeon with initially low volumes for these procedures, raising the volumes of the surgeon. If the initial low volume reflected an inherently lower level of skill, then the use of volume as an indicator of quality could be inaccurate. But if higher volumes created better outcomes, the measure would be better.

While Feldman and Scharfstein's work attempts to assess the quality of the providers seen by managed care patients, David Meltzer, Frederick L. Hiltz, and David Bates investigate the complex financial and other interactions between managed care organizations, physicians, and hospitals that also have a strong impact on the care received by patients enrolled in managed care organizations. One of the central questions raised by the growth of managed care is the impact of the new financial incentives (e.g., capitation) on the behavior of health care providers. In isolation, this question is not difficult; if physicians are paid more when they do less, they will have an incentive to do less. But in reality, the health care delivery system is a complex organism in which health care for any given individual is produced through numerous interactions between a variety of agents, each of whom may have differing financial and other incentives influencing his or her behavior. In this setting, gaining a full understanding of the impact of these incentives on the behavior of providers is not an easy task. Even the most straightforward HMO arrangements can impose a complicated set of incentives on interacting providers. It is not difficult, for example, to find HMOs that contract with groups of physicians using incentives to limit hospitalizations. The groups, in turn, often pay member physicians using salaries, so the incentives are not effectively passed on to the individual physicians. The same HMO may also have contracts with hospitals in which payment is based on the number of patient days, so that under some circumstances, the financial incentives would lead the hospital administrators to prefer to keep a patient in the hospital an extra day, while the physician group would rather discharge the patient, and the individual physician would find himself or herself more or less indifferent. Things only get more complex in teaching hospitals, where hospitals, attending physicians, and interns and residents may all have varying incentives. These difficulties may be among the reasons that many previous investigators have chosen to examine only ultimate outputs from hospital

care, choosing to leave the lid on the black box that conceals the actual interaction of the incentives within the hospital.

Meltzer, Hiltz, and Bates lift the lid and allow us a glimpse inside. In explicitly describing the various levels of incentives and providing empirical evidence about the effects of managed care on the operation of a teaching hospital, this paper provides very valuable information that should fuel further work on these important questions. While we know that the overall effect of managed care is to reduce hospital utilization, we now find out some more about the complex interactions that generate this outcome. Their finding that the incentives of the managed care plans on attending physicians do have a strong influence on care provided in a teaching hospital is further indication of the power of managed care organizations in dictating the care that will be provided to their members.

In the end, both of these papers provide important evidence that both helps us understand the effects of managed care on the health care system and highlights the need for further work on these questions.

Reference

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Comment on Chapters 7 and 8

Alan Weil

The paper by Feldman and Scharfstein offers insight into an important and timely topic—how the growing reliance on managed care in the health care system may affect the quality of services people receive. The paper cites but does not discuss in detail the literature showing that higher-volume providers, both hospitals and physicians, tend to offer higher-quality care. The paper provides a quantitative analysis, using Massachusetts hospital discharge data, of the extent to which managed care organizations direct patients to higher- or lower-volume providers than patients in fee-for-service (FFS) plans select.

The findings are varied. For two of the three surgical procedures examined, after controlling for factors such as patient age, location, race, and income that might affect patients' choice of providers, patients enrolled in private managed care plans are found to receive services from lower-volume physician providers. For Medicare patients, managed care plans use higher-volume physicians than Medicare FFS patients for two of the

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services, but much lower-volume physicians for the third. For all three procedures, private FFS patients tend to use higher-volume hospitals than patients in managed care plans. The comparison yields mixed results when looking at Medicare.

An important additional finding is that volume varies across managed care plans. The variation is limited when analyzing physician services. But when looking at hospital services, the variation is pronounced. Patients in one of the six health plans separately reported receive their services from high-volume hospitals at a far higher rate than that of any other plan or patients enrolled in fee-for-service plans.

These findings raise two sets of questions. First, How should we interpret the results that show a relationship between care delivery system and provider volume? Second, How do these findings help us understand the quality of care in different systems?

Given the varied results across plans, procedures, and payment sources, a finding of a relationship between delivery system and provider volume is difficult to interpret without a model of behavior by those systems that would suggest why volume might differ and vary across these parameters. One theory offered by the authors is that lower-volume hospitals are more likely to be community hospitals, which are lower cost. Price-sensitive managed care plans would rather contract with lower-cost providers, which results in a lower-volume network. This hypothesis prompts the reader to wonder what explains the other sources of variation in volume. Do Medicare plans face different incentives than private plans? Do plans use different contracting approaches for physicians than they do for hospitals? Do plans use different approaches for different sorts of physicians? Only when these issues are examined will it be possible to interpret the paper's finding that volume ratios differ by payer, provider, and procedure.

In addition, it is not clear that plans contract primarily or exclusively on the basis of price. Plans must amass a provider network that satisfies geographical and practice-breadth objectives. Plans may seek to build relationships with provider networks that rely on that plan for a large portion of their volume, thereby allowing the plan to have a greater say in the providers' actions. Provider arrangements may reflect historical alliances in a community more than they reflect an economic transaction on the basis of price.

The paper also examines variations in provider volume as a basis for understanding more about plan quality. This step in the analysis must be taken with great caution. The paper presents information that suggests an interesting hypothesis about health plan markets that the authors briefly explore. The data showing one plan with heavy reliance upon high-volume hospitals while other plans use lower-volume hospitals raises the possibility that the managed care market is segmented into high-quality and low-quality plans. High-quality plans compete for enrollees who are interested

in savings as compared to fee for service, but who are willing to pay extra to retain a higher-cost and presumably higher-quality network. Low-quality plans compete for enrollees who are primarily interested in price and are less concerned or less willing or able to pay for a higher-quality network. If this market segmentation exists, comparing aggregate HMO and fee-for-service volumes does not yield valuable information. In this model, HMOs do not affect quality. Rather, they pick a level of quality and market and price themselves within a segment of the health plan market.

In this regard, it is worth considering the possibility that product identification operates in the same manner for HMOs as it does for hospitals. Utilization patterns in fee-for-service plans are driven entirely by choices made by individual enrollees. The plan is simply a payment mechanism. An alternative way of formulating the question asked by the authors is: What actions are taken by HMOs in their selection of providers that leads them to select lower-volume providers than individuals do when left to their own choice? If fee-for-service patients tend to select higher-volume providers solely on the basis of name recognition or brand identification, HMOs that select providers on any other basis, even random choice, will tend toward lower-volume providers. Again, in this scenario, quality and volume differences between types of delivery systems are artifacts of other market factors that cannot be ascribed to actions taken by the plans.

Even after exploring these issues, it is worth asking what decision-making model for managed care plans selecting providers would cause one to believe that quality should vary plan by plan. While higher-volume providers may, in general, provide higher-quality care, and certain types of plans may rely on higher-volume providers, the conclusion that certain types of health plans are higher quality is only valid if there is some theory of plan behavior that suggests those plans seek higher-quality providers. One possible way out of this analytical challenge is to posit that plans care about quality, but believing that they cannot measure it directly, they seek to use volume as a proxy, much as the authors have done. This is a plausible approach, but again, it can only be understood in the context of a description of actual plan behavior, not through analysis of hospital records of patients. The authors do not explore this question directly—an undertaking that would require investigating the provider-selection criteria for the plans.

While not the focus of the paper, the specification of the relationship between volume and quality seems important. Particularly, knowing whether there is a linear relationship between volume and quality or a threshold level of volume necessary before quality is likely to be high would help interpret the results. This topic is of particular importance as it applies to this paper because the authors note the skewed distribution of volume across providers. The vast majority of providers operate at very low volume as the term is defined in this paper. A comparison of mean

values of volume by plan type, even when adjusted for patient factors, is meaningful if one assumes a linear relationship. If the relationship is more complex, a different comparison would be appropriate.

In sum, the paper begins to analyze a very complex and important subject. Any single analysis can only address one part of the complex relationship among plan type, provider volume, and quality of care. This paper offers information in one area that, in combination with a better understanding of the structure and dynamics of plan contracting behavior and the nature of the health plan market, helps us understand this relationship.

The Meltzer, Hiltz, and Bates paper examines utilization patterns inside a teaching hospital, comparing the practices of teams that serve a fee-for-service population with teams that serve managed care patients. The paper provides very valuable insight into how financial incentives and organizational design can affect the practice of medicine.

The setting examined in the paper offers almost ideal circumstances for an experimental design. Each of six practice services within the same hospital operates in largely the same way. In general, the attending physician who directs patient care is employed by the hospital. However, in the two services that serve the bulk of managed care patients, care is directed for managed care patients by attending physicians affiliated with the managed care organization. The authors show that the financial incentives differ for managed-care-oriented teams in very specific ways. They also show that physicians from the managed care plans receive feedback on the length of stay of their patients, while no similar feedback occurs for the housestaff.

The paper reaches a simple and strong conclusion. Managed care patients have lower costs in this hospital setting, and those lower costs are essentially entirely due to shorter lengths of stay. Since the analysis fits the behavioral model nicely, the clear implication is that financial incentives can and do affect physician behavior.

The paper creates an excellent foundation for additional analysis that could shed light on the behavioral effects of incentives. It would be interesting to know if similar behavioral results could be achieved for the hospital-based care managers if they were given feedback on the lengths of stay relative to those in the HMO-based team. That is, could information without a financial incentive affect behavior?

It would also be interesting to test the behavioral hypothesis in other areas where financial arrangements are relevant. Similar financial incentives have been established for primary care physicians in their decisions to refer patients to specialists. When referral patterns are compared across physicians with varying incentives, are behavioral differences found? The authors note the reputation that both the health plan and the hospital have for high quality. If quality were less of a behavioral constraint, would the effects of the financial incentives increase? And if so, are there other

constraints that could be designed to assure that quality does not suffer when there are incentives to control utilization?

An interesting comparison point would be the hospital's actions with respect to its Medicare patients, where payments are made on the basis of diagnosis-related groups (DRGs), which create incentives for the hospital similar to those the HMO faces. According to the authors, the hospital does not translate this institutional incentive into an individual or team incentive for the physicians treating Medicare patients. Are there institutions where efforts have been made to do so? Have these efforts had a similar effect on lengths of stay? Are there institutional reasons for avoiding approaches such as this in-house?

The authors also examine how these incentives and practice models affect the educational mission of the institution. This is a complex matter. If patients can be treated effectively and with high quality using a shorter, more intensive hospital stay, then perhaps that is the care model physicians should be educated to pursue. The appropriate pedagogical response may be to determine how care can most effectively be organized during that limited stay and how systems can be developed to meet the needs of the patient before admission and after discharge. This is not to deny the relevance of changed inpatient models on education. It is simply to say that the sense of lost opportunity from a traditional training perspective should be balanced against the opportunity to reexamine what physicians need to know to provide the best quality of care.

The authors close with a note that teaching hospitals can only survive in the current health care market if they learn to work with managed care. The impression one gains from this analysis is that at least one such hospital has taken an approach that shifts the behavior of the institution to conform to the changing financial incentives in the health care system. The paper provides those concerned about the future of teaching hospitals with excellent information that will be useful in navigating and understanding these changes.

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