Hospital–Physician Affiliations and Patient Treatments, Expenditures, and Outcomes

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Objective. To determine the relationship between hospital–physician affiliations and the treatments, expenditures, and outcomes of patients.
Data Sources. Sources include the Medicare Provider Analysis and Review dataset, the American Hospital Association (AHA) Annual Survey, and the Area Resource File (ARF).
Study Design. A multivariate regression analysis of the relationship between hospital–physician affiliations (such as physician–hospital organizations [PHOs] or salaried employment) and the treatment of Medicare patients with a diagnosis of acute myocardial infarction admitted to general medical-surgical hospitals between 1994 and 1998. Dependent variables include whether the patient received a catheterization or angioplasty or bypass surgery; whether a patient was readmitted, or died within 90 days of initial admission; and expenditures. Independent variables include patient, admission hospital, and market characteristics, as well as hospital and year fixed effects.
Principal Findings. The integrated salary model form of hospital–physician affiliation is associated with slightly higher procedure rates, and higher patient expenditures. At the same time, there is little evidence that hospital–physician affiliations in the aggregate have had any measurable impact on patient treatment or outcomes.
Conclusions. The limited effect of hospital–physician affiliations on patient outcomes is consistent with previous research showing that affiliations have not much changed the nature of health care delivery. However, the finding that the integrated salary model is associated with higher treatment intensity suggests that affiliations may have had some impact on patients, and could have more in the future.

Key Words. Hospitals, physicians, affiliations, outcomes

Hospital–physician affiliations diffused rapidly across the United States in the 1990s. Whether they took the form of hospital employment of physicians, physician–hospital organizations (PHOs), or an alphabet soup of other organizations, these affiliations had the potential to serve a variety of hospital goals (Burns and Pauly 2002). A hospital might establish an affiliation to strengthen bargaining power with payers, to control costs, to enhance the quality of care, or to generate admissions (through increases in physician loyalty or managed care contracting opportunities). Increased bargaining power, lower costs, and higher admissions will affect a hospital's financial status; previous work has explored the relationship between hospital–physician integration strategies and financial measures (Ciliberto and Dranove 2002; Stensland and Stinson 2002; Alexander and Morrisey 1988; Goes and Zhan 1995; Mark et al. 1998; Snail and Robinson 1998). But if these integration strategies change treatment patterns or quality, they will also have a more direct impact on patients. This study explores the extent to which affiliations are associated with differences in patient treatments, expenditures, and outcomes.

There are several pathways through which an affiliation may affect patient treatment. One such pathway is through the incentive it may provide for greater quality monitoring. If an affiliation makes the reputations of affiliation partners interdependent, it will give each an incentive to monitor the quality of care of the other (Simpson and Coate 1998). If a patient knows of an affiliation between a hospital and physician, for example, the patient may impute one's reputation for quality to the other, or choose providers based on the quality of bundled services. To avoid losing patients, each partner must make greater effort to assure that the other offers high-quality services. The very existence of an affiliation may in this way provide greater incentives to improve the quality of care. If physicians perceive that higher-intensity treatment will contribute to higher quality, then they will have an incentive to increase intensity. These incentives are strengthened to the extent that the partners' interests are financially aligned, through global capitation, joint marketing, physician compensation mechanisms, or other arrangements. Financial alignment means that poor quality hospital care may harm a physician not just indirectly through damage to the physician's reputation, but directly through its impact on an organization of which the physician is a part.

Alignment of hospital and physician interests is often cited as a potential advantage of affiliation (Haas-Wilson and Gaynor 1998; Simpson and Coate

This research was supported by a National Science Foundation graduate fellowship, a Health Care Financing Administration dissertation fellowship grant, and a 2001 academic year research fellowship sponsored by the John M. Olin Program in Law and Economics at Stanford Law School. Any opinions, findings, conclusions, or recommendations expressed in this article are those of the author and do not necessarily reflect the views of the National Science Foundation or the Centers for Medicare and Medicaid Services.

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1998). Physicians functioning independently of hospitals have little reason to be concerned about the financial impact of their activities on hospitals; affiliations that align financial incentives give physicians reason to change their behavior in such a way as to increase hospital revenues or lower hospital costs. Some changes, such as economizing on the use of supplies, may not affect care, but other changes may. For example, if performing procedures brings in net revenues for a hospital, affiliated physicians may have a greater incentive to perform them than unaffiliated physicians. This is a second pathway through which affiliations may affect care.

Another pathway through which hospital–physician affiliations may affect patient treatment is through an effect on transaction costs (see Robinson 1997, or for a more general discussion, Williamson 1985). Affiliations may bring together physicians who did not previously have access to internal utilization review or other information or patient management systems, because of the large fixed costs involved in establishing such systems. More generally, the complex, dynamic, and relationship-specific nature of these systems makes them difficult to implement on the basis of arm's-length contracting. These contracting costs may be much higher than the coordination costs of achieving the same goals in an integrated setting. Affiliations may facilitate the development of mechanisms to monitor and coordinate care (Budetti et al. 2002; Dynan, Bazzoli, and Burns 1998). If these systems are indeed adopted, they may change treatment patterns and perhaps increase the continuity and quality of care.

The goal of this study is to investigate the aggregate effects of affiliations on patient care, regardless of the pathways from which they emerge. Past studies have documented effects of traditional forms of hospital–physician interaction (such as physician participation in hospital decision making) on patient outcomes (Shortell and LoGerfo 1981). While modern forms of hospital–physician affiliation may also affect outcomes in theory, it is unclear whether they actually do in practice. Affiliations may have served more as vehicles for contracting with managed care organizations than as vehicles for integrating clinical activities (Burns et al. 2001). One study found that while some physician–hospital organizations accepted full risk and played a significant role in hospital quality assurance activities, others were more loosely organized (Kohn 2000). Budetti et al. (2002) chronicles the difficulties that hospitals and physicians have faced in achieving sufficient alignment to satisfy common goals. Although hospital–physician affiliations have the potential to change patient care, only empirical analysis can reveal whether they have realized this potential.

Given the continued existence of affiliations and the debate over their appropriate role in health care delivery (Luke and Begun 2001), it is important to gain a better understanding of their effects on patients. A few recent studies have begun to examine patient care effects. Stensland and Stinson (2002), for example, find that in hospitals in uncompetitive rural areas of the Upper Midwest that had acquired physician practices, patients had shorter lengths of stay. Using data from three states from 1994 through 1998, Cuellar and Gertler (2002) examine the effects of affiliations on prices, utilization, and outcomes. Among their findings are that fully integrated organizations (such as medical foundations and integrated salary models) were associated with lower levels of surgical complications. This study expands on this previous work through the use of a nationwide dataset and different treatment and outcome measures. Specifically, it examines the relationship between hospital–physician affiliations and the treatments, treatment expenditures, and health outcomes of Medicare patients who have had a heart attack.

DATA AND METHODS

Data

The primary data sources for this study are the American Hospital Association (AHA) Annual Survey (for hospital characteristics), the Area Resource File (ARF) (for market characteristics), and Medicare claims files (for patient data, including inpatient, outpatient, and physician treatments and expenditures). The AHA survey has documented hospital involvement in seven types of affiliations: independent practice associations (IPAs), PHOs, management services organizations (MSOs), integrated salary models (ISMs, arrangements under which hospitals salary physicians to provide medical care), medical foundations, equity models, and group practices without walls (GPWWs). While these arrangements may differ in legal structure, degree of integration, and the nature of services provided, each involves hospital interaction with physicians in a form that goes beyond the usual medical staff relationship.[1] In 1993, the AHA survey asked hospitals whether an IPA, PHO, or MSO was provided by the hospital, a hospital subsidiary, joint venture, contractual arrangement, or other arrangement. From 1994 through 1998, it asked whether the hospital participated directly, or through a health system or network, in each of the seven affiliation types. The hospitals' responses were combined into dichotomous variables indicating whether the hospital participated in each affiliation type, regardless of the channel of participation.[2]

In a categorization based on Dynan, Bazzoli, and Burns (1998), hospitals were coded as participating in "low-integration" affiliations if they were involved in IPAs or PHOs, and "high-integration" affiliations if they participated in other affiliation types. High-integration affiliations are more likely to involve actively coordinated behavior between the hospital and the member physicians, and so may have more of an impact on inpatient care than low-integration affiliations.

The AHA survey also provides information about hospital bed size, teaching hospital status, and contract management. A teaching hospital was one that had more than 20 residents. Contract management was defined on the basis of annual survey responses. Variables indicating multihospital system participation were constructed on the basis of AHA-coded system identifiers and individual hospitals' survey responses.[3]

Another data source is the Bureau of Health Professions' Area Resource Files (ARF) published in February 1998 and 2000. The ARF provided data on the number of physicians in an area, and the population counts used in the MSA size, market penetration, and other population-based variables. Statewide HMO penetration, a variable used for rural hospitals, was calculated based on county HMO enrollment reported in ARF in 1994–1996 and 1998. Health maintenance organization penetration for 1997 was calculated as the average of 1996 and 1998 figures. Urban HMO penetration comes from the InterStudy Trend database, which contains total HMO enrollments by MSA for January of each year.

Table 1 describes study hospitals in three of the study years. It shows both the prevalence of hospital–physician affiliations, with close to 70 percent of hospitals participating in at least one form of affiliation in the mid-1990s, and their peak of popularity in the middle of the study period (except for ISMs, which continued to grow in popularity).

Patients are Medicare enrollees from the ages of 65 to 99 who were admitted to a study hospital between 1994 and 1998 and were diagnosed with acute myocardial infarction (AMI). Inpatient data come from the Health Care Financing Administration's 100 percent sample Medicare Provider Analysis and Review tapes (which contain data from Medicare Part A claims). See Kessler and McClellan (2000) for more details. Outpatient expenditures are from Medicare data documenting provider payment amount, coinsurance, and deductibles for all AMI patients in 1993 through 1995, and for a 20 percent sample of these patients in 1996 and 1997. Physician data is drawn from accepted claims in the Medicare physician/supplier files, for a 5 percent sample of AMI patients from 1993 to 1997.[4] (Variables that include physician

Table 1: Hospital Characteristics in Selected Study Years

	1994	*1996*	*1998*
Number of nonfederal general surgical hospitals	4,991	4,888	4,772
Number of study hospitals matched to patients	4,226	4,169	3,650
With low-integration hospital–physician affiliations	44.2*	51.7*	49.6*
With independent practice associations (IPAs)	23.5	28.0	23.8
With physician–hospital organizations (PHOs)	30.3	37.6	35.7
With high-integration hospital–physician affiliations	41.3	50.0	45.3
With management services organizations (MSOs)	17.7	26.2	21.3
With integrated service models (ISMs)	17.8	22.7	24.8
With medical foundations	13.9	15.3	8.6
With equity models	2.7	4.0	3.0
With group practices without walls (GPWWs)	7.3	8.3	5.4
With any hospital–physician affiliations	61.7	70.2	68.7
Less than 100 beds	59.8	63.1	64.3
For profit	10.8	11.7	11.8
Local government	26.7	27.3	26.1
In multihospital systems	45.5	50.6	54.4
Religious	12.3	11.7	12.0
Contract managed	15.4	15.5	15.8
Teaching	10.2	10.3	9.7
With <5% HMO penetration in MSA or state (if rural)	23.4	15.8	8.5
With 5–15% HMO penetration	32.1	25.6	15.9
With 15–25% HMO penetration	27.9	23.9	29.5
With 25–35% HMO penetration	7.9	19.5	24.5
With more than 35% HMO penetration	8.7	15.3	21.5
Physicians per 1,000 in hospital area	1.80	1.90	1.96

*Figures expressed as percents.

data are therefore based on the 5 percent sample.) Demographic information is from the Health Care Financing Administration's Health Insurance Skeleton Eligibility Write-Off file, which contains information from Medicare's enrollment database.

Patient demographic variables include sex, race (black or nonblack), age, and interactions of these variables. The dependent variables are measures of patient treatment, expenditures, and outcomes. Treatment intensity variables include whether the patient received a catheterization within 90 days of initial admission, a percutaneous transluminal coronary angioplasty (PTCA, or angioplasty), or a coronary artery bypass graft (CABG, or bypass surgery). Inpatient medical expenditures are measured by the log of total payments for the Medicare patient's inpatient care (including Medicare hospital reimbursement, deductibles, and copayments) in the 90 days following the patient's index admission, in 1993 dollars. Outpatient and

Table 2: Patient Characteristics in Selected Study Years

	1994	*1996*	*1998*
Number of study patients	210,742	210,208	174,796
Initially admitted to hospital with a hospital–physician affiliation	74.3*	82.9*	80.7*
Female	48.6	50.0	50.8
Black	5.9	6.0	6.0
Ages 65 to 69	21.0	19.6	18.0
Ages 70 to 74	23.7	23.2	21.8
Ages 75 to 79	21.4	22.0	22.3
Ages 80 to 89	29.0	29.8	31.6
Ages 90 to 99	5.0	5.3	6.4
Receiving catheter within 90 days of AMI	45.4	48.5	50.3
Receiving PTCA or CABG within 90 days of AMI	31.5	35.2	37.5
Mean Medicare hospital payments within 90 days of AMI	$14,202	$16,118	$17,068
Readmitted with an AMI within 90 days of initial AMI	1.8*	1.9*	2.0*
Dying within 90 days of initial AMI	24.4	24.4	24.4

*Figures expressed as percents.

Notes: AMI = acute myocardial infarction; PTCA = percutaneous transluminal coronary angioplasty; CABG = coronary artery bypass graft.

physician payment variables are also calculated in logs and 1993 dollars. Two variables measure patient health outcomes: hospital readmission for AMI between 30 and 90 days after initial admission (a variable meant to capture subsequent heart attacks, rather than the continuation of treatment), and mortality within 90 days of admission.

Table 2 shows patient characteristics, treatments, expenditures, and outcomes for three study years. In the 5 percent sample for which physician claims are available, weighted average hospital, outpatient, and physician expenditures within 90 days of initial admission totaled $18,883 (in 1993 dollars). Weighted average expenditures for all patients with available data were $15,192 for hospital care, $420 for outpatient care, and $3,209 for physician care.

Estimation Approach

The first analysis is a descriptive comparison of average treatment intensity and mortality rates in 1994 and 1998 for hospitals that joined, left, remained in, or did not participate in selected affiliation types. Comparison of 1994 baselines shows initial differences between hospitals of different types, and comparison of 1994 and 1998 values shows changes over time potentially associated with changes in affiliation status. A regression analysis is needed, however, to control for the influence of other hospital and patient characteristics.

The core regressions of this study are ordinary least squares regressions that explore the relationship between affiliation status and patient treatment. Specifically, a regression is run for each of the five previously described dependent variables (catheterization, PTCA/CABG, inpatient payments, readmission, and mortality). For each dependent variable there are three models incorporating different sets of affiliation-related independent variables. One model includes an indicator for "any" affiliation, the second breaks this variable into separate indicators for "low-" and "high-integration" affiliations, and the third includes individual affiliation types. All regressions include hospital characteristics, patient characteristics, year fixed effects, and (except for Table 4) hospital fixed effects. An observation is a Medicare beneficiary *i* admitted to a general medical-surgical hospital *j* in the United States for treatment of AMI in year *t*. The regression form is:

$$Y_{ijt} = \begin{matrix}\text{Hospital-}\\\text{Physician}\\\text{Affiliation}\\\text{Variable(s)}\end{matrix} {}^{*}\alpha + \begin{matrix}\text{Hospital}\\\text{Traits}\end{matrix} {}^{*}\beta + \begin{matrix}\text{Patient}\\\text{Traits}\end{matrix} {}^{*}\gamma + \begin{matrix}\text{Year}\\\text{Fixed}\\\text{Effects}\end{matrix} {}^{*}\delta + \begin{matrix}\text{Hospital}\\\text{Fixed}\\\text{Effects}\end{matrix} {}^{*}\chi + \varepsilon_{ijt}$$

Supplemental analyses of physician and outpatient expenditures are of the same form.

RESULTS

Table 3 compares the procedure and mortality rates for patients initially admitted to hospitals with different hospital–physician affiliation formation histories. Patients of hospitals that were affiliated with physicians in both 1994 and 1998 experienced the highest procedure rates of any patient group in 1994; 32.8 percent of these patients received either a PTCA or a CABG. Patients of hospitals that affiliated with physicians in neither year experienced the lowest procedure rates, at 25.2 percent. Patients of hospitals that either formed or disbanded affiliations between 1994 and 1998 received procedures at intermediate rates, 29.3 percent and 30.1 percent, respectively. These treatment intensity patterns characterized not only the relationship between

Table 3: Patient-Weighted Comparison of Patient Treatment and Outcome, by Hospital Affiliation Status, 1994 and 1998

Hospital Participation in Affiliations			*Percent with PTCA or CABG within 90 Days*			*Percent Mortality within 90 Days*		
Type	*Status*	*Hosps N*	*1994*	*1998*	*Percent Change*	*1994*	*1998*	*Percent Change*
Any	Joined	604	29.3	35.6	21.5	25.0	24.7	– 1.2
	Left	341	30.1	35.5	17.9	24.9	25.3	1.5
	In: 1994 and 1998	1,683	32.8	39.1	19.1	24.0	24.0	0.0
	Out: 1994 and 1998	687	25.2	31.5	25.3	26.1	25.6	– 1.9
Low	Joined	579	30.5	36.4	19.3	24.9	24.9	– 0.2
	Left	354	31.8	37.7	18.7	24.7	25.0	1.4
	In: 1994 and 1998	1,076	33.0	39.1	18.7	23.7	23.9	1.0
	Out: 1994 and 1998	1,306	28.3	35.0	23.5	25.3	24.5	– 3.1
High	Joined	591	32.3	38.7	19.7	23.9	24.1	0.7
	Left	419	31.8	36.4	14.5	24.3	24.8	2.0
	In: 1994 and 1998	922	33.9	40.5	19.2	24.0	23.7	– 1.1
	Out: 1994 and 1998	1,383	26.8	33.2	23.7	25.4	25.2	– 0.9
PHO	Joined	495	31.0	37.2	20.0	24.7	24.9	0.8
	Left	283	32.9	37.6	14.3	24.1	24.5	1.7
	In: 1994 and 1998	711	33.1	39.5	19.3	23.6	23.6	– 0.1
	Out: 1994 and 1998	1,826	29.3	35.7	22.0	25.1	24.8	– 1.3
ISM	Joined	464	33.6	40.3	19.9	23.8	23.8	0.0
	Left	206	34.8	39.4	13.4	23.9	23.7	– 0.8
	In: 1994 and 1998	367	34.2	41.0	19.8	23.5	23.4	– 0.3
	Out: 1994 and 1998	2,278	29.3	35.4	20.9	24.9	24.9	– 0.3

Notes: PTCA = percutaneous transluminal coronary angioplasty; CABG = coronary artery bypass graft; PHO = physician–hospital organization; ISM = integrated salary model.

treatment and affiliation formation in general, but also the relationship between treatment and the formation of specific affiliation types, such as low-integration affiliations, high-integration affiliations, and PHOs. Integrated salary models displayed a slightly different pattern. While hospitals that did not engage in ISMs in 1994 or 1998 again had the lowest procedure rates, hospitals in ISMs in 1994 but not in 1998 had higher procedure rates than hospitals that participated in ISMs in both years.

By 1998, procedure rates had risen for each hospital and affiliation type, resulting in little change of the rank ordering as a function of affiliation status. Patients of hospitals that remained in affiliations were still the most likely to receive procedures, while patients of hospitals that were not in affiliations in 1994 or 1998 were the least likely to receive procedures. In two cases, for "any" affiliation and for ISMs, the ordering of affiliation-joiners and affiliation-leavers switched, so that by 1998, patients of hospitals that had formed affiliations over the study period had slightly higher procedure rates than patients of hospitals that left affiliations over the time period. For each affiliation type, forming an affiliation with physicians was associated with a higher percentage increase in procedure rates than terminating such an affiliation.

The disparity in mortality rates by affiliation status is smaller than the disparity in treatment rates, and the patterns less pronounced, but still present. In 1994, for most affiliation types, patients of hospitals that participated in affiliations in both 1994 and 1998 had the lowest mortality rates (e.g., 24.0 percent, for any affiliation), and patients of hospitals that participated in neither year had the highest mortality rates (26.1 percent, for any affiliation). Patients of hospitals joining or leaving partnerships with physicians tended to experience intermediate mortality rates; in 1994, patients of hospitals that eventually joined affiliations had a 25.0 percent inpatient mortality rate, while patients of hospitals that eventually left affiliations had a 24.9 percent mortality rate.

Several of the affiliation types (any, low, PHO) showed a decreased dispersion of mortality rates between 1994 and 1998. Mortality rates at the hospitals with the highest mortality rates tended to decrease substantially, while rates at the hospitals with the lowest mortality rates often (but not always) remained flat or even increased. For each affiliation type except ISMs, hospitals that joined an affiliation between 1994 and 1998 experienced better mortality rates (either decreased rates, or a lower rate of increase) relative to hospitals that left an affiliation. Patients of hospitals that were not in ISMs in 1994, but joined by 1998, experienced the same 23.8 percent mortality rate, whether they were admitted in 1994 or 1998. The patients of hospitals that left ISMs over the study period, on the other hand, experienced a 23.9 percent mortality rate in 1994, and a 23.7 percent mortality rate in 1998. In general, mortality within each ISM affiliation category varied by less than .2 percentage points.

Multivariate regressions can control for changes in hospital characteristics or patient composition that may contribute to the patterns in the descriptive statistics. The regression producing the results of Table 4 regressed five measures of patient treatments, expenditures, and outcomes (listed along the top of the table) on hospital participation in any type of physician affiliation, in addition to the hospital, market, and patient characteristics displayed in Tables 1 and 2, regional and MSA size variables, and year fixed effects. The coefficient estimates for the affiliation variable, along with standard errors, are reported in Table 4 in percentage point terms. They show

Table 4: Ordinary Least Squares Analysis without Fixed Effects: Relationship between Affiliations and Patient Treatments, Payments, and Outcomes

Affiliation Type	*Catheter within 90 Days*	*PTCA or CABG within 90 Days*	*Log 90-Day Inpatient Payments*	*AMI Readmit within 90 Days*	*90-Day Mortality*
Any	1.83	1.30	2.60	−.08	−.15
	(.40)	(.33)	(.57)	(.04)	(.16)

Notes: AMI = acute myocardial infarction; PTCA = percutaneous transluminal coronary angioplasty; CABG = coronary artery bypass graft.

that Medicare AMI patients initially admitted in 1994 through 1998 to hospitals participating in affiliations were about 1.8 percentage points more likely to receive a catheterization, and 1.3 percentage points more likely to receive a PTCA or CABG, than a patient admitted to a hospital that did not participate. Inpatient expenditures for patients initially admitted to hospitals affiliated with physicians were about 2.6 percentage points higher than expenditures for patients initially admitted to independent hospitals. While these results were statistically significant at the $p < .05$ level, the estimated effects on readmissions and mortality were not.

These results may be misleading, however, because they may result from a greater propensity among high-intensity treatment hospitals to form affiliations. For example, if high-intensity treatment generates revenues that facilitate the formation of affiliations, then it should not be surprising that the presence of affiliations would be associated with higher-intensity treatment.[5] The inclusion of fixed effects, however, would account for consistently high utilization patterns, along with other unchanging hospital characteristics. The effect of affiliations would then be identified not through a comparison of hospitals with affiliations and hospitals without, but instead through hospitals' changes in affiliation status over time. Model 1 of Table 5 recreates the regression of Table 4, but adds indicator variables for each hospital in the dataset. The results for Model 1 indicate that affiliation participation has no statistically significant impact on any of the measures at a $p < .05$ level. Nor do statistically significant results appear when low-integration affiliations are separated from high-integration affiliations, as demonstrated by the results of Model 2.

The lack of statistically significant results may be driven in part by the aggregation of model types with disparate effects. Model 3 therefore introduces regressors for each of the model types. (More complete results for Model 3 are reported in the online-only Appendix.) For most model types,

Table 5: Ordinary Least Squares Analysis: The Relationship between Hospital–Physician Affiliations and AMI Patient Treatments, Payments, and Outcomes, 1994–1998

		Dependent Variables				
	Independent Variable: Affiliation Type	*Catheter within 90 Days*	*PTCA or CABG within 90 Days*	*Log 90-Day Inpatient Payments*	*AMI Readmit within 90 Days*	*90-Day Mortality*
Model 1	Any	.14	.12	.35	−.10	.33
		(.26)	(.25)	(.34)	(.06)	(.19)
Model 2	Low	−.04	.14	.01	−.06	.13
		(.24)	(.24)	(.34)	(.06)	(.18)
	High	.17	.09	.38	−.07	.12
		(.21)	(.21)	(.28)	(.05)	(.15)
Model 3	IPA	.25	.44	.41	−.02	−.03
		(.25)	(.24)	(.37)	(.06)	(.19)
	PHO	.03	.22	−.04	−.05	−.13
		(.26)	(.25)	(.37)	(.06)	(.19)
	MSO	−.22	−.21	−.50	−.12*	.14
		(.24)	(.23)	(.31)	(.05)	(.17)
	ISM	.68*	.62*	.86*	.07	.07
		(.25)	(.24)	(.36)	(.06)	(.18)
	Foundation	.30	.31	.62	−.10	.21
		(.28)	(.28)	(.40)	(.07)	(.20)
	Equity	.02	−.34	−.18	.14	.09
		(.43)	(.44)	(.68)	(.11)	(.33)
	GPWW	−.09	.15	−.34	−.10	−.11
		(.30)	(.31)	(.46)	(.08)	(.25)

Notes: Regressions also include hospital traits, patient traits, market traits, hospital fixed effects, and year fixed effects; full results reported in Appendix. Coefficients and robust standard errors (in parentheses) reported in percentage points. Stata cluster function used to correct for lack of independence across observations for patients admitted to the same hospital. AMI = acute myocardial infarction; PTCA = percutaneous transluminal coronary angioplasty; CABG = coronary artery bypass graft; IPA = independent practice association; PHO = physician–hospital organization; MSO = management services organization; ISM = integrated salary model; GPWW = group practice without walls.

*Significant at $p<.05$ level.

most of the estimates are not statistically significantly different from zero. However, in the instances in which results are statistically significant, they replicate the high-intensity pattern visible in Table 4. In particular, AMI patients initially admitted to hospitals that participate in an ISM (i.e., that salary physicians), are more than .6 percentage points more likely to receive cardiac procedures, and have expenditures about .9 percentage points higher than patients of hospitals not involved in ISMs. The only statistically

Table 6: Ordinary Least Squares Analysis: The Relationship between Hospital–Physician Affiliations and AMI Patient Inpatient, Outpatient, and Physician Payments, 1993–1997

		Dependent Variables		
	Independent Variable: Affiliation Type	*Log 90-Day Inpatient Payments*	*Log 90-Day Outpatient and Physician Payments*	*Log 90-Day Total Payments*
Model 1	Any	.42	1.78	1.11
		(.30)	(1.86)	(1.17)
Model 2	Low	.30	3.36	2.05
		(.31)	(1.82)	(1.17)
	High	−.25	−1.80	−1.23
		(.28)	(1.69)	(1.03)
Model 3	IPA	.21	−2.37	−.80
		(.36)	(1.96)	(1.22)
	PHO	.43	4.49*	3.57*
		(.34)	(1.89)	(1.28)
	MSO	−.33	−.13	−.51
		(.31)	(1.89)	(1.18)
	ISM	−.15	−.99	−1.11
		(.37)	(2.01)	(1.26)
	Foundation	−.07	−3.48	−1.23
		(.38)	(2.06)	(1.33)
	Equity	−.72	.52	1.69
		(.66)	(3.46)	(2.26)
	GPWW	−.42	−.38	.35
		(.46)	(2.82)	(1.60)
N Model 1		1,035,482	51,786	51,441
N Model 2		1,032,507	51,653	51,310
N Model 3		1,003,532	50,189	49,858

Notes: Regressions include hospital fixed effects and regressors listed in Appendix. Coefficients and robust standard errors (in parentheses) reported in percentage points. Stata cluster function used to correct for lack of independence across observations for patients admitted to the same hospital. AMI = acute myocardial infarction; IPA = independent practice association; PHO = physician–hospital organization; MSO = management services organization; ISM = integrated salary model; GPWW = group practice without walls.

*Significant at $p < .05$ level.

significant difference in outcomes is the .1 percentage point lower readmission rates for patients of hospitals that sponsor MSOs.

Table 6 reports the results of regressions that examine the relationship between hospital–physician affiliations and physician and outpatient expenditures. Data limitations required a switch to a 1993 to 1997 study period. The switch in patient samples, combined with imputed coding for some affiliation types and differences in survey questions for others, resulted in different results for inpatient expenditures (such as the loss of the positive, statistically significant ISM coefficient).[6] Most results for outpatient and physician payment variables were statistically insignificant. Patients of hospitals participating in PHOs, however, do appear to experience rates of outpatient and physician expenditure and total expenditures several percentage points higher than patients initially admitted to hospitals that do not participate in PHOs.

DISCUSSION

The descriptive analysis in Table 3 suggests that joining or leaving an affiliation is associated with differential rates of procedure growth. Relative to hospitals that do not enter affiliations, patients of hospitals that do enter affiliations experience slower growth rates in procedure use. Affiliations would therefore appear to have a negative impact on procedure growth rates. On the other hand, relative to hospitals that remain in affiliations, hospitals that leave them also experience slower growth rates. This implies that affiliations may have a positive impact on procedure rates.

Part of the explanation for the discrepancy may be the dispersion in the initial treatment rates. Given the nonaffiliated hospitals' comparatively low 1994 procedure rates, their procedure rates are likely to grow faster as a percentage of the base rate than those of other hospitals. In terms of percentage points (rather than the percentage of the initial base rate), the increase in rates for joiners of any affiliation was the same as that for nonjoiners. Hospitals that left affiliations, on the other hand, often had initial procedure rates that were slightly lower than those of hospitals that remained in affiliations, but still experienced lower growth rates. In percentage point terms, the growth rate was anywhere from .9 to more than 2 percentage points lower for hospitals that left affiliations relative to hospitals that remained in affiliations. This supports an inference that affiliations are associated with higher procedure rates.

The argument that affiliations are associated with higher-intensity treatment is strongest for ISMs. While the growth rate in procedure rates for hospitals that joined ISMs was somewhat lower than for hospitals that remained unaffiliated, the increase in procedure rates was actually .6 percentage points greater for hospitals with ISMs. At the same time, the increase in procedure rates for hospitals that abandoned ISMs was more than 2 percentage points lower than for hospitals that continued to salary physicians.

The experience of ISM-joiners and ISM-leavers therefore points to an association between ISM participation and high rates of procedure use.

This conclusion is reinforced by the results of the ordinary least squares regression, which controls for changes in hospital, market, and patient traits for which the descriptive analysis cannot account. (It also controls for hospital fixed effects, which would include any fixed hospital characteristics that contribute to the baseline differences visible in Table 3.) While the estimates for the other affiliation types are not statistically significant at the $p < .05$ level, participation in an ISM is positively associated with higher procedure rates. This is true not only for the PTCA/CABGs documented in Table 3, but also for catheterizations.[7] Patients treated in hospitals affiliated with salaried physicians receive more intensive treatment, which may translate into higher expenditures for care. And in fact, expenditures are higher for patients of ISM hospitals than for patients of hospitals without ISMs.

The fact that the ISM form of affiliation exhibited a pattern of higher-intensity treatment when other affiliations did not is not surprising, given the nature of the ISM. Of the four common forms of affiliation (IPA, MSO, PHO, and ISM), it is the most integrated, involving an employment relationship. The relationship between a hospital and a salaried institutional employee is likely to be stronger than that mediated by an IPA or a PHO; physicians may receive only a fraction of their patients through an IPA or PHO, for example. Given the strength of this relationship, an ISM may choose to publicly advertise the affiliation between hospitals and physicians, which would tend to reinforce the sort of reputational incentives discussed earlier. If physicians believe that higher-intensity treatment could contribute to a better reputation of the institution as a whole (for example, because they believe intensity produces better outcomes), they will be more likely to engage in it than they would have, had their relationship with the hospital been weaker. Other types of affiliation tend to be less publicly visible, perhaps because their limited scope does not merit advertisement, or because they focus on payers rather than patients.

The ISM's employment relationship may also help align hospital and physician financial incentives to a greater degree than IPAs, PHOs, or MSOs. If reimbursement for cardiac procedures generates positive net revenues, and physicians have a stake in the success of the larger organization, then they will have an incentive to treat their patients more intensively. Similarly, if physicians believe that higher intensity treatment is higher quality treatment, and that quality will be rewarded in the marketplace, again they will tend to suggest more intensive treatment.[8]

This is not to say that ISMs always will have powerful incentive effects. For example, affiliated physicians may not always have significant influence over patient care; to the extent that ISMs involve primary care practitioners, and that the relevant treatment decisions are made by specialists, the effect of ISMs on patient treatment will be attenuated. Furthermore, the degree of financial alignment depends on institutions' willingness to use high-powered incentives to reward productivity; fixed salaries will again tend to weaken the impact of ISMs. But even salaried physicians have an interest in the overall financial health of their organization. Physicians involved in other types of affiliation may not. The financial incentives associated with affiliations such as IPAs, PHOs, and MSOs will vary depending on the incentive structure of the organization's relationship with payers (global capitation or fee-for-service?), the financial incentives the organization provides to its physician members, and the share of the physician's income attributable to the organization. For these reasons, hospital–physician alignment of interests may be weaker on average within these organizations than within ISMs.

The close relationship between ISM physicians and hospitals may also allow for lower coordination, monitoring, and influence costs. Along a continuum that stretches from spot-contracting to hierarchy, the typical ISM is likely to the right of the other common affiliation forms. While hospitals are unlikely to dictate physician treatment patterns, an ISM hospital may have more influence over salaried physicians than a hospital whose relationship is limited to joint contracting through a PHO. The closer relationship may also lower the costs of implementing systems that facilitate the provision and monitoring of patient care. If these systems affect treatment patterns, then an ISM affiliation may be associated with more intense treatments.[9]

While inpatient care is clearly important to patients, providers, and payers in terms of its impact both on expenditures and outcomes, it is not the only dimension of care potentially affected by affiliations. One hope of integrated delivery system proponents is that the development of such systems can rationalize the provision of care by shifting patients away from more expensive inpatient settings toward less expensive outpatient settings. But Table 6 shows no statistically significant drop in total expenditures. Outpatient and physician expenditures were statistically significantly higher for patients admitted to hospitals participating in PHOs, but there was no corresponding decrease in inpatient expenditures. As a result, total expenditures of patients of PHO hospitals were more than 3 percent higher than expenditures of patients in non-PHO hospitals. Thus, to the extent that affiliations impact total expenditures, they appear to cause expenditures to increase.

Changes in treatment intensity may affect patient outcomes, as may the improved coordination or quality monitoring that may accompany affiliation formation. But neither the descriptive nor the regression analysis shows a strong relationship between hospital–physician affiliations of any type and improvements in mortality. The trend in mortality rate for the study's AMI population as a whole was flat (24.4 percent died within 90 days of initial admission in both 1994 and 1998). Increases and decreases within each affiliation type and hospital status were also small. As with the procedure rate statistics, hospitals not affiliated in either 1994 or 1998 began the study period with mortality rates that were quite different (higher) than those of the other hospitals, and for several of the affiliation types they also tended to experience the fastest mortality rate decreases. In each case, they decreased more than the mortality rates of hospitals that joined affiliations (or decreased while the rates of affiliation-joiners increased), suggesting that if anything, joining an affiliation increases rates. But once again, except for ISMs, hospitals that left affiliations experienced larger increases in rates than hospitals that remained in affiliations, suggesting that affiliations are associated with lower mortality rates. The descriptive statistics therefore paint an unclear picture of the effect of affiliations on mortality.

Controlling for other patient, hospital, and market characteristics, there seems to be no statistically significant relationship between outcome measures and hospital–physician affiliations. For the individual affiliation types, the only measure that is statistically significant at the $p < .05$ level is a very slightly lower readmission rate for patients initially admitted to hospitals that sponsor MSOs. The estimates for 90-day mortality were small and not statistically significant. While affiliations like ISMs may be associated with higher treatment intensity, this difference in practice style is not associated with improvements in patient outcomes.

Conclusions

Some forms of hospital–physician affiliation appear to be associated with a higher level of treatment intensity, but in general the impact of these affiliations has been limited, particularly with respect to mortality. This assessment is consistent with the work of researchers who have examined the ways in which these organizations function in practice, and who have concluded that many affiliations do not achieve much integration, or change in the way that care is provided (Burns and Pauly 2002). Kohn (2000) points out that it is unclear whether affiliations are formed to manage financial incentives, or to combat them by forming larger organizations resistant to change. The small effect of hospital–physician affiliations on patient care is consistent with the latter view (as are the Cuellar and Gertler [2002] findings of increased prices with few efficiency effects). The bulk of hospital participants' efforts may be directed not toward the improvement of efficiency or quality, but instead toward the preservation of financial stability through the generation of hospital admissions or an increase in market power. If this indeed is the case, it provides further justification for continued scrutiny of affiliations by antitrust agencies.

Any conclusion that affiliations' patient care effects have been limited must be qualified, however. First, this analysis has been limited to heart attack patients. Given its impact on patients' lives and its responsibility for a significant share of hospital admissions, AMI (and more generally, cardiac disease) is an important topic of study. But the treatment of other diseases and conditions is also likely to be affected by organizational change. While previous studies have shown significant regional variation in cardiac treatment choices, treatment patterns for other conditions may be even more susceptible to alteration. Second, while readmissions and mortality are important outcomes, they are blunt measures that cannot fully capture improvements in the quality of life that may result from high-quality cardiac care. Third, this study includes just five years of data from the early history of hospital–physician affiliations. Even in these early years, the results suggest that hospital participation in integrated salary model arrangements may have increased treatment intensity. If hospital–physician affiliations begin to direct more effort toward improving patient treatment, they may produce more beneficial effects.

While the popularity of hospital–physician affiliations has declined somewhat in recent years, many affiliations persist. Through its demonstration projects such as the Medicare Partnerships for Quality Cardiovascular Services, Medicare continues to express interest in encouraging hospital–physician collaboration and incentive alignment. The potential for collaboration to make a difference is clear. For this reason, it is important that studies of hospital–physician affiliations continue. With more years of data, and more detailed data, regression analysis may be better able to identify the effects of affiliations—or to track changes in these effects. Further research could help health care providers develop organizations that facilitate improvements in the efficiency and quality of patient care.

ACKNOWLEDGMENTS

I would like to thank Jason Brown, Jeff Geppert, Dan Kessler, Julie Lee, Mark McClellan, John Pencavel, Abigail Tay, and Akila Weerapana for their encouragement, suggestions, assistance in obtaining data, and many helpful discussions. I also thank the editors and two anonymous reviewers for their suggestions.

NOTES

1. Most of the affiliation forms involve some combination of increased integration among doctors, stronger financial relationships between doctors and hospitals, and the provision of administrative or management services. Hospitals may sponsor the formation of IPAs, which bring together independent physician practices for managed care contracting. Physician–hospital organizations join hospitals and physicians into a single organization that may negotiate contracts for both hospital and physician services with payers. Management services organizations are vehicles through which hospitals provide management services for physician practices. An ISM occurs when a hospital salaries physicians to provide medical care. A hospital may establish a foundation that purchases the assets of a physician group, and then enters into a professional services contract with the physicians. The AHA (1998) defines an "equity model" as an arrangement that "allows established practitioners to become shareholders in a professional corporation in exchange for tangible and intangible assets of their existing practices." Finally, GPWWs also combine physicians into a single entity. For more extensive descriptions, see AHA 1998, Burns and Thorpe 1993, Furrow et al. 1997, and Snail and Robinson 1998.
2. An algorithm based on current and surrounding year survey data was applied to fill in missing data and to ensure consistency across years in affiliation measures. Coding of the aggregate affiliation variables low, high, and any, was based on nonmissing, gap-filled individual affiliation codes. Algorithms were also applied for other hospital variables.
3. Hospitals with an AHA-assigned system identifier retained that identifier. System identifiers were also assigned when at least two hospitals reported the same system name, or when hospitals reported participation in systems that were ever listed either in the *AHA Guide* (between 1985 and 2000) or in system lists prepared annually by *Modern Healthcare*. A gap-filling algorithm was then applied. To be treated as a system hospital, a hospital must have had at least one hospital partner that fulfilled the study inclusion criteria.
4. The unavailability of 1998 claims reduces the total expenditures for the 1997 AMI cohort, as 90 days' worth of claims will not be available for patients admitted near the end of 1997.
5. I thank an anonymous reviewer for suggesting this possibility.

6. In Table 6, hospitals are treated as if they did not participate in ISMs, equity models, and GPWWs in 1993. Revising this analysis to include only 1994 through 1997 data (for which information on these affiliation forms is available) increased standard errors and decreased the magnitude of the PHO coefficients (by less than a percentage point), leaving the results significant at only a $p<.20$ level.
7. Supplementary regressions suggest that hospitals that join ISMs and hospitals that leave ISMs both contribute to the relationship between ISM participation and treatment intensity. For example, patients admitted to an ISM hospital that had joined the ISM during the study period experienced a .6 percentage point higher rate of catheterizations ($p<.10$) relative to patients of hospitals that had not yet joined ISMs. At the same time, patients admitted to hospitals that had abandoned ISMs experienced a .8 percentage point lower rate of catheterizations ($p<.10$) relative to patients of hospitals still in ISMs.
8. An alternative explanation for the high-intensity treatment patterns is that one goal of hospitals in forming an ISM is to increase (or prevent the loss of) patient admissions. Suppose a hospital purchases the practices of physicians who tend to practice intensively, and the affiliation increases the proportion of the physicians' referrals admitted to the acquiring hospital. The hospital would then experience higher procedure rates due to a change not in practice style, but in physician composition. Patients of physicians who practice high-intensity medicine would not receive more procedures; instead, they would become more likely to be treated in affiliated hospitals than in unaffiliated hospitals. More detailed physician data would be required to decompose increased procedure rates into "intensity" and "composition" effects.
9. Another potential explanation for high-intensity treatment patterns among ISM hospitals is that these hospitals may be differentially likely to offer catheterization, angioplasty, and open-heart surgery services. While regression results suggest that patients initially admitted to hospitals offering these services are more likely to receive them, a regression controlling for service offerings does not substantially change the coefficients reported in Table 5. Results available from the author upon request.

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