

Hospital purchasing alliances: Utilization, services, and performance

Lawton R. Burns

J. Andrew Lee

Background: Hospital purchasing alliances are voluntary consortia of hospitals that aggregate their contractual purchases of supplies from manufacturers. Purchasing groups thus represent pooling alliances rather than trading alliances (e.g., joint ventures). Pooling alliances have been discussed in the health care management literature for years but have never received much empirical investigation. They represent a potentially important source of economies of scale for hospitals.

Purposes: This study represents the first national survey of hospital purchasing alliances. The survey analyzes alliance utilization, services, and performance from the perspective of the hospital executive in charge of materials management. This study extends research on pooling alliances, develops national benchmark statistics, and answers important issues raised recently about pooling alliances.

Methodology/Approach: The investigators surveyed hospital members in the seven largest purchasing alliances (that account for 93% of all hospital purchases) and individual members of the Association of Healthcare Resource & Materials Management. The concatenated database yielded an approximate population of all hospital materials managers numbering 5,014.

Findings: Hospital purchasing group alliances succeed in reducing health care costs by lowering product prices, particularly for commodity and pharmaceutical items. Alliances also reduce transaction costs through commonly negotiated contracts and increase hospital revenues via rebates and dividends. Thus, alliances may achieve purchasing economies of scale. Hospitals report additional value as evidenced by their long tenure and the large share of purchases routed through the alliances. Alliances appear to be less successful, however, in providing other services of importance and value to hospitals and in mediating the purchase of expensive physician preference items. There is little evidence that alliances exclude new innovative firms from the marketplace or restrict hospital access to desired products.

Practice Implications: Pooling alliances appear successful in purchasing commodity and pharmaceutical products. Pooling alliances face the same issues as trading alliances in their efforts to work with physicians and the supply items they prefer.

Hospital purchasing alliances (also known as purchasing groups or group purchasing organizations) have been discussed in the health care

Key words: alliances, group purchasing, hospitals

Lawton R. Burns, PhD, MBA, is The James Joo-Jin Kim Professor and Professor of Health Care Systems & Management, Department of Health Care Systems, The Wharton School, University of Pennsylvania, Philadelphia. E-mail: burnsL@wharton.upenn.edu.

J. Andrew Lee, SCM, is Doctoral Student, Department of Health Care Systems, The Wharton School, University of Pennsylvania, Philadelphia.

This research was funded by the National Science Foundation Award 0437262 and by the Center for Health Management Research.

Health Care Manage Rev, 2008, 33(3), 203-215

Copyright © 2008 Wolters Kluwer Health | Lippincott Williams & Wilkins

management literature for years. Alliance case studies have been profiled in multiple editions of major texts on organizational theory (Shortell & Kaluzny, 2006) and strategic management (Swayne, Duncan, & Ginter, 2006). An alliance's structure and function have been the subject of two recent qualitative analyses of the health care supply chain (Burns & Wharton School Colleagues, 2002; Schneller & Smeltzer, 2006).

Nevertheless, alliances have rarely been studied empirically and using large samples of hospitals or purchasing groups. As a consequence, there is a gap in the evidence base concerning alliances' utilization, services, and performance. This study seeks to answer four questions regarding purchasing alliances. First, what is the level of hospital participation in such alliances (e.g., number of

alliance memberships and percentage of supplies purchased through the alliances)? Second, what services do alliances perform for hospital members (e.g., cost savings, other efficiencies, and value-adding services)? Third, what is the performance of the alliance (assessed in terms of the perceived value and importance of its services) reported by hospital members? Fourth, does the level of hospital participation in the alliance influence the perceived value derived from the alliance?

This study's conceptual model is grounded in two branches of the strategic alliances literature: pooling alliances and value-chain alliances. Strategic alliances are defined as any formal arrangement between two or more organizations for purposes of ongoing cooperation and mutual gain–risk sharing (Zajac, D'Aunno, and Burns, 2006). There are two types of strategic alliances. To date, the healthcare management literature on alliances has focused heavily on “trading alliances”, in which members contribute complementary resources. Examples include physician-hospital alliances (Dyanan, Bazzoli, and Burns, 1997; Madison, 2004; Cuellar and Gertler, 2006), physician-hospital joint ventures (Shortell & Zajac, 1988; Zajac, Golden, & Shortell, 1991), and non-ownership-based hospital networks (Bazzoli, Shortell, Dubbs, Chan, & Kralovec, 1999). In contrast, hospital purchasing groups represent *pooling alliances* in which members pool their supply purchases, reduce their common dependence on product manufacturers, avert market and demand-related risks, and gain joint influence over their task environment and supply chain (Schneller & Smeltzer, 2006; Zajac et al., 2006). Similarly, in terms of interorganizational relations, they represent *voluntary agency federations* that cede certain limited functions to a central management organization to augment their bargaining power in the marketplace (Oliver, 1990, p. 252). Pooling does not necessarily mean equal participation in alliances. Hospitals differ in their utilization of an alliance (e.g., percentage of purchases routed through the alliance) and loyalty to a specific alliance (e.g., use of alliance's contract price as a ceiling to negotiate a better deal).

Purchasing groups are not only pooling alliances among hospitals but also value-chain alliances with hospitals: they represent intermediaries between the hospitals and the manufacturers from which they acquire products. Schneller and Smeltzer (2006) argue that hospitals' effective utilization of these alliances is one of the few vehicles for hospital cost containment remaining to be explored. Supplies and purchased services account for roughly one third of a hospital's operating expenditures but have not received the same level of cost-containment effort given to staffing reductions, work restructuring, lean manufacturing, and total quality management techniques. One reason may be that supply chain management (e.g., a hospital's relationship with its purchasing group) has heretofore been considered more tactical than strategic and

thus relegated to departments below the executive level (e.g., materials management, central supply, and pharmacy). Another related reason may be that supply chain management is considered the realm of operations research, logistics, or industrial engineering and not the purview of organizational research.

Hospital purchasing alliances are thus important for two reasons: they represent a different type of strategic alliance than normally studied, and they serve an important function in hospital cost-containment activities. This study represents the first national investigation of hospital purchasing alliances and their contribution to cost containment. This study draws on survey data collected from the hospital managers responsible for medical supply procurement who assess the performance of their purchasing alliances in lowering supply costs and providing value-adding services to hospitals. This study thus asks one side of the alliance (hospital members) to evaluate the performance of the other side (purchasing groups). Given the lack of prior research and thus the novelty of the subject area, we confine our presentation to descriptive and bivariate statistics from this study and their implications for hospital managers.

Prior Research

Participation in Alliances

Prior research has only tangentially addressed our four research questions and rarely with empirical evidence. Researchers commonly rely on estimates reported by trade associations to assess the level of hospital participation in purchasing alliances. These figures suggest that (a) 90–98% of hospitals belong to an alliance, (b) hospitals belong to an average of 1.6–2.6 such alliances, and (c) hospitals route 66–72% of their supply purchases through them (Burns & Wharton School Colleagues, 2002; Schneller & Smeltzer, 2006). There are no independently derived statistics to verify these industry estimates. Researchers also rely on data provided to trade journals by the alliances themselves to estimate their membership size and market shares (cf. Rhea, 2007).

Alliance Services

The services provided by purchasing alliances have been frequently discussed in the health care literature. The many editions of a prominent health care organization design and behavior text have included a short case discussion of The Yankee Alliance, a consortium of hospitals that pursues joint contracting and purchasing of supplies (Zajac et al., 2006). Similarly, the many editions of a health care strategy text have included a case on the Premier Health Care Alliance, a merger

of separate purchasing consortiums (Swayne & Ginter, 2006). The cases illustrate the historical development of these alliances and their strategic intent to add value to their hospital members: reduce product costs; gain scale economies through committed purchasing programs; make operational improvements; and improve organizational learning and innovation, technology assessment, information sharing, and access to consulting services.

More recently, researchers have conducted two broad investigations of the health care supply chain and purchasing alliances in particular, using field techniques (Burns & Wharton School Colleagues, 2002; Schneller & Smeltzer, 2006). Schneller and Smeltzer (2006) analyze both (a) internal hospital supply chain management functions and (b) external purchasing alliances utilized by hospitals to manage their product sourcing and contracting activities. Their analysis documents the primary goals of purchasing alliances: lower prices, cost reductions, and standardization of products. They also highlight some emerging goals: patient safety, clinical technology assessment, review of breakthrough technologies, and especially the management of expensive physician preference items (PPIs)—that is, items for which physicians have strong vendor preferences, which heavily influence the product selection decision, and which resist standardization (Montgomery & Schneller, 2007). They discuss some additional avenues by which alliances can deliver value to hospital members: networking and sharing of best practices, increasing revenues (e.g., via shareholder dividends), and lowering transactions costs (Web-based product catalogs).

Burns and Wharton School Colleagues (2002) depict the role of hospital purchasing alliances in the value chain of health care—for example, relationships with upstream product manufacturers and downstream hospitals and physicians. Their analysis examines alliance functions and services, business models, strategic capabilities and competitive advantage, and efforts to reduce the cost of expensive PPIs and package multiple products in lower cost contracts negotiated with large diversified manufacturers. Such packaged contracts can be executed with a single (sole source), dual (dual source), or multiple manufacturers (multisource). The more restricted the hospital's choice of vendor and the greater the purchasing commitment the hospital makes to that vendor, the lower the negotiated contract price is. Their analysis also considers the extent to which alliances are successful in mediating the hospital's purchases of different categories of products, such as commodity medical-surgical items, pharmaceuticals, and medical devices.

Alliance Performance

Research on alliance performance and the value of services provided is confined to a few empirical analyses scattered over time. One early study found that six purchasing

alliances (primarily hospital systems) secured lower product prices compared with a control group of 24 hospitals not participating in such alliances, primarily due to hospital commitment to the alliance's contracts (Cleverly & Nutt, 1984). A second study found that purchasing consortia across various industries lowered product pricing for their members by an average of 12–14% (Hendrick, 1996). Three other empirical studies examined issues tangential to alliance performance, including the determinants of member commitment to alliance contracts (Doucette, 1997), the performance of hospital materials management departments (Dacosta-Claro, 2002), and critical success factors for purchasing alliances (Nollet & Beaulieu, 2003). The case studies referenced above also describe the internal tensions present in purchasing alliances, for example, voluntary alliances that seek hospital compliance with purchasing contracts, hospitals that test whether the alliances obtain better pricing, and alliance efforts to standardize physicians' varying preferences for high-cost medical devices (e.g., stents and defibrillators).

A somewhat different set of findings on alliance performance has been published by the health care trade press, consulting firms, governmental agencies, and expert witnesses in conjunction with industry litigation and a succession of Senate hearings. Much of this literature is referenced by Schneller and Smeltzer (2006) and Burns and Wharton School Colleagues (2002). One main issue is whether alliance contracts are consistent with the hospital's prior product preferences, purchasing strategy (if any), and overall outsourcing efforts. Schneller (2000) has documented the variable and sometimes minimal dependence of hospitals on alliance contracts. Hospitals appear to pick and choose (a) when they want to use the alliance's contracts, (b) when they want the alliance to customize a national contract to their specifications, and (c) when they want to use the alliance's contract pricing as a ceiling and negotiate their own deals beneath it.

The other main issues in this literature are (a) whether it is appropriate for alliances to collect administration fees from manufacturers as a cost of brokering supply contracts with hospitals, (b) whether the committed single-source, dual-source, or multisource contracts with large manufacturers exclude smaller firms from the contracting marketplace, (c) whether the alliances suffer from conflicts of interest by virtue of accepting fees from manufacturers and engage in unethical business practices, and whether the alliance industry's code of ethics (approved by the Senate) is sufficient, (d) whether the alliances really obtain lower product prices, and thus (e) whether alliances really serve the hospitals' interest.

Alliance Participation and Perceived Value

No empirical studies have addressed this issue. We hypothesize that greater participation is associated with

higher perceived value. Because greater participation is sought by alliances and higher value is sought by hospitals, evidence for such an association suggests that alliances and hospitals can achieve win–win collaboration.

Summary of Prior Research

The bulk of the academic literature suggests that the performance of purchasing alliances should be gauged by the value (e.g., tangible savings and intangible benefits) they add to their hospital members (Schneller & Smeltzer, 2006, pp. 102 and 110). There is a clear presumption in the academic research that such value is conferred based on prior research documenting lower alliance prices (Cleverly & Nutt, 1984) and given that an estimated 90–98% of hospitals belong to purchasing alliances. Nevertheless, there is considerable controversy in the public arena and the courts and little empirical data. This study seeks to document the degree to which hospitals acknowledge this value-added contribution and in which alliance areas.

Purpose of the Study

This study thus builds upon prior research but also seeks to extend it in several ways. First, the analysis is based on empirical data drawn from a national survey of the population of U.S. hospitals. Second, alliance performance is evaluated by the hospital stakeholder most intimately involved (the director of materials management). Following the sage advice of Peter Drucker (1973, pp. 79–80), the success of purchasing alliances can be partially gauged by the level of satisfaction expressed by its hospital customers. Third, the survey covers a comprehensive list of alliance functions and value-adding services that permits a broad assessment of their contribution. Fourth, this study addresses some important public policy issues surrounding these purchasing alliances (e.g., ethical conduct, new market entry for small firms, and value of product bundles). Finally, this study contributes to the management knowledge base on pooling alliances.

Data and Methods

National Survey

Hospitals can belong to multiple purchasing alliances, both national and local. For a variety of reasons, however, most hospitals route most of their purchases through a single national alliance. First, alliance membership fees are nonnegligible (e.g., \$300,000–600,000 for a small hospital system anchored around a teaching hospital). Second, hospitals incur greater overhead costs in

managing two or more alliances and their contract portfolios. Third, the prices negotiated by the national alliances vary within a narrow band, eliminating any advantage in using two or more. In our sample, 59% of hospitals belong to only one national alliance, whereas 41% belong to two or more. The percentage of purchases routed through the primary national alliance is nearly equal in both groups (71.9% vs. 68.8%), suggesting that hospitals utilize a secondary national alliance only for specific contracts in limited supply areas.

The researchers developed a national survey of hospital directors of materials management to query their views of their primary national purchasing alliance. The survey was developed in consultation with academic researchers who had conducted prior supply chain studies, hospital materials managers, supply chain consultants, and top executives of the seven largest alliances (in Table 1). The survey was then pilot tested among a sample of 40 hospitals. None of the alliances financially supported the survey. Survey development and administration costs were supported by matching grants from the National Science Foundation and its Center for Health Management Research. The National Science Foundation-funded Center for Health Management Research supported the two prior field studies referenced above.

The survey contained several sections. The first section gathered background information on the identity of the hospital's primary and secondary national alliances, tenure and shareholder status in the primary alliance, percentage of total supply spending and spending on different product categories (commodity medical–surgical supplies, pharmaceuticals, PPIs, capital equipment, and purchased services) routed through the primary alliance, and the degree to which the hospital tests alliance's pricing by developing its own price bids with suppliers (5 = *always*, 3 = *sometimes*, and 1 = *never*).

The second section of the survey assessed the primary alliance's ability to provide savings to the hospital in nine different areas (e.g., lower prices, rebated contract fees, shareholder dividends, and labor reductions), measured on a 5-point scale originally developed by Likert (1932): 5 = *strongly agree*, 3 = *unsure*, and 1 = *strongly disagree* (Likert labeled the midpoint category *uncertain*). The third section asked the respondents to evaluate their primary alliance's contracts for PPIs on nine different dimensions (e.g., excellent prices overall, excellent prices from sole-source vs. dual-source contracts, and value from sole-source and multisource committed contracts), again using a Likert scale (5 = *strongly agree*, 3 = *unsure*, and 1 = *strongly disagree*). The fourth section asked respondents three questions about the industry's code of conduct: Have they reviewed the code (1 = *yes*)? Is the code strong enough (1 = *yes*)? How well their primary alliance complies with this code (5 = *always*, 3 = *sometimes*, and 1 = *never*)?

The fifth section asked the directors of materials management to evaluate their level of satisfaction with 37 different alliance services, measured on a 5-point scale (5 = *very satisfied*, 3 = *unsure*, and 1 = *very dissatisfied*). These services were identified from the prior field studies and informant interviews. The broad dimensions tapped by these 37 services included the following: low pricing, pricing information, information system tools, supply chain analysis and improvement, hospital voice in alliance decision making, benchmarking and networking with other hospitals, product selection and contract conversion, supply contracting convenience, clinical improvements, education of clinicians, and outsourcing. The sixth section asked the respondents to weight each alliance service in terms of its importance to their hospital (3 = *high importance* and 1 = *low importance*).

Statistical Techniques

Due to the large number of items in the survey, we employed two methods to simplify the presentation of the data. First, we used principal factor analysis to reduce the number of survey items to a manageable number of underlying dimensions. Survey items included in the factor analysis included the following: the 8 measures of cost savings from the alliance, the 13 measures dealing with alliance contracts for PPIs, and the 37 measures of satisfaction with alliance services. Factors with eigenvalues of 1.0 or greater were retained. Factors were subjected to both orthogonal (varimax) and nonorthogonal (promax) rotation methods; the different methods yielded the same overall factor structure. Second, the factor coefficients were used as weights to construct summary scales from the items loading highly on that factor. We assessed the reliability of the scales using Cronbach's alpha (Cronbach, 1951).

Sample of Alliances and Hospitals

The survey was administered to all members of the seven alliances and individual members of the Association of Healthcare Resource & Materials Management, a professional society of materials managers hosted by the American Hospital Association. The seven alliances account for nearly 93% of hospital purchases through alliances (Rhea, 2007). Researchers concatenated membership databases from each organization to form an approximate population of materials managers ($N = 5,014$) in all U.S. hospitals. Such a database does not exist elsewhere. A total of 644 materials managers responded to the survey, yielding an initial response rate of 13%. After eliminating surveys returned due to wrong addresses and retirements and surveys sent to multiple respondents in the same hospital, the effective response rate was 16%. Although not high, the response rate

exceeds the 6% response obtained by the American Hospital Association (cf. Neil, 2005) and approaches the 23% response obtained by a national survey research firm that same year (National Economic Research Associates). The universally low response rates suggest that this is a difficult set of executives to survey.

Analysis of Survey Nonresponse

Although such a response rate might be of concern, research shows that there is no necessary connection between nonresponse rates and nonresponse bias and no minimum response rate below which survey estimates are subject to bias (Groves, 2006). Nevertheless, following the survey research literature (Groves, 2006; Rogelberg & Stanton, 2007), we employed multiple methods simultaneously to assess and handle any potential nonresponse bias. First, we compared response rates across key subgroups (e.g., the seven alliances) in the target population and found a fairly narrow range of rates (9–19%). Thus, the major alliances are proportionately represented in the obtained sample. Second, we compared the percentage of respondents in each alliance with the alliances' national market shares and found no significant difference ($p < .95$).

Third, we used supplemental matched data to compare responders and nonresponders on other key hospital attributes that might affect purchasing behavior and thus survey estimates. Analysis of the pattern of survey nonresponse revealed no bias based on membership in a hospital system ($p < .96$) or degree of centralization–decentralization of the system to which the hospital belonged ($p < .12$). We also assessed survey nonresponse in terms of other hospital characteristics which may or may not affect purchasing behavior. There was no bias based on hospital service (general medical–surgical vs. other; $p < .50$) or geographic region using the American Hospital Association's region codes ($p < .15$). Our sample does contain a higher representation of larger hospitals, hospitals with teaching programs, and nonprofit hospitals ($p < .01$). We weighted the data to correct for this overrepresentation; however, these hospital characteristics are not associated with our survey items (3rd paragraph below).

Fourth, we used benchmarking analysis to compare the estimates on key variables obtained in our sample with those in prior field studies (Burns & Wharton School Colleagues, 2002; Schneller & Smeltzer, 2006). For example, the percentage of total hospital supply purchases routed through alliances reported by our respondents is nearly identical with these prior studies (70.6% vs. 66–72%). Fifth, following Rogelberg and Stanton (2007) and Hikmet and Chen (2003), we conducted a wave analysis to discern any significant differences between initial responders and later responders on our target variables. Of the 114 different

Table 1

Univariate statistics (*n* = 644 materials managers)

Survey measure	<i>M</i>	<i>SD</i>
Background information on hospital purchasing and alliance utilization		
Primary purchasing alliance, %		
Amerinet	11.04	31.37
Broadlane	4.07	19.77
Consorta	7.41	26.22
HealthTrust	8.14	27.36
MedAssets	10.32	30.44
Novation	29.07	45.44
Premier	23.55	42.46
Other	6.50	17.60
Use one national alliance, %	58.66	49.28
Tenure with alliance, years	8.87	4.91
Shareholder of alliance, %	42.61	49.49
Supply spending via alliance, %	70.60	17.43
Use alliance's pricing as starting point in own contracting efforts ^a	3.08	1.28
Alliance offers multivendor multiproduct contracts, %	78.78	40.93
Frequency of contract participation ^b	3.04	1.02
Alliance offers single-vendor multiproduct contracts, %	80.55	39.62
Frequency of contract participation ^b	3.13	0.91
Level of agreement on cost savings through alliances		
Price savings and satisfaction		
Demonstrable cost savings and margin improvement	4.19	0.67
Savings from lower prices	4.19	0.69
Overall satisfaction with our alliance	4.06	0.85
Summary scale ($\alpha = .83$)	4.15	0.63
Savings from dividends and rebates		
Savings from shareholder dividends	3.22	1.06
Savings from rebated administrative fees	3.57	0.98
Summary scale ($\alpha = .66$)	3.39	0.85
Other savings ^d		
Savings from labor reductions	2.74	0.99
Savings from information technology	3.26	0.96
Individualized annual savings or value report	3.81	1.07
Level of agreement on alliance contracts for PPIs ^c		
Excellent contract pricing		
Obtain excellent prices overall	3.47	1.13
Obtain excellent prices through dual-source contracts	3.46	1.05
Obtain excellent prices through sole-source contracts	3.38	1.17
Summary scale ($\alpha = .83$)	3.43	0.96
Contract currency, customization, and conversion		
Increase knowledge of innovative devices and manufacturers	3.24	1.06
Assist in contract conversion	3.01	1.14
Assist in negotiating local custom contracts	2.85	1.20
Summary scale ($\alpha = .77$)	3.03	0.93
Optimization of prices and contract fees		
Hospital cannot get better prices than alliance	2.52	1.20
Collect and distribute high administrative fees	3.12	0.91
Summary scale ($\alpha = .69$)	2.81	0.66
Value of sole-source contracts		
Added value via committed single-vendor multiproduct contracts	3.51	0.97
Obtain excellent prices through sole-source contracts	3.38	1.17
Summary scale ($\alpha = .70$)	3.44	0.88
Physician preference for vendor choice		
Our physicians prefer dual-source and multisource PPI contracts	3.92	0.88
Our physicians dislike sole-source PPI contracts	3.64	1.07
Summary scale ($\alpha = .70$)	3.79	0.85

(continues)

Table 1

Continued

Survey measure			M	SD
Other ^d				
Added value via committed multivendor multiproduct contracts			3.74	0.94
Blocked access to innovative devices and manufacturers			2.29	1.03
Alliance ethical conduct				
Reviewed the Senate-approved code of ethics for alliances, %			75.18	43.24
Ethics are strong enough, %			81.65	38.75
Alliance complies with ethics ^b			4.44	0.70
Survey measure	0–24%	25–49%	50–74%	75%+
Purchases mediated by alliance ^e				
Capital items	42.91%	22.84%	23.20%	11.05%
PPIs	36.78	32.90	22.37	7.95
Pharmaceuticals	9.19	11.03	27.21	52.57
Commodity items	6.96	8.42	32.97	51.65
Purchased services	49.45	28.39	16.85	5.31

Note. PPI = physician preference item.

^a5 = *always*, 3 = *sometimes*, and 1 = *never*.

^bFrequency of participation or compliance: 5 = *always*, 3 = *sometimes*, and 1 = *never*.

^cPPIs: 5 = *strongly agree*, 3 = *unsure*, and 1 = *strongly disagree*.

^dItems which failed to load on a factor.

^ePercentages of hospitals who report that they purchase 0–24%, 25–49%, 50–74%, and 75%+ of their supplies in this category through their alliance.

variables reported in Tables 1, 2, 3, and 4, there were no significant differences on 102 (89%) of them. Although the lack of any difference here does not conclusively indicate an absence of any sampling bias, it does provide additional evidence that such bias may not exist.

In summary, there appears to be little evidence of survey bias introduced by the low level of response. Nevertheless, we employed two additional techniques to correct for any potential bias due to sample selection. Following Kalton (1983) and Tomaskovic-Devey, Leiter, and Thompson (1994), we weighted the data to conform to known population distributions to estimate population means. We estimated a logistic regression model to predict survey response using the hospital characteristics noted earlier, computed the inverse mills ratio to measure the odds of survey nonresponse, and then used it to adjust the survey statistics in Tables 1 and 2 using least square means to compensate for potential selection bias. The statistics remained unchanged. There is also the potential bias that survey responders might be heavier users of alliance services. We included this percentage, along with the hospital's tenure with the alliance, as an additional covariate in the computation of the least square means for all of the statistics in Tables 1 and 2. Again, the statistics remained unchanged.

As a final check, we examined the zero-order correlations between the hospital characteristics that may be overrepresented or underrepresented in our sample and the survey items dealing with cost savings, alliance contracts, and satisfaction. The average correlation with the survey measures for each hospital characteristic is as follows: teaching status measured by medical school affiliation ($r = .03, p < .45$), teaching status measured by residency program ($r = .02, p < .65$), hospital bed size ($r = .06, p < .20$), nonprofit hospital ownership ($r = .04, p < .39$), multihospital system membership ($r = .03, p < .45$), and hospital service: general versus other ($r = .08, p < .08$). None of these is significant at the $p < .05$ level.

Results

Alliance Participation, Services, and Performance: Univariate Statistics

Ninety-four percent of the hospitals responding to our survey utilized at least one national alliance. All of the analyses we report pertain to these hospitals. Univariate statistics for most of the survey items are presented in

Table 2

Satisfaction and importance of alliance services (n = 644 materials managers)

Alliance services	Satisfaction ^a		Importance ^b	
	M	SD	M	SD
Hospital input and voice				
Direct contact with volume purchasing executives	3.55	1.04	2.25	0.70
Direct input on product and service selection	3.45	1.14	2.50	0.60
Disclosure of finances to all members	3.50	1.09	2.32	0.69
Member's control and input on alliance direction	3.50	1.09	2.56	0.56
True strategic partnership with hospital	3.51	1.13	2.64	0.56
Summary scale ($\alpha = .89$)	3.50	0.90	2.46	0.41
Information system tools				
Chargemaster management tool for updating	2.77	0.98	2.11	0.76
Implant procurement auditing of cost per units used	3.00	1.10	2.39	0.65
Item master maintenance	2.88	1.04	2.29	0.69
Summary scale ($\alpha = .81$)	2.89	0.88	2.26	0.53
Benchmarking, product selection, and contract conversion				
Assist with selling product change to users	3.36	1.08	2.21	0.70
Benchmark with peer hospitals and hospital systems	3.56	1.10	2.56	0.62
Bring innovative products to our attention	3.64	1.04	2.60	0.55
Field representation for product conversion	3.40	1.20	2.50	0.62
Operational improvements	3.43	0.96	2.33	0.62
Summary scale ($\alpha = .85$)	3.49	0.84	2.44	0.37
Multisource contracts				
Multisource contracts for commodity items	3.96	0.85	2.47	0.68
Multisource contracts for preference items	3.86	0.93	2.64	0.57
Summary scale ($\alpha = .82$)	3.91	0.82	2.55	0.55
Supply chain analysis and improvement				
Supply chain management improvement	3.66	0.98	2.63	0.55
Supply spend audit tools	3.50	1.01	2.57	0.57
Technology assessment and advisory services	3.37	1.00	2.30	0.67
True strategic partnership with hospital	3.51	1.13	2.64	0.60
Summary scale ($\alpha = .90$)	3.51	0.88	2.54	0.44
Pricing information tools				
Electronic pricing—product downloads to item master file	3.37	1.16	2.66	0.58
Get contract prices onto purchase orders and invoices	3.50	1.06	2.69	0.58
Item master maintenance	2.88	1.04	2.29	0.69
Maintain price files	3.54	1.03	2.64	0.57
Summary scale ($\alpha = .82$)	3.32	0.86	2.57	0.44
Clinical improvements				
Clinical improvement initiatives	3.43	0.95	2.43	0.63
Clinical expert and data support for value analysis	3.46	1.06	2.56	0.57
Safety improvement initiatives	3.57	0.88	2.32	0.66
Summary scale ($\alpha = .77$)	3.48	0.80	2.44	0.48
Education				
Local high-quality education programs	3.34	1.09	2.15	0.67
Local input from clinicians for preference items	3.20	1.06	2.39	0.64
Summary scale ($\alpha = .71$)	3.26	0.95	2.27	0.54
Low pricing				
Group purchasing and price discounts	4.10	0.81	2.90	0.33
Lowest price in alliance contracts	3.72	1.00	2.91	0.30
Summary scale ($\alpha = .70$)	3.92	0.80	2.90	0.25
Contracting convenience				
Contracting ease and convenience	3.83	1.03	2.82	0.41
Prompt response to all member inquiries	4.01	0.99	2.86	0.37
Summary scale ($\alpha = .65$)	3.92	0.87	2.84	0.31

(continues)

Table 2

Continued

Alliance services	Satisfaction ^a		Importance ^b	
	M	SD	M	SD
Alliance outsourcing				
Consulting services	3.46	1.02	1.91	0.68
Outsource services (e.g., medical records management)	3.16	0.82	1.70	0.65
Summary scale ($\alpha = .65$)	3.31	0.78	1.81	0.56
Other services ^c				
Capital equipment and planning	3.35	1.10	2.42	0.65
Cross-reference materials	3.53	1.04	2.64	0.53
Experience sharing and networking	3.92	0.98	2.54	0.59
Product bundles and portfolios	3.50	0.94	2.11	0.68
Web-enabled contract catalog	4.06	0.98	2.77	0.45

^aLevel of satisfaction: 5 = *very satisfied*, 4 = *satisfied*, 3 = *unsure*, 2 = *dissatisfied*, and 1 = *very dissatisfied*.

^bLevel of importance: 3 = *high*, 2 = *medium*, and 1 = *low*.

^cItems failed to load on a factor.

Table 1. The two largest alliances represented in our sample, in terms of hospital membership, are Novation (29% of hospitals) and Premier (23%). Over 40% of hospitals are shareholders in their alliances. On average, hospitals have belonged to their national alliance for nearly 9 years and route over two thirds of their total supply spending through the alliance. The percentage of spending mediated by the alliance varies greatly by purchase area (see the bottom panel of Table 1). Nearly 85% of hospitals route 50% or more of their commodity item spending through their alliances, and 80% of hospitals route 50% or more of their pharmaceutical

spending through their alliances. The percentages of hospitals routing most of their spending through alliances are much lower for capital items (34%), PPIs (30%), and purchased services such as maintenance, telecommunications, and so forth (22%). Hospitals are more likely to contract on their own for these products and services.

Hospitals agree that their alliances produce demonstrable cost savings and lower product prices, as evidenced by the high mean values (4.19 out of 5) and low standard deviations on these two items. Hospitals also appear to be satisfied with their alliances ($M = 4.06$). The factor analysis revealed that these three items

Table 3

Correlations of alliance utilization with alliance savings and satisfaction scales

Summary scales	% Alliance spend	Multivendor contract use	Single-vendor contract use	Use alliance price as ceiling	Alliance tenure	Use one alliance
Price savings and satisfaction	.24**	.18**	.20**	-.16**	-.06	.11**
Savings from dividends	.05	.10*	.07	-.04	.04	.12**
Hospital input and voice	.11**	.09	.08	-.08	-.11**	.13**
Information system tools	.16**	.08	.10**	-.02	-.06	.07
Benchmark and product selection	.15**	.08	.06	-.08	-.05	.06
Multisource contracts	.18**	.07	.08	-.12**	-.06	.11**
Supply chain analysis	.16**	.12**	.11*	-.08	-.08	.05
Pricing information tools	.20**	.10*	.10*	-.06	-.03	.09*
Clinical improvements	.16**	.11*	.13**	-.11**	.00	.09*
Education	.14**	.16**	.15**	-.03	.03	.07*
Low pricing	.10*	.06	.11*	-.15**	-.11**	.11**
Contracting convenience	.21**	.14**	.18**	-.15**	-.03	.12**
Alliance outsourcing	.12**	.12**	.12**	-.05	-.02	.03

* $p < .05$. ** $p < .01$.

Table 4

Use of alliance contracts for PPIs and savings and benefits from PPI contracts

	Purchase levels of PPIs mediated by alliance				F	p
	0–24%	25–49%	50–74%	75+%		
Excellent contract pricing for PPIs summary scale	3.06	3.45	3.77	4.08	70.51	.001
Contract currency, customization, and conversion summary scale	2.80	3.06	3.28	3.36	26.47	.001
Physician preference for vendor choice summary scale	3.85	3.69	3.80	3.94	0.02	.890
Value of sole-source contracts summary scale	3.19	3.48	3.71	3.81	35.65	.001
Optimization of prices and contract fees summary scale	2.63	2.86	2.98	3.01	25.54	.001

Note. PPI = physician preference item.

loaded on a common factor (eigenvalue = 3.45, 43% of variance explained). Two other items—savings through rebated administrative fees and shareholder dividends—loaded on a second factor (eigenvalue = 1.05, 13% of variance explained). There is thus some agreement that, in addition to reducing prices and costs, alliances also serve to increase hospital revenues. This achievement may be secondary to price reductions. There is little agreement that alliances yield hospital savings through information technology and some disagreement that they yield savings by allowing hospitals to reduce personnel.

The 13 items in the next section of the survey dealt with alliance contracts for expensive PPIs. The factor analysis revealed five underlying dimensions. The summary statistics for the first factor (eigenvalue = 3.93, 30% of variance explained) suggest that alliances are less successful in obtaining lower prices for PPIs than for products overall. One reason is that physicians may have differing product and vendor preferences that cannot be standardized. This prevents the hospital from using an alliance sole-source contract and requires it to contract with two or more manufacturers. Indeed, the dimension with the highest summary score pertains to physician preference for choice among vendors (eigenvalue = 1.48, 11% of variance). Nevertheless, when hospitals can standardize their physicians' preferences, they find value in the sole-source contracts and prices their alliances obtain (eigenvalue = 1.07, 8% of variance). The two other dimensions reveal that hospitals perceive less value in their alliance's ability to customize contracts or help them convert to new vendors (eigenvalue = 1.71, 13% of variance) and to obtain better pricing and contract fees on these items (eigenvalue = 1.03, 7% of variance).

Hospitals nevertheless report that their alliance adds some value by developing single-vendor and (especially) multivendor contracts for multiproduct contracts. Indeed,

roughly 80% of hospitals report that their alliance offers them both types of contracts and that they "sometimes" utilize them. Hospitals disagree with the statement that their alliance and its contract portfolio block their access to innovative devices and manufacturers.

Finally, with regard to the alliance industry's code of ethics, three quarters of the respondents indicate that they have personally reviewed the code of ethics, and four fifths feel that it is strong enough. They also believe that their alliance nearly always complies with the code (4.44 out of 5.00).

Table 2 presents the univariate statistics for the survey items covering the hospital's satisfaction with alliance services and perceived importance of those services. The table organizes these items by the factor dimensions on which they load.

The first dimension of alliance services deals with the hospital's input on supply product selection and alliance direction (eigenvalue = 16.89, 46% of variance explained). Six of the next seven dimensions concern four broad areas of alliance services: supply chain analytics (analysis and improvement, information system tools, and pricing information tools); benchmarking, product selection, and contract conversion; clinical improvements; and education. Eigenvalues for these dimensions average approximately 1.20, with 2–4% of the variation explained by each. The overall satisfaction levels for the summary scales of these dimensions are generally modest, ranging from 2.89 to 3.51. The overall importance of these dimensions of service to hospital is also modest, ranging from 2.26 to 2.57. Similar results are found for two individual survey items that did not load on any dimension (cross-referencing of materials and product bundles). Thus, hospitals are moderately satisfied with many alliance services that are of moderate importance to them.

By contrast, three other dimensions of service are more satisfying and more important to hospitals. Survey items dealing with multisource contracts, low product prices, and contracting convenience achieve by far the highest satisfaction levels. The latter two are also the most highly rated in importance. These results suggest that the key alliance services as perceived by hospitals concern contracting and pricing. Similar results are found for another individual survey item that did not load on any dimension (Web-enabled contract catalog).

Alliance Utilization and Performance: Bivariate Statistics

We next investigated the relationship between the utilization and performance measures discussed earlier. The measures of alliance utilization (percentages of spending routed through the alliance, participation in contracts, tenure in alliance, alliance's pricing, and use of only one national alliance) might be considered as outcomes of importance to the alliances, whereas the measures of savings and satisfaction (summary scales in Tables 1 and 2) represent outcomes important to the hospital members. To the degree these two sets of measures are interrelated, there is the potential for win-win collaboration.

Table 3 presents the correlations between these two sets of measures from the survey responses. The data reveal that they are significantly but not strongly associated with one another. Hospitals that route a larger percentage of their overall supply spending through the alliance, participate more frequently in the alliance's single-vendor and multivendor multiproduct contracts, and utilize only one alliance are more likely to report savings and satisfying benefits from their alliance. Conversely, hospitals that use the alliance's pricing as a benchmark ceiling to negotiate their own deals are less likely to report savings and satisfying benefits. Surprisingly, hospitals with longer membership in their current alliance are, if anything, less likely to report savings and benefits; most of these associations are insignificant.

Table 4 conducts a similar analysis for PPIs. The table suggests that hospitals that route more of the purchase of these expensive items through their alliance are more likely to report savings on their PPI contracts. The data reveal strong significant associations for four of the five items.

Discussion

Limitations of the Study

The findings above are subject to several limitations. First, we rely on survey responses rather than on empirical analyses of hospital supply procurement with docu-

mented cost savings from alliance contracts. Although hospital directors of materials management likely have imperfect knowledge, they are nevertheless the ones most closely tied to contracts developed by their alliances. Second, there is the possibility of social desirability bias, which might lead materials managers to report more favorable conduct on behalf of their purchasing alliances (e.g., with regard to conformity with ethics and hospital access to new vendors and technology). Third, the survey does not include parallel items for commodity supplies and PPIs, thus limiting our comparison of alliance performance in these two areas. The survey also does not include questions on alliances' potential conflicts of interest resulting from their collection of fees from manufacturers or whether alliance contracts inhibit hospitals from selecting new vendors not currently on contract. Fourth, the survey considers the views of only one party to the alliance. Fifth, the bivariate associations reported in Tables 3 and 4 may suffer from common methods variance. Sixth, the data come from a survey with a low response rate. Nevertheless, the low rate does not appear to introduce bias in terms of measurable hospital characteristics, and the sample appears to be representative of important system characteristics. Seventh, the data represent a snapshot at one point in time and do not allow for any trend analysis of alliance performance.

Some Conclusions

This study suggests that strategic alliances between hospitals and purchasing groups serve to contain rising health care costs by reducing product prices. This is accomplished in two ways: (1) through the pooled purchasing leverage of hospitals buying products on nationwide contracts and (2) through the establishment of price ceilings in these contracts beneath which hospitals negotiate on their own. The alliances may also benefit hospitals financially by reducing transactions costs (contracting convenience) and by increasing revenues via rebates and dividends but to a lesser degree. Alliances perform this important set of services by brokering, negotiating, and aggregating supply contracts between manufacturers and hospitals. They thus enable hospitals to achieve purchasing economies of scale (Besanko, Dranove, & Shanley, 2000).

There is other indirect evidence that purchasing alliances add value for hospitals. This evidence includes the long tenure of hospitals with their alliances, the large (and apparently) stable share of total purchases flowing through these alliances, and the hospitals' overall level of satisfaction with their alliances.

At the same time, however, the strength of these alliances may be their weakness. The data suggest that alliances excel in their core functions of pricing and

contracting but perform less well in many other areas. Alliances have long sought to develop an array of value-adding services for their members, to diversify their offerings, and to seek some advantage that differentiates them from rival alliances. Our findings suggest that the noncore services alliances have diversified into are not as important or satisfying.

From a policy perspective, the results suggest that there is more smoke than fire surrounding these alliances. The hospital customers in purchasing alliances do not believe that there are ethical code violations committed by their alliances. They also do not believe that the alliances restrict market entry by smaller firms with innovative technology by virtue of the contracts struck with large incumbent suppliers. Hospital managers do acknowledge that their physicians desire free choice of manufacturer and dislike sole-source contracts. Hospitals appear to strike a balance here between the clinical needs and desires of their physicians and the hospital's economic interest in standardizing on a small number of vendors. Thus, most hospitals participate in the diversified packaged portfolios of contracts developed by their alliances and indicate that they add value, but hospitals only sometimes participate in them. Ultimately, hospitals do not appear to be "captives" of their purchasing alliances but rather use them as they suit the hospitals' and physicians' product needs. Indeed, alliances may constitute only one of several strategies utilized by hospitals to source, contract, and procure their supply inputs.

From the perspective of organization research, the data suggest that pooling alliances perform much differently than trading alliances. First, they appear to be quite stable, whereas trading alliances such as physician-hospital contracting vehicles have been more fragile and transitory. Second, they appear to be successful in lowering hospital costs and increasing hospital revenues, much like voluntary-based rural hospital consortia (Chan, Feldman, & Manning, 1999). The success of pooling alliances may be due to their pooled interdependence, which requires lower decision making, coordination, communication, and governance costs compared with the sequential and reciprocal interdependence inherent in trading alliances (Thompson, 1967). Indeed, with the spread of information technology (e.g., materials management information systems) and the use of the Internet (e.g., Web-based purchasing), the transaction costs between hospitals and their alliances should decrease.

As an illustration of this pooled interdependence, purchasing alliances do not require hospitals to directly partner with clinicians to achieve savings on commodity medical-surgical products. There are fewer physician-hospital relationships here that need to be developed and fewer conflicts to be managed. Such relationships and conflicts become more problematic for purchasing

alliances that seek to manage the contracts for PPIs. In this regard, PPI contracts may begin to resemble trading alliances such as physician-hospital joint ventures rather than simple pooling alliances. This may explain the relatively lower evaluations of PPI contracts in this study. We might speculate, however, that as hospitals continue to integrate with their medical staff specialists (e.g., salaried roles, gain-sharing arrangements, etc.), they will gain greater cooperation with their physicians on national contracts for PPIs. This could result in greater utilization of alliance contracts for PPIs, greater contract compliance (which leads to lower pricing), and standardization on a smaller number of vendors (E. S. Schneller, personal communication, September 2007).

Finally, the bivariate analyses suggest that alliances based on pooled interdependence serve the needs of both parties. There is evidence that contract utilization and participation are associated with perceived savings and satisfaction with alliance services. The association is weak, however. There appears to be stronger evidence that contract utilization leads to greater savings and satisfaction for PPIs. The problem here is that the realized benefits are constrained by the hospital's need to accommodate physician tastes. Greater savings here and contributions to hospital cost containment will thus rest partially on improvements in physician-hospital integration (both economic and clinical).

Implications for Managers

Our findings suggest that hospital managers derive value from their organizations' participation in pooling alliances. Such value, although currently confined to commodity items, may be extended to PPIs in the future as hospitals develop closer economic integration with the specialists on their medical staffs who use these supply items. To maximize this value, materials managers will need to develop their behavioral science skills (e.g., communication, negotiation, conflict resolution, and team building) in working with clinicians on the selection of these products, bargaining with manufacturers for lower prices, and subsequent utilization of these products. They will also need to foster a climate of mutual trust and respect (Montgomery & Schneller, 2007).

Future Research

Future research on purchasing alliances should seek to replicate the findings reported here. Future research should also investigate the determinants of alliance performance. For example, researchers should investigate what types of alliances achieve better performance (e.g., for-profit vs. nonprofit alliances and large-size vs. small-size alliances), whether their economic benefits exhibit a curvilinear relationship with alliance size due

to complexity (Chan et al., 1999), and whether alliances have any ability to differentiate themselves from one another and in which areas. Researchers should also investigate whether the burgeoning supply chain activities of hospital systems (Schneller & Smeltzer, 2006) serve to substitute or complement purchasing alliances. Now, there appears to be a rough division of labor between the two, with hospitals doing more of the contracting for PPIs and alliances doing more of the contracting for commodity and pharmaceutical products.

Acknowledgments

The authors wish to thank Gene Schneller, Douglas Wholey, two anonymous reviewers, and the editor for their helpful comments on earlier drafts of this article. They also thank Colm O'Muircheartaigh at the National Opinion Research Center and Robert Boruch at the University of Pennsylvania for advice on handling survey nonresponse.

References

- Bazzoli, G. J., Shortell, S. M., Dubbs, N., Chan, C., & Kralovec, P. (1999). A taxonomy of health networks and systems: Bringing order out of chaos. *Health Services Research, 33*(6), 1683–1717.
- Besanko, D., Dranove, D., & Shanley, M. (2000). *Economics of strategy*. (2nd ed.). New York: John Wiley.
- Burns, L. R., Wharton School Colleagues. (2002). *The health care value chain*. San Francisco: Jossey-Bass.
- Chan, B., Feldman, R., & Manning, W. G. (1999). The effects of group size and group economic factors on collaboration: A study of the financial performance of rural hospitals in consortia. *Health Services Research, 34*(1), 9–31.
- Cleverly, W. O., & Nutt, P. C. (1984). The effectiveness of group-purchasing organizations. *Health Services Research, 19*(1), 65–81.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297–333.
- Cuellar, A., & Gertler, P. (2006). Strategic integration of hospitals and physicians. *Journal of Health Economics, 25*(1), 1–28.
- Dacosta-Claro, I. (2002). The performance of material management in health care organizations. *International Journal of Health Planning and Management, 17*, 69–85.
- Doucette, W. R. (1997). Influences on member commitment to group purchasing organizations. *Journal of Business Research, 40*(3), 183–189.
- Drucker, P. (1973). *Management: Tasks, responsibilities, practices*. New York: Harper & Row.
- Dynan, L., Bazzoli, G. J., & Burns, L. R. (1997). Assessing the extent of integration achieved through physician-hospital arrangements. *Journal of Healthcare Management, 43*, 242–262.
- Groves, R. M. (2006). Nonresponse rates and nonresponse bias in household surveys. *Public Opinion Quarterly, 70*(5), 646–675.
- Hendrick, T. E. (1996). *Purchasing consortiums: Horizontal alliances among firms buying common goods and services. What? Who? Why/How?* Tempe: Center for Advanced Purchasing Studies, Arizona State University.
- Hikmet, N., & Chen, S. K. (2003). An investigation into low mail survey response rates of information technology users in health care organizations. *International Journal of Medical Informatics, 72*, 29–34.
- Kalton, G. (1983). *Compensating for missing data*. Ann Arbor: Institute for Social Research, University of Michigan.
- Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology, 22*(140), 5–53.
- Madison, K. (2004). Hospital-Physician affiliations and patient treatments, expenditures, and outcomes. *Health Services Research, 39*(2), 257–278.
- Montgomery, K., & Schneller, E. (2007). Hospitals' strategies for orchestrating selection of physician preference items. *Milbank Quarterly, 85*(2), 307–335.
- Neil, R. (2005). A survey of materials managers about their GPOs. From the buyer's perspective. *Materials Management in Health Care, 14*(9), 18–25.
- Nollet, J., & Beaulieu, M. (2003). The development of group purchasing: An empirical study in the healthcare sector. *Journal of Purchasing and Supply Chain Management, 9*(1), 3–10.
- Oliver, C. (1990). Determinants of interorganizational relationships: Integration and future directions. *Academy of Management Review, 15*(2), 241–265.
- Rhea, S. (2007). Moving beyond the hospital. *Modern Healthcare, 37*(35), S1–S5.
- Rogelberg, S. G., & Stanton, J. M. (2007). Understanding and dealing with organizational survey nonresponse. *Organizational Research Methods, 10*(2), 195–209.
- Schneller, E. S. (2000). *The value of group purchasing in the health care supply chain*. Tempe: School of Health Administration and Policy, Arizona State University.
- Schneller, E. S., & Smeltzer, L. (2006). *Strategic management of the health care supply chain*. San Francisco: Jossey-Bass.
- Shortell, S. M., & Kaluzny, A. D. (2006). *Health care management: organization design and behavior*. (5th ed.). Clifton Park, NY: Delmar Learning.
- Shortell, S. M., & Zajac, E. J. (1988). Internal corporate joint ventures: Development processes and performance outcomes. *Strategic Management Journal, 9*, 527–542.
- Swayne, L. E., Duncan, W. J., & Ginter, P. M. (2006). *Strategic management of health care organizations*. (5th ed.). Malden, MA: Blackwell Publishing.
- Swayne, L. E., & Ginter, P. M. (2006). The premier health care alliance emerges. In L. E., Swayne, W. J., Duncan, & P. M., Ginter (Eds.), *Strategic management of health care organizations*. (5th ed., pp. 817–841). Malden, MA: Blackwell Publishing.
- Thompson, J. D. (1967). *Organizations in action*. New York: McGraw-Hill.
- Tomaskovic-Devey, D., Leiter, J., & Thompson, S. (1994). Organizational survey nonresponse. *Administrative Science Quarterly, 39*(4), 439–457.
- Zajac, E. J., Golden, B. R., & Shortell, S. M. (1991). New organizational forms for enhancing innovation: The case of internal corporate joint ventures. *Management Science, 37*, 70–84.
- Zajac, E. J., D'Aunno, T. A., & Burns, L. R. (2006). Managing strategic alliances. In S. M., Shortell, & A. D., Kaluzny (Eds.), *Health care management: organization design and behavior*. (5th ed., pp. 356–381). Clifton Park, NY: Delmar Learning.