AVALON HEALTH ECONOMICS

The Effects of Physician-Owned Hospitals on Medical Care Quality and Expenditures

Briefing Notes

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1. INTRODUCTION

The debate over physician ownership of acute care hospitals has been active for the past decade. Although the debates have been nuanced and have evolved over the decade, most of the arguments boil down to a relatively simple debate. Critics argue that physician-owned hospitals (POHs) "over-utilize" medical care services because, they argue, physicians are more likely to utilize services in which they share an ownership interest. Defenders of POHs argue that POHs deliver a high quality of care, evident in their stellar performance in the Centers for Medicare and Medicaid Services' (CMS) new Hospital Value Based Purchasing Program (HVBP), and that the incentives to under-utilize or over-utilize medical care services are persistent issues throughout the system—just as evident in non-POHs (NPOHs), community hospitals, and doctors' offices as anywhere else.

The purpose of this report is to bring together into one place the body of knowledge on POHs. The overarching goal is to provide all of the extant evidence available to answer two relatively simple questions: (1) is the quality of care delivered in POH settings different from the quality of care delivered in NPOH settings? And (2), is the level of medical expenditures in POHs higher than their NPOH counterparts, all else equal? Put differently, we are interested in determining whether, or the extent to which, POHs deliver "value for money." If POH expenditures are lower than NPOHs, but the quality is worse, than the POH value proposition deserves to be questioned. Likewise, if POH expenditures are higher than NPOH expenditures, payers need to see evidence of the added quality associated with those higher expenditures.

As we will show, it is clear that POH expenditures are about the same as NPOHs in the aggregate, but POHs clearly deliver higher quality care and receive a lower average net payment per service from CMS. Thus, POHs deliver higher quality care at a lower price; in the parlance of cost-effectiveness analysis, POHs would represent the "dominant" choice because they provide better outcomes at a lower price. In recent Affordable Care Act (ACA) cost projections, the Congressional Budget Office (CBO) has estimated that if referrals to POHs were limited and that the growth of POHs were halted, some additional savings could be achieved. In the evidence we present here, that appears to be an erroneous assumption in the cost projections.

The remainder of this report is organized as follows. In Section 2, we review the theory and evidence on POH quality. The theory section (2.1) focuses on why we might expect POH quality to differ from NPOH quality, and the evidence section (2.2) focuses on the results of ten peer-reviewed studies from the past decade. The quality section ends with some supplementary analyses of POH performance in the HVBP. In Section 3, we turn our attention of POH volume and expenditures. Again, using the same structure as the quality discussion, the theory section (3.1) focuses on the underlying theory of why expenditures differ across health care entities, and the evidence section (3.2) focuses on the results of ten peer-reviewed studies from the past decade. We supplement the discussion with an analysis of average payment rates between POHs and NPOHs, using recently released hospital charge data from CMS.

2. QUALITY

Making high-quality health care available to Medicare and Medicaid recipients is a primary organizational goal of CMS. The CMS website prominently states that: "We're here to help the people who use our programs to get *high quality, effective care* that results in lower costs..."[1] The explicit linkage between high quality and lower costs is appropriate given the health economics literature showing that higher quality results in lower costs. In this section, we review the theory of why we would *expect* POHs to have higher quality compared to NPOHs (Section 2.1). The second section (Section 2.2) reviews the published evidence on POH quality (versus NPOHs) and the last section introduces some new supplemental analyses on how POHs have performed under CMS's new Hospital Value-Based Purchasing ("HVBP") program, and how that performance is likely to affect the overall expenditures associated with POHs versus NPOHs.

2.1 Theory

2.1.1 It is important to briefly lay out the general business model of the typical POH. Most POHs can also be classified as "specialty hospitals" in that they offer a limited range of services. This suggests that an important part of the POH motivation and business model involves to some extent the capturing of the benefits of specialization. There is a large literature in the fields of business and economics which focuses on the benefits of specialization. In this section we review that literature as it applies to POHs. The intent of this section is to provide a conceptual framework within which to understand how the quality of care delivered in POHs differs from the quality of care delivered in NPOHs. Following the discussion of the theory and conceptual framework, we will put forth evidence that supports the hypothesis that specialized hospital care has distinct quality advantages over generalized "big box" hospital care.

2.1.2 One of the main benefits of specialization is the ability to capture what are generally referred to as *clinical efficiencies*.[2] These efficiencies refer to the ability of physicians to more effectively manage the quality of care, scheduling, triaging patients to most appropriate settings, and equipment utilization and purchasing.[3] In some cases, the

[1] See generally http://www.cms.gov/About-CMS/Story-Page/coordinating-care.html (emphasis added).

[2] J.J. Rohack, "Report to the Board of Trustees: Specialty Hospitals and Impact on Health Care," (Chicago, IL: American Medical Association, 2004); J.E. Schneider et al., "The Economics of Specialty Hospitals," *Medical Care Research and Review* 65, no. 5 (2008).

[3] T. Walker, "Specialty Care Facilities Make a Case by Improving Outcomes and Costs," *Managed Healthcare* 8, no. 6 (1998); MedPAC, "Transcript from Public Meeting on Inpatient and Outpatient Hospital Payment Issues," (Washington, D.C.: Medicare Payment Advisory Commission, 2003); L.P. Casalino, K.J. Devers, and L.R. Brewster, "Focused Factories? Physician-Owned Specialty Facilities," *Health Affairs* 22, no. 6 (2003); L.P. Casalino, H. Pham, and G. Bazzoli, "Growth of Single-Specialty Medical Groups," *Health Affairs* 23, no. 2 (2004); J. Casey, "The Case for Specialty Hospitals," *Modern*

existence of competing clinical objectives impedes physician decision-making and productivity. Physicians practicing in POHs report that they are more effectively able to initiate programs that enhance patient care and improve quality, whereas their counterparts in NPOHs typically describe the decision-making process as "less efficient" and "overly bureaucratic."[4] These differences are to some extent analogous to the differences between large multi-specialty versus single-specialty practices. For example, Casalino, Pham, and Bazzoli report that one of the motivating factors for single-specialty medical groups was to "avoid the complicated governance and operational issues engendered by having primary care and specialty physicians in the same organization" (p.86).[5] Similar thoughts are expressed in a report on specialty hospitals compiled by the American Medical Association, "[physicians] want a greater involvement in governance and management, reinvestment of profits to maintain state-of-the-art care and equipment, and greater control over scheduling and types of cases performed in the operating room" (p.3).[6]

2.1.3 Another important factor associated with specialization is *economies of scale*. Economies of scale exist if the average costs of producing a product or service decline as the volume of production increases.[7] The evidence on economies of scale in the production of hospital services, while highly variable, indicates that U.S. general hospitals typically experience scale economies up to approximately 10,000 discharges per year.[8] However, the same evidence suggests that scale economies vary significantly by

Healthcare 34, no. 47 (2004); Rohack, "Report to the Board of Trustees: Specialty Hospitals and Impact on Health Care."

[4] CMS, "Study of Physician-Owned Specialty Hospitals Required in Section 507(C)(2) of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003," (Centers for Medicare and Medicaid Services, Department of Health and Human Services, 2005); Rohack, "Report to the Board of Trustees: Specialty Hospitals and Impact on Health Care; Schneider et al., "The Economics of Specialty Hospitals; Sylan Lee Weinberg, "The Specialty Heart Hospital Concept: Transcending the Economic Issues," *Am Heart Hosp J* 5, no. 2 (2007).

[5] Casalino, Pham, and Bazzoli, "Growth of Single-Specialty Medical Groups."

[6] Rohack, "Report to the Board of Trustees: Specialty Hospitals and Impact on Health Care."

[7] In some cases, economies of scale refer to declining average and marginal costs in the relevant range of production. These cases are generally referred to as "natural monopoly," and have historically been applied to industries with high fixed costs (e.g., network utilities, like water, natural gas, electricity, telephone cable television, etc.). Although arguments have been made that the relatively high fixed costs of general hospitals see R.R. Roberts et al., "Distribution of Variable Vs. Fixed Costs of Hospital Care," *Journal of the American Medical Association* 281, no. 7 (1999). invite comparisons to natural monopoly, it is unlikely that any single surgical procedure exhibits continually declining average and marginal costs over the relevant range of output. See R.G. Noll, "The Consequences of Public Utility Regulation of Hospitals," in *Institute of Medicine Papers of the Conference on Regulation in the Health Industry* (Washington DC: National Academy of Sciences, 1975); J.E. Schneider, "Changes in the Effects of Mandatory Rate Regulation on Growth in Hospital Operating Costs, 1980-1996," *Review of Industrial Organization* 22, no. 4 (2003).

[8] T.G. Cowing, A.G. Holtmann, and S. Powers, "Hospital Cost Analysis: A Survey and Evaluation of Recent Studies," *Advances in Health Economics and Health Services Research* 4(1983); M. Vita,

product and service line. For many specific surgical procedures, the volume of specific services performed at specialty hospitals typically exceed that performed in general hospitals within the same market area.[9] Thus, economies of scale in these specific procedures are likely to be realized to a greater degree in specialized hospitals compared to general hospitals with lower procedural volume.

2.1.4 A related advantage of specialization relates to *core competencies and learning.*[10] Core competencies refer to firms' knowledge, know-how, skills, and resources. By diversifying and expanding into activities that are related to core competencies and capabilities, firms are typically able to take better advantage of the learning process and improve managerial efficiency.[11] Skinner stressed that "simplicity, repetition, experience, and homogeneity of tasks breed competence" (p.115).[12] Concentrating on core competencies enhances the learning process by assuring that decision-making

"Exploring Hospital Production Relationships with Flexible Functional Forms," *Journal of Health Economics* 9(1990); M. Gaynor and G.F. Anderson, "Uncertain Demand, the Structure of Hospital Costs, and Cost of Empty Hospital Beds," ibid.14(1995); T.E. Keeler and J.S. Ying, "Hospital Costs and Excess Bed Capacity: A Statistical Analysis," *Review of Economics and Statistics* (1996); D. Dranove, "Economies of Scale in Non-Revenue Producing Cost Centers: Implications for Hospital Mergers," *Journal of Health Economics* 17(1998b); T. Li and R. Rosenman, "Cost Inefficiency in Washington Hospitals: A Stochastic Frontier Approach Using Panel Data," *Health Care Management Science* 4, no. 2 (2001).

[9] GAO, "Specialty Hospitals: Geographic Location, Services Provided, and Financial Performance," (Washington, D.C.: General Accounting Office, 2003b); P.C. Cram, G.E. Rosenthal, and M.S. Vaughan-Sarrazin, "Cardiac Revascularization in Specialty and General Hospitals," *New England Journal of Medicine* 352, no. 14 (2005); J.M. Mitchell, "Effects of Physician-Owned Limited Service Hospitals: Evidence from Arizona," *Health Affairs* W5(2005); P.C. Cram et al., "A Comparison of Total Hip and Knee Replacement in Specialty and General Hospitals," *Journal of Bone and Joint Surgery* 89, no. 8 (2007).

[10] D.J. Teece, "Towards an Economic Theory of the Multiproduct Firm," *Journal of Economic Behavior and Organization* 3(1982); A.D. Chandler, *Scale and Scope: The Dynamics of Industrial Capitalism* (Cambridge, MA: The Belknap Press/Harvard University Press, 1990); "Organizational Capabilities and the Economic History of the Industrial Enterprise," *Journal of Economic Perspectives* 6, no. 3 (1992); D.J. Teece et al., "Understanding Corporate Coherence: Theory and Evidence," *Journal of Economic Behavior and Organization* 23(1994a); D.J. Teece and G. Pisano, "The Dynamic Capabilities of Firms: An Introduction," *Industrial and Corporate Change* 3, no. 3 (1994b); K.H. Wruck and M.C. Jensen, "Science, Specific Knowledge, and Total Quality Management," *Journal of Accounting and Economics* 18(1994); C.E. Helfat et al., *Dynamic Capabilities: Understanding Strategic Change in Organizations* (Malden, MA: Blackwell Publishing, 2007).

[11] C.W.L. Hill, "Diversification and Economic Performance: Bringing Structure and Corporate Management Back into the Picture," in *Fundamental Issues in Strategy: A Research Agenda*, ed. R.P. Rumelt, D.E. Schendel, and D.J. Teece (Boston, MA: Harvard Business School Press, 1994); E. Danneels, "The Dynamics of Product Innovation and Firm Competencies," *Strategic Management Journal* 23(2002); Helfat et al., *Dynamic Capabilities: Understanding Strategic Change in Organizations*.

[12] W. Skinner, "The Focused Factory," *Harvard Business Review* 52, no. 3 (1974).

situations are repeated in sufficiently large numbers. In health care settings, there also appear to be distinct advantages to focusing production within core competencies.[13]

2.1.5 Another important motivation of the formation of POHs is to *maintain and improve access to care* in underserved urban and rural areas. There are several instances of physicians pooling their own resources to purchase a failing community hospital.[14] For example, St. Joseph's Medical Center is the only acute care hospital in downtown Houston, and it would have closed its doors were it not for a group of physician investors.[15] The facility is a large full-service Level-3 trauma center, providing a full range of services (including charity care) to a diverse urban population. A similar example is the case of Pacific Alliance Medical Center ("PAMC"), a 142-bed full service hospital located in the Chinatown section of Los Angeles.[16] PAMC served the community for 140 years, and was purchased by a group of 20 physicians 21 years ago after the hospitals owners at the time planned to close and demolish the hospital. With service to the hospital's vulnerable indigent population threatened, the group of physician investors rescued the hospital.

2.2 Published Evidence

2.2.1 Since their inception, numerous studies have been aimed at assessing the quality of care provided in specialty hospitals and POHs. In this section we briefly review the studies that have been published in peer-reviewed journals. The results of this brief review help

[13] The relationship between core competencies and hospital efficiency has been explored in a relatively small number of studies, most of which show a positive relationship between overall efficiency and focus on areas of competence and experience e.g., D.C. Coddington, L.E. Palmquist, and W.V. Trollinger, "Strategies for Survival in the Hospital Industry," ibid., no. May-June (1985); T.J. Douglas and J.A. Ryman, "Understanding Competitive Advantage in the General Hospital Industry: Evaluating Strategic Competencies," *Strategic Management Journal* 24, no. 4 (2003); S.R. Eastaugh, "Hospital Strategy and Financial Performance," *Health Care Management Review* 17, no. 3 (1992); "Hospital Costs and Specialization: Benefits of Trimming Product Lines," *Journal of Health Care Finance* 28, no. 1 (2001); M.E. Porter and E.O. Teisberg, "Refining Competition in Health Care," *Harvard Business Review* 82, no. 6 (2004); S. M. Shortell, E. Morrison, and S. Hughes, "The Keys to Successful Diversification: Lessons from Leading Hospital Systems," *Hospital and Health Services Administration* 34, no. 4 (1989); T.S. Snail and J.C. Robinson, "Organizational Diversification in the American Hospital," *Annual Review of Public Health* 19(1998); L.R. Walker and M.D. Rosko, "Evaluation of Health Care Service Diversification Options in Health Care Institutions and Programs by Portfolio Analysis: A Marketing Approach," *Journal of Health Care Marketing* 8, no. 1 (1988)..

[14] Refer to, for example, G. Gosselin, "Pontiac's Nomc to Become State's First Private Acute Care Hospital," *Oakland Business Review* Thursday August 28(2008); C. Holyoke, "Troy Doctors Attempt to Buy Hospital," (WSFA12 News, 2010); Texas Medicine, "Physician Ownership Saves Houston's Oldest Hospital," April 2008 Issue(2008).

[15] "Physician Ownership Saves Houston's Oldest Hospital."

[16] The PAMC case and others are discussed in a letter written from U.S. Senator Diane Feinstein to Finance Committee Chairman Max Baucus, dated September 15, 2009.

set the stage for the calculations based on the HVBP data. The above quality scores of POHs are driven by the factors described in these published studies.

2.2.2 POHs and specialty hospitals clearly offer levels of quality at least comparable to and in most cases *better* than their non-physician-owned hospital (NPOH) counterparts—a conclusion reached by *all* of the articles and reports published to date (**Table 2-1**).

2.2.3 A study commissioned by the Centers for Medicare and Medicaid Services (CMS) observed cardiac and orthopedic surgical hospitals consistently performed better than expected given the mix of patients treated.[17] Moreover, the CMS study found that specialty cardiac hospitals performed better than their general hospital competitors on three of the four cardiac inpatient quality indicators based on ratios of observed versus expected rates. The three measures (i.e., Patient Safety Indicators, or PSIs) were "selected infections due to medical care" (PSI = 7), "post-op pulmonary embolism or deep vein thrombosis" (DVT) (PSI = 12), and "post-op sepsis" (PSI = 13). For each of these measures, the "expected" rate[18] of occurrence was significantly higher than the observed rate in the specialty hospital group, whereas in all but one measure[19] general hospital competitors (NPOHs) had higher than expected rates.

Table 2-1
Summary of Studies of
Physician-Owned & Specialty Hospital Quality

	Study	POH v. NPOH
1	Cram et al. 2005	POHs Better[/A,B]
2	Nallamothu et al. 2006	POHs Better[/A,B,D]
3	Barro et al. 2006	POHs Better[/A,B]
4	Greenwald et al. 2006	POHs Better[/B,C,D]
5	Cram et al. 2007	POHs Better[/B,C]
6	Hwang et al. 2007	No Difference[/A,B,C,E]
7	Popescu et al. 2008	No Difference[/A,E]
8	Hagen et al. 2010	POHs Better[/A,B,C]
9	Cram et al. 2012	POHs Better[/B,C]
10	O'Neill & Hartz 2012	No Difference[/B]

Notes: A) study of specialty hospitals as opposed to POHs, but assumed high correlation between specialization and physician ownership; B) outcome measure is mortality rate; C) outcomes measure is complication rate; D) study includes other quality measures; E) outcomes worse in POH for patients with greater comorbidities

2.2.4 In addition, Schneider et al. (2007), in an unpublished analysis, used the CMS PSI rate differentials and mortality data to calculate the added costs incurred by moving POH cases into NPOHs. They calculated the costs of excess deaths to be $521,132,267 per

[17] CMS, "Study of Physician-Owned Specialty Hospitals Required in Section 507(C)(2) of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003; L. Greenwald et al., "Specialty Versus Community Hospitals: Referrals, Quality, and Community Benefits," *Health Affairs* 25, no. 1 (2006).

[18] The expected rate is the rate that would be expected given the case mix severity of the patients treated at the hospital in question (only cardiac patients in this case).

[19] For PSI 12 (post-op pulmonary embolism or DVT) in the general hospital group, the ratio of expected versus observed rates was 0.93, meaning that the rates were essentially the same.

year, and costs of poor quality to add another $9,408,883 per year, for a total excess cost of $606 million per year.

2.2.5 Barro et al. (2006) analyzed Medicare claims data at the hospital referral region (HRR) level and found that specialty hospital entry leads to both a reduction in expenditures and a decrease in mortality.[20] A consistent theme in these and other studies is that specialty hospitals have higher procedural volumes on average,[21] and are therefore well-positioned to exploit the positive outcome effects associated with higher volume .

2.2.6 Cram et al. (2005) found no significant differences in mortality for cardiac patients treated at specialty hospitals and general hospitals, after adjusting for lower severity and higher procedure volume at specialty hospitals.[22] Similar results were found by Nallamothu et al. (2006), who also studied cardiac specialized hospitals but used different methods. Using a rich dataset from the National Registry of Myocardial Infarction, the authors found that greater hospital specialization in primary percutaneous coronary intervention ("PPCI") was associated with lower risk of in-hospital mortality.[23]

2.2.7 In addition to the learning effects of higher procedural volumes, another explanation for the better outcomes at specialized cardiac hospitals is better adherence to clinical practice guidelines and protocols. Popescu et al. (2008) used CMS data to compare the quality of care of specialty cardiac hospitals and competing general hospitals, and found that specialty hospital compliance with heart attack and heart failure guidelines was similar to that of competing general hospitals.[24]

2.2.8 In sum, the peer-reviewed literature on quality of care provided in POHs is remarkably consistent, finding that specialty hospitals and POHs provide at least the same quality of care as NPOHs, and according to most studies the levels of quality observed in POHs exceeds that of NPOHs.

[20] These findings are based on the assumption that HRRs would have retained their 1993-1999 trend in expenditures and outcomes in the absence of specialty hospital entry. Refer to J.R. Barro, R.S. Huckman, and D.P. Kessler, "The Effects of Cardiac Specialty Hospitals on the Cost and Quality of Medical Care," *Journal of Health Economics* 25(2005).

[21] Of the 15 studies of specialty hospitals available at the time of this writing, five studies explicitly compared procedural volumes in specialty versus general hospitals. Of those five studies, four studies found that specialty hospitals had higher procedural volumes.

[22] Cram, Rosenthal, and Vaughan-Sarrazin, "Cardiac Revascularization in Specialty and General Hospitals."

[23] Brahmajee K. Nallamothu et al., "Acute Myocardial Infarction and Congestive Heart Failure Outcomes at Specialty Cardiac Hospitals," *Circulation* 116, no. 20 (2007).

[24] Ioana Popescu et al., "Do Specialty Cardiac Hospitals Have Greater Adherence to Acute Myocardial Infarction and Heart Failure Process Measures? An Empirical Assessment Using Medicare Quality Measures: Quality of Care in Cardiac Specialty Hospitals," *Am Heart J* 156, no. 1 (2008).

2.3 Supplemental Analyses

2.3.1 The published evidence on POH quality clearly supports the conceptual framework of the quality-related benefits of specialization, procedural volume, and learning-by-doing. In recent months, however, we have been able to supplement these findings with the results of CMS's own Hospital Value-Based Purchasing ("HVBP") program, enacted as part of the Patient Protection and Affordable Care Act. POHs have performed exceptionally well in the HVBP program. In 2012, the largest reward went to a POH, and some of the biggest cuts went to NPOHs.

2.3.2 Higher quality can result in cost savings a number of different ways, but the most likely types of savings occur in the reduction of "excess" charges associated with (1) patient safety and preventable medical errors, and (2) avoidable deviations from established clinical practice guidelines (CPGs) and protocols. Prior to the HVBP, we would expect POHs to perform well in these dimensions. The CMS report found that POHs had substantially lower preventable medical errors, and the Popescu article (discussed above) found that POHs are better at following CPGs.

2.3.3 Whereas the 2006 CMS study focused on patient safety indicators, the HVBP program focuses on related process of care measures. Comparative data from the HVBP program for NPOHs versus POHs is shown in **Table 2-2**. POHs outperform NPOHs by a sizable margin in both of the HVBP composite measures. Consistent with the published studies to date, the HVBP process quality composite score is nearly 16% higher on average for POHs.[25] The difference in patient-experience measures is substantially greater, where the POH score is nearly twice the NPOH score. Combined, the composite score for POHs is about 30% higher than the NPOH composite score.

Table 2-2
HVBP 2013 Composite Scores:
POHs v. NPOHs

Measure	NPOH Mean	POH Mean	Diff.	% Diff.
HVBP Process Score	42.16	48.76	6.60	15.7%
HVBP Patient Score	12.45	21.59	9.14	73.4%
HVBP Total Score	54.61	70.35	15.74	28.8%

Source/Notes: CMS Hospital Compare HVBP downloadable databases; higher scores are better

2.3.4 Higher HVBP process scores suggest better adherence to CPGs.[26] To calculate the cost savings associated with better adherence to CPGs, we calculated the expected costs for

[25] In the HVBP composite measures, higher scores are better; i.e. higher scores imply better quality

[26] Consistent with the HVBP score differentials, some studies have shown that POHs are better at following clinical practice guidelines and clinical protocols; see generally Popescu et al., "Do Specialty Cardiac Hospitals Have Greater Adherence to Acute Myocardial Infarction and Heart Failure Process

each of the HVBP process measures for the typical hospital, and then applied the 16% process score differential from the most recent HVBP data.[27] The results show that if all POH patients were moved to NPOHs, an additional $107 million per year would be incurred by the Medicare program.

2.3.5 Adding together the $606 million in excess costs associated with worse patient safety in NPOHs (based on our earlier analysis based on the CMS report) and the $107 million in excess costs associated with worse clinical process scores in NPOHs (based on the HVBP score differentials), the total excess costs of moving POH patients to NPOHs is $713 million per year. Put differently, the presence of POHs is saving payers—mainly Medicare—close to three quarters of a billion dollars each year.

2.3.6 Assuming a compounded annual medical care inflation rate of 4% per year, these savings total $9.62 billion over a 10-year period—the typical time horizon for CBO expenditure and savings projections.

3. EXPENDITURES

Healthcare spending in the U.S. continues to rise at a rapid pace, projected to eclipse the $4 trillion mark by 2019.[28] During the debates preceding the passage of the ACA, both political parties expressed serious concerns over the rise of health care costs—both the underlying

Measures? An Empirical Assessment Using Medicare Quality Measures: Quality of Care in Cardiac Specialty Hospitals."

[27] To calculate expected costs, we first calculated the joint probabilities associated with each process measure by multiplying the probability of occurrence of the hospital admission by the probability of the "non-CPG compliant" event occurring. This joint probability was then multiplied by the average cost of the "non-CPG compliant" event. The resulting expected costs for each measure were summed. The method was repeated for a scenario where one set of hospitals had 16% lower probabilities of CPG non-compliance (i.e., POHs in the latest HVBP data). This resulted in a lower total expected cost, and the difference between the two estimates of expected costs was used in calculating the difference in total expected costs between POHs versus NPOHs. A variety of data sources were used to populate the necessary data fields; see generally Chunliu Zhan and Marlene R. Miller, "Excess Length of Stay, Charges, and Mortality Attributable to Medical Injuries During Hospitalization," *JAMA: The Journal Of The American Medical Association* 290, no. 14 (2003); C.E. Carpenter, D.B. Nash, and N.E. Johnson, "Evaluating the Cost Containment Potential of Clinical Guidelines," *QRB*, no. April (1993); J.M. Grimshaw and A. Hutchinson, "Clinical Practice Guidelines--Do They Enhance Value for Money in Health Care?," *British Medical Bulletin* 51, no. 4 (1995); M.S. Niederman, "Guidelines for the Management of Community-Acquired Pneumonia," *Medical Clinics of North America* 85, no. 6 (2001); J.A. O'Brien, L.M. Jacobs, Jr., and D. Pierce, "Clinical Practice Guidelines and the Cost of Care," *International Journal of Technology Assessment in Health Care* 16, no. 4 (2000); JE Schneider et al., "Clinical Practice Guidelines and Organizational Adaptation: A Framework for Analyzing Economic Effects," ibid.22, no. 1 (2005); C.A. Silagy et al., "The Effectiveness of Local Adaptation of Nationally Produced Clinical Practice Guidelines," *Family Practice* 19, no. 3 (2002).

[28] CMS Office of the Actuary, "National Health Expenditure Projections 2011-2021," (Centers for Medicare and Medicaid Services, U.S. Department of Health and Human Services, 2013).

inflationary trends and the projected growth associated with ACA-related expansion. In addition, CMS has gradually increased its efforts to control costs. In addition to programs like the HVBP, as we mentioned above CMS's organizational goals include keeping medical care expenditures under control. As we discussed in the Quality section, the CMS website prominently states that: "We're here to help the people who use our programs to get high quality, effective care that results in *lower costs*..."[29] If it were the case that POHs could have the potential to lower government health care expenditures, then surely this would be of interest to the large government payers like Medicare and Medicaid. We have already shown that higher quality results lower expenditures by improving adherence to CPGs and reducing medical errors and other avoidable events. In this section, we review the theory of why we would *expect* POHs to have lower expenditures compared to NPOHs (Section 3.1). The second section (Section 3.2) reviews the published evidence on POH utilization (versus NPOHs) and the last section (3.3) introduces some new supplemental analyses on payment differentials between POHs and NPOHs for the same inpatient DRGs and outpatient APCs.

3.1 Theory

3.1.1 An important part of any scholarly work is the establishment of a reasonable theoretical framework, the main purpose of which is to guide the structure of empirical inquiry. It is the theoretical framework that allows researchers to formulate hypotheses—arguably the most important stage of any empirical (i.e., data-driven) study. In the absence of a theoretical framework with testable hypotheses, it is exceedingly difficult to interpret the findings research based on the analysis of data, especially the determination of the direction of causality.

3.1.2 The main argument against POHs has been that they encourage "overutilization." The implicit basis for this conjecture is that ownership interests lead to what is commonly referred to in the health economics literature as "supplier induced demand" ("SID"). In the medical care context, SID is defined as "the effect that doctors (or some other group of professionals), as providers of services, may have in creating more patient demand than there would be if they acted as "perfect agents" for their patients."[30] However, there are at least four major problems with relying on SID as the key theoretical basis for formulating hypotheses regarding the effects of ownership form on key performance measures, such as utilization and quality.

3.1.3 The literature on the comparative effects of different organizational designs, including ownership forms, is inherently comparative; that is, the performance attributes of one form of ownership can only be evaluated *relative* to some feasible alternative form of ownership.[31] In the context of POHs and SID theory, the evaluation of the role of SID in POHs is essentially meaningless unless it is done in a comparative way. Is SID present in

[29] See generally http://www.cms.gov/About-CMS/Story-Page/coordinating-care.html (emphasis added).

[30] A.J. Culyer, *The Dictionary of Health Economics* (Northampton, MA: Edward Elgar, 2005)., p.333

[31] O.E. Williamson, *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting* (New York: The Free Press, 1985).

NPOHs? There is nothing in the SID literature that suggests that the theory is *less* relevant in NPOH settings. Although NPOHs cannot legally explicitly compensate any physician for the volume or value of referrals they provide, NPOHs with employed physicians can require employed physicians to refer only to their employer. But employment is not the only way referrals can be influenced; in case of non-employed physicians, there are myriad ways in which NPOHs can provide strong incentives and rewards to referring physicians, including medical directorships, contractual arrangements, gain-sharing, capital financing, joint ventures, employment agreements, productivity bonuses, and non-monetary compensation.[32] Each of these alignment strategies can closely couple the incentives of hospitals and referring physicians, *regardless* of ownership status.

3.1.4 SID theory is often used to explain "imperfect agency" on behalf of physicians, but there are in fact many factors that cause physicians to act as "imperfect agents" for their patients, including (1) information asymmetry between patient and physician; (2) financial incentives associated with third-party payment mechanisms; and (3) physician associations (e.g., joint ventures and other collaborative arrangements) with medical groups, practice associations, and hospitals. Each one of these factors is enough to move physicians away from perfect agency; a combination of all three, as is typically at play in any given patient-physician relationship, moves the patient-physician relationship into "imperfect agency," as others have argued.[33]

3.1.5 SID theory is highly susceptible to the determination of causation. It is obvious that areas with greater availability of physician services would be expected to be characterized by higher utilization rates. However, the existence of an *association* between availability and utilization does not establish that greater availability *causes* greater utilization. To illustrate this point, Dranove and Wehner looked for evidence of demand inducement in childbirths.[34] Using rigorous econometric methods to adjust for the "endogenous entry" of obstetricians into market areas, they still found "evidence" that obstetricians induced demand for childbirths. They conclude that this obviously nonsensical finding illustrates the inherent methodological difficulties encountered when assessing the magnitude of demand inducement given this "chicken or egg" problem. It is obvious that physicians were attracted to areas with a strong potential for growth in the rate of childbirths.

[32] See generally Jillian Addy et al., "Accelerating Hospital-Physician Collaboration 2008," (McGuireWoods 2008).

[33] R.P. Ellis and T.G. McGuire, "Provider Behavior under Prospective Reimbursement," *Journal of Health Economics* 5, no. 2 (1986); J.E. Harris, "The Internal Organization of Hospitals: Some Economic Implications," *The Bell Journal of Economics* 8, no. 2 (1977); T.G. McGuire, "Physician Agency," in *Handbook of Health Economics*, ed. A.J. Culyer and J.P. Newhouse (New York: Elsevier, 2000); M.V. Pauly, *Doctors and Their Workshops: Economic Models of Physician Behavior* (Chicago, IL: The University of Chicago Press, 1980).

[34] D Dranove and P Wehner, "Physician-Induced Demand for Childbirths," *Journal of Health Economics* 13, no. 1 (1994).

3.1.6 An essential element of the SID hypothesis is the assumption of a passive and myopic buyer—an assumption that may have been appropriate twenty years ago but is less plausible in today's payment environment characterized by managed care and better-informed patients. A general problem with studies drawing inferences from differences in utilization rates is that the rates are based predominantly on supply factors and do not adequately account for demand factors. Demand for medical care is a function of several factors, including individual characteristics, preferences and price.[35] All of these demand determinants are expected to vary by hospital referral region, metropolitan area, and county, depending on the socioeconomic characteristics of the area.[36]

3.1.7 Much of the research on ancillary service utilization is limited by inadequate controls for case mix severity and other "demand-side" factors. Consequently, these studies offer little evidence that higher utilization rates resulting from self-referral to ancillary services (and owned hospitals) represent inappropriate or unnecessary care.[37] A grave flaw with many studies of the "the effects of X on utilization" is that researchers cannot objectively determine the *appropriateness* of the additional utilization attributable to X (if any is found). Put differently, it is possible that increases in utilization reflect "pent-up" demand for services (i.e., services that would have been performed at higher rates prior to X were there to have been sufficient capacity) rather than inappropriate care. For example, Restuccia et al. (1996) assessed whether the rate of inappropriate hospital admissions is high in areas with high medical admission rates. Seventy small geographic areas were formed by grouping Massachusetts ZIP codes by similarity of hospital use.[38] Appropriateness of hospital admission was measured both by applying an appropriateness protocol and physician judgment based on chart review. The authors found *no relationship between hospital admission rate and inappropriate admission rate*, which clearly calls into question the common assumption that areas with higher hospital use have more inappropriate use of hospital care.

[35] For example, see e.g., M. Grossman, "On the Concept of Health Capital and the Demand for Health," *Journal of Political Economy* 80, no. Mar.-Apr. (1972); M.R. Rosenzweig and T.P. Schultz, "Estimating a Household Production Function: Heterogeneity, the Demand for Health Inputs, and Their Effects on Birth Weight," ibid.91, no. 5 (1983).

[36] Even if we were able to adequately control for socioeconomic differences between market areas, we would still be faced with the problem of variation in net prices. Since most prices faced by specialty POHs and NPOHs alike are administered by third-party payers using variants of essentially the same fee-schedule, the only prices left to vary are those related to transaction costs. Specialty POHs, by virtue of their design, scope, and amenities, may be associated with lower search costs (e.g. Schneider et al., "The Economics of Specialty Hospitals."). For the "marginal" patient, these lower search costs may be enough to encourage them to seek treatment (as opposed to not seeking treatment at all). It is methodologically difficult to identify such patients using conventional databases, but the main point is that we do not know the proportion of increased utilization that can be attributed to such factors.

[37] B.E. Kouri, R.G. Parsons, and H.R. Alpert, "Physician Self-Referral for Diagnostic Imaging: Review of the Empiric Literature," *AJR* 179(2002); D.M. Zientek, "Physician Entrepreneurs, Self-Referral, and Conflicts of Interest: An Overview," *HEC Forum* 15, no. 2 (2003).

[38] J. Restuccia et al., "High Hospital Admission Rates and Inappropriate Care," *Health Affairs* 15, no. 4 (1996).

3.1.8 Appropriateness also appears to be insensitive to financial incentives, even on the part of price-sensitive consumers.[39] Further supporting the fact that the mix of appropriate and inappropriate care is a by-product of any medical care transaction, a study of the Veterans Health Administration ("VA") hospitals found evidence of relatively high levels of inappropriate care.[40] In no other U.S. health system are financial incentives as immaterial as they are in the VA health system, so why is there so much inappropriate care? Finally, even Mitchell and Scott (1992)—strident supporters of SID theory—concede in their article summary that "none of the studies to date...has been able to determine whether the increased utilization...represents inappropriate or unwarranted services."[41]

3.2 Evidence on POH Utilization

3.2.1 After a decade of debate, critics of POHs have not been able to demonstrate that POHs have higher utilization than their NPOH counterparts. At the time this report was written, there were a total of 10 empirical studies which directly assess the effects of physician ownership on the utilization of POHs (**Table 3-1**). All of these studies were conducted since the POH policy debates started in 2004. In sum, 6 out of 10 of the peer-reviewed published studies show that POHs are *not* associated with higher utilization. Of the four studies that do show a utilization effect, three were conducted by the same author and have been widely criticized for having flawed methodologies. Though there may be numerous ways of interpreting the nuances of these findings, it is clear that that there is no clear and convincing expenditure effect of the kind argued by POH critics.

3.2.2 In one of the earliest studies, Woods et al. (2005) analyzed practice data from ten orthopedic surgeons during an interval spanning seven years before and eight years after the opening of an orthopedic surgery specialty hospital in which the surgeons held a financial interest.[42] The ten orthopedic surgeons did not increase their surgical volume after the specialty hospital opened, performing an average of 4,399 procedures per year before the hospital opened and 4,542 procedures per year after the hospital opened. In addition, annual patient volume and the percentage of patients who underwent surgery did not significantly change after the specialty hospital opened. The obvious limitation of

[39] See generally A. L. Siu, W. G. Manning, and B. Benjamin, "Patient, Provider and Hospital Characteristics Associated with Inappropriate Hospitalization," *American Journal of Public Health* 80, no. 10 (1990); A. L. Siu et al., "Inappropriate Use of Hospitals in a Randomized Trial of Health Insurance Plans," *N Engl J Med* 315, no. 20 (1986).

[40] C. B. Smith et al., "Overutilization of Acute-Care Beds in Veterans Affairs Hospitals," *Medical Care* 34, no. 1 (1996).

[41] J. M. Mitchell and E. Scott, "Physician Ownership of Physical Therapy Services. Effects on Charges, Utilization, Profits, and Service Characteristics," *JAMA* 268, no. 15 (1992).

[42] G.W. Woods, D.P. O'Connor, and P. Pierce, "Orthopaedic Surgeons Do Not Increase Surgical Volume after Investing in a Specialty Hospital," *Journal of Bone and Joint Surgery* 87-A, no. 6 (2005).

the Woods et al. study is that it is limited to the experiences of only ten surgeons at one facility.

3.2.3 The studies commissioned by Congress were the first comprehensive studies of POHs. The first of these studies was conducted by Centers for Medicare and Medicaid Services (CMS) and Research Triangle International (RTI). The CMS study is especially noteworthy because they were able to measure actual physician ownership shares through site visits to 13 specialty hospitals, and link those ownership shares to Medicare claims data through the Medicare provider identifier; no other study has done this. The CMS study found that the incentive for physicians to refer to hospitals in which they have an ownership stake depended more on the size of the ownership stake rather than the fact that they were owners.[43] Given that ownership shares on average were very low, the CMS study found that referral patterns were not significantly affected by the entry of specialty POHs into the market. The most important limitation of the CMS study is that it did not take into account endogenous POH entry and did not examine the role of baseline trends in utilization.

Table 3-1
Summary of Studies of Physician-Owned Hospital Utilization

	Study	POH v. NPOH Findings	Notes
1	Woods et al. 2005	No effect	[a]
2	Mitchell 2005	Increase	[b,c,d]
3	Greenwald et al. 2006	No effect	
4	MedPAC 2005; 2006	No effect	
5	Barro et al. 2006	No effect	
6	Nallamothu et al. 2007	Increase	[b,d]
7	Mitchell 2007	Increase	[b,c,d]
8	Mitchell 2008	Increase	[b,c,d]
9	Schneider et al. 2010	No effect	
10	Lu et al. 2010	No effect	

Notes: (a) study does not include a control group; (b) study does not control for endogenous effects of ownership; i.e., ownership may be more prevalent in high demand areas; (c) study lacks sufficient methods of identification and measurement of ownership; (d) study does not measure ownership effect versus other confounding factors affecting utilization.

3.2.4 Using a different methodology, the CMS study essentially reached the same conclusions as a parallel study conducted by the Medicare Payment Advisory Commission (MedPAC)[44]—MedPAC's first of two reports. The MedPAC study used a "differences in differences" model to examine the effect of cardiac POHs on changes in Medicare cardiac treatment costs from 1996 to 2002. The study found no statistically significant findings in utilization rates between hospital referral regions (HRRs) with and without cardiac specialty hospitals. The main limitations of the MedPAC study are that it only focused on cardiac POHs and that the study did not take into account the likelihood that

[43] Greenwald et al., "Specialty Versus Community Hospitals: Referrals, Quality, and Community Benefits; CMS, "Study of Physician-Owned Specialty Hospitals Required in Section 507(C)(2) of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003."

[44] J. Stensland and A. Winter, "Do Physician-Owned Cardiac Hospitals Increase Utilization?," *Health Affairs* 25, no. 1 (2006); MedPAC, "Physician-Owned Specialty Hospitals," in *Report to Congress* (Washington, DC: Medicare Payment Advisory Commission, 2005a).

POHs are more likely to enter areas with higher than average pre-entry levels of utilization, thereby creating a potentially serious endogeneity problem. MedPAC later repeated their analyses using a larger sample of cardiac POHs and a more recent time period—1996 to 2004.[45] In the revised study, they found that cardiac surgeries per capita were 6% higher in markets with cardiac POHs. Again, the main limitations of the revised MedPAC study are that it only focused on cardiac POHs and that the study did not take into account endogeneity of POH market entry.

3.2.5 Nallamothu et al. (2007) focused exclusively on the effects cardiac POHs.[46] Using Medicare claims data from 1995 to 2003, they found that rates of change for total revascularization were higher in HRRs after cardiac POHs opened when compared with HRRs where new cardiac programs opened at NPOHs and HRRs with no new programs. Four years after their opening, the relative increase in adjusted rates was more than two-fold higher in HRRs where cardiac POHs opened when compared with HRRs where new cardiac programs opened at NPOHs and HRRs with no new programs. The relative increase in adjusted rates of coronary revascularization was 19.2% for HRRs with new cardiac POHs, compared to 6.5% for HRRs with new cardiac programs at NPOHs and 7.4% for HRRs with no new programs. Similar to the MedPAC studies, the main limitations of this study are that it only focused on cardiac POHs and it did not adequately take into account endogeneity of POH market entry. An additional limitation of the study is that it is not clear how much variation in HRR utilization rates is explained by the models, and how well the models deal with unobservable time-variant HRR characteristics.

3.2.6 Two studies to date have examined the effect of POHs on Medicare expenditures, rather than focusing separately on the volume and price components of expenditures. The first of these studies-- Barro, Huckman, and Kessler (2006)-- analyzed Medicare claims data from 1993, 1996, and 1999, using a matched case control panel design with fixed HRR effects.[47] Their main findings were that hospital expenditures for patients treated in HRRs with cardiac specialty hospital entry ("entry HRRs") experienced roughly 3% slower growth in cardiac care expenditures compared to patients treated in HRRs without cardiac specialty hospitals ("control HRRs"). Under the reasonable assumption that HRRs with POH entry would have retained their 1993-1996 trend in expenditures and outcomes in the absence of POH entry, they found that specialty hospital entry leads to both a *reduction* in expenditures of at least 7% and a *reduction* in mortality of at least a 4%. The results were robust to several different specification tests. The main limitations of the Barro et al. study are the limited time frame (only three time points, with 1999 as the most recent year) and inadequate consideration of endogenous market entry.

[45] "Physician-Owned Specialty Hospitals Revisited," (Washington, DC: Medicare Payment Advisory Commission, 2006).

[46] B.K. Nallamothu et al., "Opening of Specialty Cardiac Hospitals and Use of Coronary Revascularization in Medicare Beneficiaries," *Journal of the American Medical Association* 297, no. 9 (2007).

[47] J.R. Barro, R.S. Huckman, and D.P. Kessler, "The Effects of Cardiac Specialty Hospitals on the Cost and Quality of Medical Care," *Journal of Health Economics* 25(2006).

3.2.7 Schneider et al. (2010) examined the effect of POHs on Medicare per-enrollee expenditures at the metropolitan area (MSA) level nationwide, spanning the 8-year time period from 1998 to 2005.[48] The study was the first POH study to use fixed effects panel data estimation with instrumental variables to account for the bias introduced by endogenous POH market entry (i.e., POHs may be more likely to open in high-growth/high-demand markets with high levels of Medicare per enrollee expenditures). After controlling for other variables that are likely to affect expenditures (especially the age and sex distribution of the MSA), Schneider et al. found no association between POH presence and Medicare expenditures per enrollee at the MSA level. The results were robust to changes in model specification, estimation technique, and definition of geographic market, leading the authors to conclude that "the 'demand inducement' aspects of physician ownership of acute care hospitals (if any) have no meaningful impact on market-level Medicare expenditures per enrollee." The results of Schneider et al. were somewhat similar to the results two recent studies by Lu et al., both of which employed a sound methodological approach and found no POH effects.[49]

3.2.8 Finally, two studies by Mitchell reach conclusions somewhat similar to those of Nallamothu et al. (2007), although the methods differ substantially. Mitchell (2005) reached similar conclusions using state-level data from Arizona, although the study is severely hampered by its assumption that physician owners can be identified simply as physicians with relatively high-volume admissions to POHs.[50] In addition, the study is largely descriptive, lacking necessary statistical controls for case mix differences, baseline trends, and the likely possibility that POH entry is endogenous (i.e., POHs will enter markets with high demand). The other Mitchell study (2008) analyzed workers compensation claims in Oklahoma, finding that the entry of orthopedic specialty hospitals was followed by increases in market area utilization for complex fusion surgery.[51] The main problems with the Mitchell studies can be summarized as follows: (1) absence of a theoretical framework; (2) inability to determine whether utilization differences reflect appropriate or inappropriate care; (3) inappropriate control group; and (4) lack of representativeness of findings.

3.2.9 At best, the net or average result of the existing volume/utilization studies is mixed. However, it is clear that the studies with the most methodological rigor tend to reach the conclusion of "no effect," and one of those studies with particularly good methods

[48] J.E. Schneider, P. Li, and R.L. Ohsfeldt, "The Effects of Endogenous Market Entry of Physician-Owned Hospitals on Medicare Expenditures: An Instrumental Variable Approach," *Contemporary Economic Policy* On-line First(2010).

[49] X. Lu et al., "The Impact of New Hospital Orthopaedic Surgery Programs on Total Joint Arthroplasty Utilization," *Journal of Bone and Joint Surgery* 92-A, no. 6 (2010); Xin Lu et al., "The Impact of Physician-Owned Specialty Orthopaedic Hospitals on Surgical Volume and Case Complexity in Competing Hospitals," *Clin Orthop Relat Res* 467, no. 10 (2009).

[50] Mitchell, "Effects of Physician-Owned Limited Service Hospitals: Evidence from Arizona."

[51] "Do Financial Incentives Linked to Ownership of Specialty Hospitals Affect Physicians' Practice Patterns?," *Medical Care* 46, no. 7 (2008).

actually finds that POHs *decrease* utilization and expenditures. The only rational conclusion that can be drawn from this is that POHs have *no utilization effects*, and the most that can be said beyond that is that the studies show mixed results; there is clearly no trend toward showing that POHs lead to higher utilization. Moreover, none of these studies were able to address a crucial issue in analyzing utilization: whether services are appropriate and necessary. However, according to previously discussed research on POH quality, there is no indication that POHs provide higher levels of inappropriate care.

3.2.10 It is important to note that the CMS report on POHs found that physician owners do not change their referral patterns after taking an ownership interest in a hospital.[52] They continue to refer approximately 50% of their cases to other community hospitals. The RTI researchers conducting the study for CMS used Medicare claims data to investigate referral pattern changes of "true" owners, a very strong research methodology not undertaken in any other study. This fact is likely an important reason behind the mixed (or lack of) empirical findings on utilization.

3.3 Supplementary Analyses

3.3.1 Total POH expenditures can be expressed as a simple identity: $TE_{POH} = Q_{POH} \times P_{POH}$, where TE_{POH} represents total medical care expenditures in POHs, Q_{POH} is the quantity of services provided in POHs, and P_{POH} is the average price per service provided in POHs. In the inpatient setting, P_{POH} is analogous to a Medicare Severity Diagnosis Related Group (MS-DRG) payment in CMS's Medicare Inpatient Prospective Payment System (IPPS); in the outpatient setting, P_{POH} is analogous to CMS's Ambulatory Payment Classification (APC) Groups paid under the Medicare Outpatient Prospective Payment System (OPPS).

3.3.2 In Section 3.2, we presented evidence that the *quantity* of services provided in POHs (Q_{POH}) is essentially no different than the quantity of services provided in NPOHs, all other things equal. Thus, in order for POHs to truly have higher *total expenditures* (as their critics argue), it must be the case that $P_{POH} > P_{NPOH}$, where P_{NPOH} is the average price per service in NPOHs. To further explore this, we utilized the recently released Medicare Provider Charge Data (Inpatient & Outpatient) from CMS[53] to explore differences in Medicare payments to hospitals according to POH versus NPOH status.

3.3.3 The basic hypothesis was that actual Medicare payment rates vary substantially by hospital, and that net payments per services in POHs is less than the same services provided in NPOHs; that is, $P_{POH} < P_{NPOH}$ for a given set of DRGs or APCs. We based this hypothesis on the fact that NPOHs are more likely to receive outlier payments,

[52] CMS, "Study of Physician-Owned Specialty Hospitals Required in Section 507(C)(2) of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003."

[53] See generally the Medicare Provider Charge Data description available www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Medicare-Provider-Charge-Data (Inpatient description available on the same page via link)

disproportionate share payments, indirect medical education, graduate medical education, capital expenses, and other pass-through expenses.[54]

3.3.4 The CMS inpatient data include hospital-specific charges for the more than 3,000 U.S. hospitals that receive Medicare IPPS payments for the top 100 most frequently billed discharges, paid under Medicare based on a rate per discharge using the MS-DRG for Fiscal Year (FY) 2011. These DRGs represent almost 7 million discharges or 60% of total Medicare IPPS discharges. For these DRGs, average charges and average Medicare payments are calculated at the individual hospital level. The CMS outpatient data include estimated hospital-specific charges for 30 APC groups paid under the OPPS for Calendar Year (CY) 2011. The 30 APCs represent approximately 75% of all Medicare outpatient expenditures.[55] For these APCs, the estimated average charges and the average Medicare payments are provided at the individual hospital level.[56]

3.3.5 We compiled these downloaded CMS data using Stata® software to create inpatient and outpatient analytic databases. To each database we merged a crosswalk linking hospital provider identifiers with POH status ($n = 203$). We then calculated the average payment rate differentials (POH vs. NPOH) for the 100 DRGs and the 30 APCs. The last step was to extrapolate these findings to the national population, taking into account the fact that the DRG data represent about 60% of inpatient expenditures and the APC data represent about 75% of all outpatient expenditures.

3.3.6 The goal was to calculate the added expense that would be incurred by government payers if all POH patients were no longer allowed to visit POHs (e.g., as a result of legislative restrictions). In this hypothetical construct, the associated calculation is to take the POH caseload and apply the NPOH average paid amounts. For all DRGs and APCs, we found that POHs had lower net payment rates than NPOHs. This differential was observed at the national level and within states. **Table 3-2** summarizes the results of this analysis.

Table 3-2
Summary of Savings from POH vs. NPOH Payment Differentials

	Added Annual Costs if all POH Patients Assigned to NPOHs	
	Baseline	*Extrapolated*
Inpatient	$139,292,439	$232,154,065
Outpatient	$4,795,484	$6,393,978
TOTAL	$144,087,923	$238,548,043
10-yr Proj.		**$3,217,142,741**

Source: CMS Medicare Provider Charge Data (downloadable; see text)

3.3.7 Adding together the estimated inpatient and outpatient baseline payment differentials, and extrapolating to the national level by taking

[54] For a description of how these factors affect CMS DRG and APC payment rates by hospital, refer to T.M. Schuhmann, "Understanding Variation in Medicare Inpatient Payment," *Healthcare Financial Management* October(2010).

[55] Personal communication with CMS

[56] See CMS-1589-FC-Claims Accounting narrative available at www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalOutpatientPPS/Downloads/CMS-1589-FC-Claims-Accounting-narrative.pdf

into account the fact that CMS only reports data for the top 100 DRGs and top 30 APCs, we estimate that government payers would pay an extra $3.22 billion by moving all POH users into NPOHs.[57]

4. CONCLUSIONS

In the preceding analysis we provided theoretical discussions on what we would expect in the way of differences between POHs and NPOHs in quality and expenditures. In quality dimensions, the theory of specialization, the volume-outcome relationship in medical care, and learning-by-doing strongly suggest that that POH model is capable of delivering high quality care. In cost and expenditure dimensions, the over-reliance on the theory of "supplier induced demand" by POH critics weakens the case against POHs, as demand inducement is not uniquely a function of ownership in the health care industry. Thus, while we may be able to argue that demand inducement is a relevant issue, it is not a factor that clearly differs by organizational model; we have evidence of many cases in which demand inducement is present in NPOH settings as well.

The peer-reviewed published evidence reviewed herein ads empirical evidence to support the hypotheses based on theory. As theory would suggest, POHs appear to have a substantial advantage in terms of quality, outscoring their NPOH counterparts in both the process and patient experience summary scores of the HVBP. Similarly, the fact that the risk of demand inducement is spread more or less evenly across the health industry is supported by the fact that POHs and NPOHs do not appear to differ in terms of utilization rates. When actual average payment rates are analyzed, it is clear that the average payments to POH are substantially less than the average payments to NPOHs for the same services, adding further support to the argument that POHs are actually *cost saving* rather than inflationary.

In the quality section of this report, we calculated the POH savings associated with higher HVBP scores to be $107 million per year. Adding that to the $606 million per year that we previously calculated based on the 2006 CMS report on POHs, quality savings alone are $713 million per year, or $9.62 billion over the usual 10-year projection window used by the CBO (**Table 4-1**).

Adding the $3.22 billion attributable to the higher prices paid to NPOHs for the same services, the total savings associated with POHs is nearly **$13 billion** over a 10-year period.

Table 4-1
Summary of Aggregate Cost Savings from POHs: 10-year Projected Savings

Source of Savings	*10-year Projected Savings*
Quality	$9.62 billion
Payments	$3.22 billion
TOTAL	**$12.84 billion**

[57] Similar to the 10-year forecast for quality-related savings, this calculation assumes a compounded annual rate of medical inflation of 4%.

5. BIOSKETCHES

5.1 John E. Schneider, PhD is the CEO of AHE and is also actively involved with most AHE projects. Prior to forming AHE, Dr. Schneider was Senior Director of the US health economics practice at Oxford Outcomes, Inc. Prior to joining Oxford Outcomes, he was Principal and Senior Health Economist of Health Economics Consulting Group, LLC. Dr. Schneider is adjunct faculty in the Department of Economics at Drew University and a faculty affiliate at the Petris Center on Health Care Markets at the University of California Berkeley. He was recently on the faculty in the Department of Health Management and Policy and the Department of Economics at the University of Iowa. His PhD is in Health Services and Policy Analysis from the University of California Berkeley, with a concentration in health economics. He has over 25 years of experience studying economic and organizational aspects of the health care industry. After earning an MA in economics, Dr. Schneider was a research analyst at the Center for Health Economics Research from 1989 to 1993, involved extensively in analyses of large databases, cost analyses, and economic modeling of regulatory programs. While at CHER he co-authored numerous technical project reports for clients including the Centers for Medicare and Medicaid Services, the Agency for Healthcare Research and Quality, and the Robert Wood Johnson Foundation. After earning his PhD, Dr. Schneider served as the Director of Research at the California Association of Health Plans for two years. At CAHP, he led projects on technology assessment, physician organization, collaborative quality improvement, policy analysis, public relations, and developing research to support government relations functions for the health insurance industry in California. Dr. Schneider has also served as a consultant to managed care organizations, state health departments, trade associations, medical device manufacturers, large pharmaceutical companies, and others. Some of his research has been published in *Health Affairs, Inquiry, Health Services Research, Medical Care Research and Review, International Journal of Health Care Financing and Economics, Review of Industrial Organization, International Journal of Technology Assessment in Health Care, Prevention Science, and Health Care Financing Review*. He is co-author of the book *The Business of Health* (AEI Press, 2006).

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6. WORKS CITED

Addy, Jillian, Bill Woddson, Tom Stallings, Kristian Werling, Elissa Moore, Scott Becker, and Amy Nolan. "Accelerating Hospital-Physician Collaboration 2008." McGuireWoods 2008.

Bachmann, M.O., D. Alderson, T.J. Peters, C. Bedford, D. Edwards, S. Wotton, and I.M. Harvey. "Influence of Specialization on the Management and Outcome of Patients with Pancreatic Cancer." *British Journal of Surgery* 90 (2003): 171-77.

Barro, J.R., R.S. Huckman, and D.P. Kessler. "The Effects of Cardiac Specialty Hospitals on the Cost and Quality of Medical Care." *Journal of Health Economics* 25 (2005): 701-21.

———. "The Effects of Cardiac Specialty Hospitals on the Cost and Quality of Medical Care." *Journal of Health Economics* 25 (2006): 701-21.

Barro, Jason R., Robert S. Huckman, and Daniel P. Kessler. "The Effects of Cardiac Specialty Hospitals on the Cost and Quality of Medical Care." *J Health Econ* 25, no. 4 (2006 Jul (Epub 2005 Dec 2006): 702-21.

Birkmeyer, J.D., T.A. Stukel, A.E. Siewers, P.P. Goodney, D.E. Wennberg, and F.L. Lucas. "Surgeon Volume and Operative Mortality in the United States." *New England Journal of Medicine* 349, no. 22 (2003): 2117-27.

Carpenter, C.E., D.B. Nash, and N.E. Johnson. "Evaluating the Cost Containment Potential of Clinical Guidelines." *QRB*, no. April (1993): 119-23.

Casalino, L.P., K.J. Devers, and L.R. Brewster. "Focused Factories? Physician-Owned Specialty Facilities." *Health Affairs* 22, no. 6 (2003): 56-7.

Casalino, L.P., H. Pham, and G. Bazzoli. "Growth of Single-Specialty Medical Groups." *Health Affairs* 23, no. 2 (2004): 82-90.

Casey, J. "The Case for Specialty Hospitals." *Modern Healthcare* 34, no. 47 (2004): 21-22.

Chandler, A.D. "Organizational Capabilities and the Economic History of the Industrial Enterprise." *Journal of Economic Perspectives* 6, no. 3 (1992): 79-100.

———. *Scale and Scope: The Dynamics of Industrial Capitalism*. Cambridge, MA: The Belknap Press/Harvard University Press, 1990.

CMS. "Study of Physician-Owned Specialty Hospitals Required in Section 507(C)(2) of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003." Centers for Medicare and Medicaid Services, Department of Health and Human Services, 2005.

CMS Office of the Actuary. "National Health Expenditure Projections 2011-2021." Centers for Medicare and Medicaid Services, U.S. Department of Health and Human Services, 2013.

Coddington, D.C., L.E. Palmquist, and W.V. Trollinger. "Strategies for Survival in the Hospital Industry." *Harvard Business Review*, no. May-June (1985): 129-38.

Cowing, T.G., A.G. Holtmann, and S. Powers. "Hospital Cost Analysis: A Survey and Evaluation of Recent Studies." *Advances in Health Economics and Health Services Research* 4 (1983): 257-303.

Cram, P., J. A. House, J. C. Messenger, R. N. Piana, P. A. Horwitz, and J. A. Spertus. "Percutaneous Coronary Intervention Outcomes in Us Hospitals with Varying Structural Characteristics: Analysis of the Ncdr(R)." [In eng]. *Am Heart J* 163, no. 2 (Feb 2012): 222-9 e1.

Cram, P., M. S. Vaughan-Sarrazin, and G. E. Rosenthal. "Hospital Characteristics and Patient Populations Served by Physician Owned and Non Physician Owned Orthopedic Specialty Hospitals." [In eng]. *BMC Health Serv Res* 7 (2007): 155.

Cram, P.C., G.E. Rosenthal, and M.S. Vaughan-Sarrazin. "Cardiac Revascularization in Specialty and General Hospitals." *New England Journal of Medicine* 352, no. 14 (2005): 1454-62.

Cram, P.C., M.S. Vaughan-Sarrazin, B. Wolf, J.N. Katz, and G.E. Rosenthal. "A Comparison of Total Hip and Knee Replacement in Specialty and General Hospitals." *Journal of Bone and Joint Surgery* 89, no. 8 (2007): 1675-84.

Cram, Peter, Gary E. Rosenthal, and Mary S. Vaughan-Sarrazin. "Cardiac Revascularization in Specialty and General Hospitals." *N Engl J Med* 352, no. 14 (2005 Apr 2005): 1454-62.

Cram, Peter, Mary S. Vaughan-Sarrazin, Brian Wolf, Jeffrey N. Katz, and Gary E. Rosenthal. "A Comparison of Total Hip and Knee Replacement in Specialty and General Hospitals." *J Bone Joint Surg Am* 89, no. 8 (2007 2007): 1675-84.

Culyer, A.J. *The Dictionary of Health Economics*. Northampton, MA: Edward Elgar, 2005.

Danneels, E. "The Dynamics of Product Innovation and Firm Competencies." *Strategic Management Journal* 23 (2002): 1095-121.

Douglas, T.J., and J.A. Ryman. "Understanding Competitive Advantage in the General Hospital Industry: Evaluating Strategic Competencies." *Strategic Management Journal* 24, no. 4 (Apr 2003 2003): 333-47.

Dranove, D, and P Wehner. "Physician-Induced Demand for Childbirths." *Journal of Health Economics* 13, no. 1 (1994): 61-73.

Dranove, D. "Economies of Scale in Non-Revenue Producing Cost Centers: Implications for Hospital Mergers." *Journal of Health Economics* 17 (1998b): 69-83.

Eastaugh, S.R. "Hospital Costs and Specialization: Benefits of Trimming Product Lines." *Journal of Health Care Finance* 28, no. 1 (Fall 2001 2001): 61.

———. "Hospital Strategy and Financial Performance." *Health Care Management Review* 17, no. 3 (1992): 19-31.

Ellis, R.P., and T.G. McGuire. "Provider Behavior under Prospective Reimbursement." *Journal of Health Economics* 5, no. 2 (1986): 129-51.

GAO. "Specialty Hospitals: Geographic Location, Services Provided, and Financial Performance." Washington, D.C.: General Accounting Office, 2003b.

Gaynor, M., and G.F. Anderson. "Uncertain Demand, the Structure of Hospital Costs, and Cost of Empty Hospital Beds." *Journal of Health Economics* 14 (1995): 291-317.

Gosselin, G. "Pontiac's Nomc to Become State's First Private Acute Care Hospital." *Oakland Business Review* Thursday August 28 (2008).

Greenwald, L., J. Cromwell, W. Adamache, S. Bernard, E. Drozd, E. Root, and K.J. Devers. "Specialty Versus Community Hospitals: Referrals, Quality, and Community Benefits." *Health Affairs* 25, no. 1 (2006): 106-18.

Grimshaw, J.M., and A. Hutchinson. "Clinical Practice Guidelines--Do They Enhance Value for Money in Health Care?". *British Medical Bulletin* 51, no. 4 (1995): 927-40.

Grossman, M. "On the Concept of Health Capital and the Demand for Health." *Journal of Political Economy* 80, no. Mar.-Apr. (1972): 223-55.

Hagen, T., M.S. Vaughan-Sarrazin, and P.C. Cram. "Relation between Hospital Orthopaedic Specialization and Outcomes in Patients Aged 65 and Older: Retrospective Analysis of U.S. Medicare Data." *British Medical Journal* Online First (2010).

Harris, J.E. "The Internal Organization of Hospitals: Some Economic Implications." *The Bell Journal of Economics* 8, no. 2 (1977): 467-82.

Helfat, C.E., S. Finklestein, W. Mitchell, M.A. Peteraf, H. Singh, D.J. Teece, and S.G. Winter. *Dynamic Capabilities: Understanding Strategic Change in Organizations*. Malden, MA: Blackwell Publishing, 2007.

Hill, C.W.L. "Diversification and Economic Performance: Bringing Structure and Corporate Management Back into the Picture." In *Fundamental Issues in Strategy: A Research Agenda*, edited by R.P. Rumelt, D.E. Schendel and D.J. Teece, 297-321. Boston, MA: Harvard Business School Press, 1994.

Holyoke, C. "Troy Doctors Attempt to Buy Hospital." WSFA12 News, 2010.

Hwang, C.W., G.F. Anderson, M. Diener-West, and N.R. Powe. "Comorbidity and Outcomes of Coronary Artery Bypass Graft Surgery at Cardiac Specialty Hospitals Versus General Hospitals." *Medical Care* 45, no. 8 (2007): 720-28.

Keeler, T.E., and J.S. Ying. "Hospital Costs and Excess Bed Capacity: A Statistical Analysis." *Review of Economics and Statistics* (1996): 470-81.

Kouri, B.E., R.G. Parsons, and H.R. Alpert. "Physician Self-Referral for Diagnostic Imaging: Review of the Empiric Literature." *AJR* 179 (2002): 843-50.

Li, T., and R. Rosenman. "Cost Inefficiency in Washington Hospitals: A Stochastic Frontier Approach Using Panel Data." *Health Care Management Science* 4, no. 2 (2001): 73-81.

Lu, X., T. Hagen, M.S. Vaughan-Sarrazin, and P.C. Cram. "The Impact of New Hospital Orthopaedic Surgery Programs on Total Joint Arthroplasty Utilization." *Journal of Bone and Joint Surgery* 92-A, no. 6 (2010): 1353-61.

Lu, Xin, Tyson P. Hagen, Mary S. Vaughan-Sarrazin, and Peter Cram. "The Impact of Physician-Owned Specialty Orthopaedic Hospitals on Surgical Volume and Case Complexity in Competing Hospitals." *Clin Orthop Relat Res* 467, no. 10 (2009 Oct (Epub 2009 May 2009): 2577-86.

McGuire, T.G. "Physician Agency." In *Handbook of Health Economics*, edited by A.J. Culyer and J.P. Newhouse, 461-536. New York: Elsevier, 2000.

MedPAC. "Physician-Owned Specialty Hospitals." In *Report to Congress*. Washington, DC: Medicare Payment Advisory Commission, 2005a.

———. "Physician-Owned Specialty Hospitals Revisited." Washington, DC: Medicare Payment Advisory Commission, 2006.

———. "Transcript from Public Meeting on Inpatient and Outpatient Hospital Payment Issues." Washington, D.C.: Medicare Payment Advisory Commission, 2003.

Mitchell, J. M., and E. Scott. "Physician Ownership of Physical Therapy Services. Effects on Charges, Utilization, Profits, and Service Characteristics." *JAMA* 268, no. 15 (1992 Oct 1992): 2055-9.

Mitchell, J.M. "Do Financial Incentives Linked to Ownership of Specialty Hospitals Affect Physicians' Practice Patterns?". *Medical Care* 46, no. 7 (2008): 732-37.

———. "Effects of Physician-Owned Limited Service Hospitals: Evidence from Arizona." *Health Affairs* W5 (2005): 481-90.

Nallamothu, B.K., M.A.M. Rogers, M.E. Chernew, H.M. Krumholz, K.A. Eagle, and J.D. Birkmeyer. "Opening of Specialty Cardiac Hospitals and Use of Coronary Revascularization in Medicare Beneficiaries." *Journal of the American Medical Association* 297, no. 9 (2007): 962-68.

Nallamothu, B.K., Y. Wang, D.J. Magid, R.L. McNamara, J. Herrin, E.H. Bradley, E.R. Bates, C.V. Pollack, and H.M. Krumholz. "Relation between Hospital Specialization with Primary Percutaneous Coronary Intervention and Clinical Outcomes in St-Segment Elevation Myocardial Infarction: National Registry of Myocardial Infarction-4 Analysis." *Circulation* 113, no. 2 (2006 Jan 17 (Epub 2006 Jan) 2006): 222-9.

———. "Relationship between Hospital Specialization with Primary Percutaneous Coronary Intervention and Clinical Outcomes in St-Segment Elevation Myocardial Infarction: National Registry of Myocardial Infarction-4 Analysis." *Circulation* 113, no. January 17 (2006): 222-29.

Nallamothu, Brahmajee K., Yongfei Wang, Peter Cram, John D. Birkmeyer, Joseph S. Ross, Sharon-Lise T. Normand, and Harlan M. Krumholz. "Acute Myocardial Infarction and Congestive Heart Failure Outcomes at Specialty Cardiac Hospitals." *Circulation* 116, no. 20 (2007 Nov 13 (Epub 2007 Oct 2007): 2280-7.

Niederman, M.S. "Guidelines for the Management of Community-Acquired Pneumonia." *Medical Clinics of North America* 85, no. 6 (November 2001).

Noll, R.G. "The Consequences of Public Utility Regulation of Hospitals." In *Institute of Medicine Papers of the Conference on Regulation in the Health Industry*. Washington DC: National Academy of Sciences, 1975.

O'Brien, J.A., L.M. Jacobs, Jr., and D. Pierce. "Clinical Practice Guidelines and the Cost of Care." *International Journal of Technology Assessment in Health Care* 16, no. 4 (2000): 1077-91.

O'Neill, L., and A. J. Hartz. "Lower Mortality Rates at Cardiac Specialty Hospitals Traceable to Healthier Patients and to Doctors' Performing More Procedures." [In eng]. *Health Aff (Millwood)* 31, no. 4 (Apr 2012): 806-15.

Pauly, M.V. *Doctors and Their Workshops: Economic Models of Physician Behavior*. Chicago, IL: The University of Chicago Press, 1980.

Popescu, I., R. M. Werner, M. S. Vaughan-Sarrazin, and P. Cram. "Characteristics and Outcomes of America's Lowest-Performing Hospitals: An Analysis of Acute Myocardial Infarction Hospital Care in the United States." [In eng]. *Circ Cardiovasc Qual Outcomes* 2, no. 3 (May 2009): 221-7.

Popescu, Ioana, Brahmajee K. Nallamothu, Mary S. Vaughan-Sarrazin, and Peter Cram. "Do Specialty Cardiac Hospitals Have Greater Adherence to Acute Myocardial Infarction and Heart Failure Process Measures? An Empirical Assessment Using Medicare Quality Measures: Quality of Care in Cardiac Specialty Hospitals." *Am Heart J* 156, no. 1 (2008 Jul (Epub 2008 May 2008): 155-60.

Porter, M.E., and E.O. Teisberg. "Refining Competition in Health Care." *Harvard Business Review* 82, no. 6 (June 2004): 65-76.

Restuccia, J., M. Shwartz, A. Ash, and S. Payne. "High Hospital Admission Rates and Inappropriate Care." *Health Affairs* 15, no. 4 (Win 1996): 156-63.

Roberts, R.R., P.W. Frutos, G.G. Ciavarella, L.M. Gussow, E.K. Mensah, L.M. Kampe, H.E. Straus, G. Joseph, and R.J. Rydman. "Distribution of Variable Vs. Fixed Costs of Hospital Care." *Journal of the American Medical Association* 281, no. 7 (1999): 644-49.

Rohack, J.J. "Report to the Board of Trustees: Specialty Hospitals and Impact on Health Care." Chicago, IL: American Medical Association, 2004.

Rosenzweig, M.R., and T.P. Schultz. "Estimating a Household Production Function: Heterogeneity, the Demand for Health Inputs, and Their Effects on Birth Weight." *Journal of Political Economy* 91, no. 5 (1983): 723-46.

Schneider, J.E. "Changes in the Effects of Mandatory Rate Regulation on Growth in Hospital Operating Costs, 1980-1996." *Review of Industrial Organization* 22, no. 4 (2003): 297-312.

Schneider, J.E., P. Li, and R.L. Ohsfeldt. "The Effects of Endogenous Market Entry of Physician-Owned Hospitals on Medicare Expenditures: An Instrumental Variable Approach." *Contemporary Economic Policy* On-line First (2010).

Schneider, J.E., T.R. Miller, R.L. Ohsfeldt, M.A. Morrisey, B.A. Zelner, and P. Li. "The Economics of Specialty Hospitals." *Medical Care Research and Review* 65, no. 5 (2008): 531-53.

Schneider, JE, NA Peterson, T Vaughn, EN Mooss, and BN Doebbeling. "Clinical Practice Guidelines and Organizational Adaptation: A Framework for Analyzing Economic Effects." *International Journal of Technology Assessment in Health Care* 22, no. 1 (2005): 58-66.

Schuhmann, T.M. "Understanding Variation in Medicare Inpatient Payment." *Healthcare Financial Management* October (2010): 1-11.

Shortell, S. M., E. Morrison, and S. Hughes. "The Keys to Successful Diversification: Lessons from Leading Hospital Systems." *Hospital and Health Services Administration* 34, no. 4 (Winter 1989): 471-92.

Silagy, C.A., D.P. Weller, H. Lapsley, P. Middleton, T. Shelby-James, and B. Fazekas. "The Effectiveness of Local Adaptation of Nationally Produced Clinical Practice Guidelines." *Family Practice* 19, no. 3 (2002): 223-30.

Siu, A. L., W. G. Manning, and B. Benjamin. "Patient, Provider and Hospital Characteristics Associated with Inappropriate Hospitalization." *American Journal of Public Health* 80, no. 10 (Oct 1990): 1253-56.

Siu, A. L., F. A. Sonnenberg, W. G. Manning, G. A. Goldberg, E. S. Bloomfield, J. P. Newhouse, and R. H. Brook. "Inappropriate Use of Hospitals in a Randomized Trial of Health Insurance Plans." *N Engl J Med* 315, no. 20 (1986 Nov 1986): 1259-66.

Skinner, W. "The Focused Factory." *Harvard Business Review* 52, no. 3 (May-June 1974): 113-20.

Smith, C. B., R. L. Goldman, D. C. Martin, J. Williamson, C. Weir, C. Beauchamp, and M. Ashcraft. "Overutilization of Acute-Care Beds in Veterans Affairs Hospitals." *Medical Care* 34, no. 1 (Jan 1996): 85-96.

Snail, T.S., and J.C. Robinson. "Organizational Diversification in the American Hospital." *Annual Review of Public Health* 19 (1998): 417-53.

Stensland, J., and A. Winter. "Do Physician-Owned Cardiac Hospitals Increase Utilization?". *Health Affairs* 25, no. 1 (2006): 119-29.

Teece, D.J. "Towards an Economic Theory of the Multiproduct Firm." *Journal of Economic Behavior and Organization* 3 (1982): 39-63.

Teece, D.J., and G. Pisano. "The Dynamic Capabilities of Firms: An Introduction." *Industrial and Corporate Change* 3, no. 3 (1994b): 537-56.

Teece, D.J., R. Rumelt, G. Dosi, and S. Winter. "Understanding Corporate Coherence: Theory and Evidence." *Journal of Economic Behavior and Organization* 23 (1994a): 1-30.

Texas Medicine. "Physician Ownership Saves Houston's Oldest Hospital." April 2008 Issue (2008): p.29.

Vita, M. "Exploring Hospital Production Relationships with Flexible Functional Forms." *Journal of Health Economics* 9 (1990): 1-21.

Walker, L.R., and M.D. Rosko. "Evaluation of Health Care Service Diversification Options in Health Care Institutions and Programs by Portfolio Analysis: A Marketing Approach." *Journal of Health Care Marketing* 8, no. 1 (1988): 48-59.

Walker, T. "Specialty Care Facilities Make a Case by Improving Outcomes and Costs." *Managed Healthcare* 8, no. 6 (1998): 51-54.

Weinberg, Sylan Lee. "The Specialty Heart Hospital Concept: Transcending the Economic Issues." *Am Heart Hosp J* 5, no. 2 (2007 2007): 65-7.

Williamson, O.E. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting.* New York: The Free Press, 1985.

Woods, G.W., D.P. O'Connor, and P. Pierce. "Orthopaedic Surgeons Do Not Increase Surgical Volume after Investing in a Specialty Hospital." *Journal of Bone and Joint Surgery* 87-A, no. 6 (2005): 1185-90.

Wruck, K.H., and M.C. Jensen. "Science, Specific Knowledge, and Total Quality Management." *Journal of Accounting and Economics* 18 (1994): 247-87.

Zhan, Chunliu, and Marlene R. Miller. "Excess Length of Stay, Charges, and Mortality Attributable to Medical Injuries During Hospitalization." *JAMA: The Journal Of The American Medical Association* 290, no. 14 (10/08/ 2003): 1868-74.

Zientek, D.M. "Physician Entrepreneurs, Self-Referral, and Conflicts of Interest: An Overview." *HEC Forum* 15, no. 2 (2003): 111-33.