Physician-Owned Specialized Facilities: Focused Factories or Destructive Competition? A Systematic Review.

Melissa De Regge1,*, Jeroen Trybou2,*, Paul Gemmel1, Philippe Duyck3 and Lieven Annemans2,4

1 Department of Management, Innovation and Entrepreneurship, Ghent University, Belgium
2 Department of Public Health, Ghent University, Belgium
3 General Hospital AZ Nikolaas, Belgium
4 Faculty of Medicine and Pharmacy, Vrije Universiteit Brussel, Brussels, Belgium

*PhD Student

Corresponding author:
Melissa De Regge
Tweekerkenstraat 2
B-9000 Ghent
Belgium
Tel +32 (0)92643493
Fax +32 (0)92647888
melissa.deregge@ugent.be
Physician-Owned Specialized Facilities: Focused Factories or Destructive Competitors: A Systematic Review.

ABSTRACT

Multiple studies have investigated the business case of physician-owned specialized facilities (specialized hospitals and ambulatory surgery centers). However, literature lacks integration. Building on the theoretical insights of disruptive innovation, a systematic review was conducted to assess the evidence base of these innovative delivery models. The Institute of Medicine’s quality framework (safe, effective, equitable, efficient, patient-centered and accessible care) was applied in order to evaluate the performance of such facilities. In addition, the corresponding impact on full-service general hospitals was assessed. Database searches yielded 6,108 candidate articles of which 47 studies fulfilled the inclusion criteria. Overall, the quality of the included studies was satisfactory. Our results show that little evidence exists in support of competitive advantages in favor of specialized facilities. Moreover, even if competitive advantages exist, it is equally important to reflect on the corresponding impact on full-service general hospitals. The development of specialized facilities should therefore be monitored carefully.

Key words: specialty hospital, ambulatory surgery center, physician ownership, disruptive innovation, focused factory, systematic review.
INTRODUCTION

In response to pervasive deficits in quality of care (i.e. Mc Glynn et al., 2003) and skyrocketing health care expenditures (OECD, 2012) pressures to provide better and more efficient care continue to shape health care management and policy debate. Besides changing the payment framework and the associated incentives (e.g. pay for quality initiatives), policymakers and providers have turned their attention to the way care is delivered. More specifically an increasing part of care historically delivered at the hospital inpatient setting can now be conveniently performed in a short-stay or even the ambulatory setting. Consequently, besides the traditional full-service general hospital, specialized facilities have emerged as alternative settings of care delivery. These specialized facilities are typically defined as hospitals that treat patients with specific medical conditions or those in need of specific medical or surgical procedures, most notably orthopedic, spine, cardiac and surgical procedures (Mitchell, 2007; Schneider et al., 2008). Several types of specialized facilities have been described and a distinction has been made between facilities that focus on the ambulatory setting and hospitals that specialize in certain inpatient procedures. The former are ambulatory surgery centers (ASCs), described as freestanding outpatient facilities, dedicated to provide a specialized service such as cataract repair or colonoscopy (Meyerhoefer, Colby & Mc Fetridge, 2012). The latter are specialty hospitals (SH) which are licensed hospitals, typically small with approximately 20 beds (Badlani, Boden & Phillips, 2012). Examples of procedures performed in these hospitals are coronary artery bypass grafting and total knee replacement. Virtually all these specialized facilities are for-profit and approximately 83% of surgery centers in the U.S. are wholly or partly owned by physicians (Gabel et al., 2008; Lynk & Longley, 2002; Mitchell, 2007; Strope et al., 2009).

Both types of these specialized facilities have been the subject of intense debate (Casalino, Devers & Brewster, 2003) and in recent years, a lot of research has been published
on this theme. However, the literature lacks a clear and systematic view on the extent to which potential improvements in terms of quality and cost of care are realized. In addition the feasibility is unclear when the corresponding impact on full service-general hospitals is taken into account.

Proponents argue that these specialized facilities are ‘focused factories’ with associated economies of scale and scope (Schneider et al., 2008) and therefore can be considered as ‘disruptive innovations’ improving health care delivery (Christensen, 1997; Christensen, Grossman & Hwang, 2009). This potentially lowers the cost of health care delivery and possibly enhances quality of care by concentration of the expertise associated with the increased specialization (Casalino, Devers & Brewser, 2003). For example, the Shouldice clinic in Ontario Canada has been subject to a Harvard Business School case-study because of its focused model of care delivery (hernia repair) which is associated with higher quality and lower overall costs (Hallowell & Heskett, 2004). As most of these specialized facilities are physician-owned this element has been argued to improve quality of care (Ford & Kaserman, 2000) by reinforcing the physician professional role as the primary enforcer of quality of care. Moreover, this line of thought advocates specialized facilities as patient-centered and physician-friendly organizations (Badlani et al., 2012).

Critics contend that physician ownership associated with specialized facilities presents a major potential conflict of interest. Financial incentives linked to ownership have the potential to affect physicians’ practice patterns. Physicians with an ownership stake generate professional fees for performing their medical duties, but are also entitled to share facility fees generated by the center in which they have invested. This changes the financial incentives for physicians. Therefore it can be argued that with a facility ownership stake some physicians may lower thresholds for treatment thereby increasing the utilization of procedures (Mitchell, 2008) and focusing to a higher degree on well-insured patients (Cram, Pham, Bayman &
Furthermore there is the possibility that these specialized facilities treat primarily low-acuity patients within DRGs that are more profitable and send clinically complex cases to full service general hospitals (Mitchell, 2005). Concerns rise because hospitals are then left with the care for the poor or uninsured population and the most complicated onerous cases. This potentially undermines the current business model of full-service hospitals endangering their financial viability. Finally, the asymmetric obligation to assure 24/7 emergency call for full service general hospitals combined with a shrinking physician workforce has emerged as a major challenge to hospitals and has led to an unequal struggle (Casalino, Lawrence, November, Berenson & Pham, 2008).

The aim of this review is to assess and summarize the current evidence related to SHs and ASCs. Although the idea of a focused factory seems valuable and theoretically the benefits are high, the question remains if these advantages are really realized. We investigate if the formulated concerns are justified and whether the benefits outweigh the potential side-effects. The opposing views depicted above have manifested themselves in two distinct policy perspectives. If competition from these specialized facilities has social benefits, then policy makers should allow, and even facilitate, their entry. If competition from specialty hospitals is undesirable than policy makers should set regulations and financial incentives to account for the negative external effects that these facilities create (Barro, Huckman & Kessler 2006).
New contribution

Internationally, physician-owned specialized facilities and equity ownership has become an important issue of debate. Despite the increasing popularity of these facilities, to the authors’ knowledge, no systematic evaluation of the current evidence base has been conducted yet. In recent years, a lot of research has been published on this theme but the literature lacks synthesis and integration. Since there has been no attempt to synthesize and integrate current systematically knowledge our study goes beyond previous work. Furthermore, the heterogeneity in clinical setting (i.e. urology, orthopedic surgery), procedures (i.e. knee and hip surgery) and methodology (i.e. longitudinal and cross sectional studies) suggests a need for reviewing the literature systematically. Additionally, most previous studies do not explain their findings through the application of theory. Our study fills this research gap by building on the theory of disruptive innovation (Christensen, 1997, Christensen et al., 2009). The results are intended to inform health policy makers, third party payers and health care providers as well as to formulate priorities for further research.

Conceptual framework

Physician-owned specialized facilities can be seen as focused factories or a special case of a disruptive innovative model of health care delivery. Theoretical approaches that explain this emerging model of disruptive innovation may serve as a useful conceptual framework to understand the case of specialized facilities. The theory of disruptive innovation has created a significant impact on the development of new business-models and aroused plenty of rich debate within practice and academia (Dan & Chang, 2010). Disruptive innovations, as developed by Christensen, 1997 and Christensen et al., 2009, are considered to be innovations that disrupt an existing market thereby improving health care delivery. An overview is depicted in figure 1.
At the basis of the innovative model lies a technological enabler (1) that is translated into a new delivery model (2) characterized by lower-cost, higher-quality or more accessible services. The delivery of medical care has been historically frozen into two dominant business models, the full service-general hospital and the physician practice. However, both models were designed a century ago, when the nature of medicine was very different from modern health care. Due to developments like minimal invasive surgery, improved anesthetics and diagnostic possibilities, hospitals have shifted their focus from patient recovery in a nursing ward to highly technological medical care with a limited length of stay. This evolution raises the question whether the current business models of general hospitals and physician practises are still the most cost-effective way of health care delivery. The third important enabler of disruption innovations is the coalescence of an independent value network (3) around the new disruptive business models through which care is delivered. The new business-model needs to be knit together in a value network leading to added value for the system as a whole. While technological advancements may contribute to improved care, the greatest opportunities to improve the care provided to the population are to focus on and modify the health care delivery system currently in place (Hansen & Bozic, 2009). Finally, the impact of regulation should be considered (Curtis & Schulman, 2006). This aspect is a central component of disruptive innovation theory and coincides with the ultimate goal of our paper: enabling evidence based policy making (4) by synthesizing and integrating the available scientific evidence. We use the six dimensions of quality of health care (5) identified by the Institute of...
Medicine (safe, effective, equitable, efficient, patient-centered and accessible care) that are considered to be overarching principles that help to provide specific direction for policymakers and providers to implement change and improve health care (Institute Of Medicine, 2001). Since the interaction with the delivery system in place is not fully covered by the described dimensions (Health Services Research Group, 1992), the added value for the entire secondary care delivery was added to our assessment framework. Moreover, physician-owned specialized facilities have been criticized for undermining the business model of full service-general hospitals due to asymmetric obligations (Shactman, 2005) and deteriorating hospital-physician relationships (Goldsmith, 2007). Therefore, this dimension can be considered to be important as well. Table 1 provides a definition of the different dimensions.

METHOD

This study draws upon the analysis of literature from the systematic review perspective. The databases Embase, Pubmed, Cinahl, PsychInfo, Web Of Science, Eric and the Cochrane Library were searched for relevant studies. The searches were conducted in October 2012 (Week 40). Two reviewers independently searched for relevant studies using a standardized search strategy. The concepts of specialized facilities and the different dimensions of quality of care (explained above) were combined into a standardized search string using MeSH and non-MeSH entry terms “[(ambulatory care center* OR ambulatory surgery center* OR outpatient clinic* OR surgicenter* OR specialty hospital*) AND (“Treatment Outcome” OR "Safety” OR "Health Services Accessibility” OR quality OR
outcome* OR error* OR safety* OR access* OR equity OR effectiveness OR continuity OR practice pattern*) AND (ownership* OR Salaries and Fringe Benefits OR Reimbursement OR Incentive OR compensation* OR reimbursement* OR financ* OR bonus* OR remunerat*)].

The initial search strategy was validated using a selection of key papers known to the authors.

**Inclusion and exclusion criteria**

The following criteria were applied:

1. Only studies written in English were eligible.
2. Studies published in peer-reviewed journals between January 2000 and October 2012 were included. This time frame was selected because in this period physician-owned SHs and ASCs have emerged (Al-Amin & Housman, 2010).
3. Empirical quantitative studies were included. Qualitative research, commentaries, and theoretical analysis were excluded.
4. Single center studies were excluded.

**Data extraction**

Two reviewers searched independently for relevant studies using the standardized search strategy described above. The selection of the studies was determined in a two-step procedure. First, the search results were filtered by title and abstract and then narrowed down according to the formal inclusion and exclusion criteria. These were mainly duplicate records and references to non-empirical studies. The remaining studies were selected for full-text retrieval and underwent critical quality appraisal. In case of non-corresponding results, consensus was sought by consulting a third reviewer. In addition the reference lists of relevant publications were screened and forward citation track was applied. Comparison of the analysis results of the two reviewers identified five non-corresponding primary publications out of 6,108.
potentially relevant publications (Cohen’s Kappa: 94.1%). We did not perform a meta-
analysis because the selected studies had a high level of heterogeneity in the applied
methodology and outcome measurements.

**Quality appraisal**

Following Leonard, Stordeur & Roberfroid (2009) a global and pragmatic unweighted score
was issued for each paper (high (H), medium (M) or low (L) quality). All relevant studies
were appraised by ten generic items: clear description of the research question, patient
population and setting, intervention, comparison, effects, design, sample size, statistics,
generalizability and the addressing of confounders (Van Herck et al, 2010). Table 2 provides
an overview of the applied criteria.

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert Table 2 about here</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
</tbody>
</table>
RESULTS

Description of studies

Our literature search initially yielded 6,108 unique candidate articles, of which 112 were selected for full-text retrieval (figure 2). The references of these studies were searched to collect additional studies which were not included in the records identified through our database search. In this way, 20 additional studies were included. On the basis of abstract review, 75 articles (67 articles originating from our database search and 8 articles identified by our check of the references of the included articles) did not meet the inclusion criteria and were excluded for further review. After this step, the 57 references appearing to meet the study eligibility criteria were reviewed thoroughly. Ten papers deemed ineligible (single center case studies and qualitative studies) resulting in a final sample of 47 studies included in the review.

Almost all the studies originated from the United States. We retrieved only one European study (Denmark). A considerable increase in studies meeting the inclusion criteria published during the past years can be observed. Most reviewed articles obtained data of ASCs (21/47) or SHs (23/47). One study included both ASCs and SHs. Two studies referred to small private clinics but addressed the research question under study. Overall, the quality of the studies was apprized as satisfactory. About half of the included studies (23/47) were rated high, 40% (19/47) rated medium and 11% (5/47) were considered low. It should be noted that many of the included studies used convenience samples (i.e. Medicare data) and the
adjustment for confounding factors (i.e. sex, age, insurance status) varied across the included studies. Studies varied by a number of characteristics (table 3). First, the clinical field of the study differed across the included studies. Whereas the majority of studies focused on orthopedics (i.e. total hip prosthesis, carpal tunnel release and arthroscopic surgery of the knee) and cardiac care (coronary artery bypass grafting, percutaneous coronary artery intervention) other studies investigated SHs and ASCs in the clinical area of oncology, urology, spine surgery, eye surgery and colonoscopy.

Second, multiple outcome measures were used. While most studies focused on the extent to which physician-owned specialized facilities might impact effectiveness (i.e. clear indications), efficiency (i.e. cost) and safety (i.e. mortality) of care, we also found studies examining the effect on equity (adverse selection of the poor and uninsured population) and patient centeredness (i.e. patient satisfaction). Remarkably, while accessibility is considered a conceptual and theoretical argument in favor of specialized facilities we did not retrieve a single study focusing directly on this issue. Finally, the effect of specialized facilities on full service-general hospitals (the impact on the health care value network) was studied frequently.

Effect findings

**Safety**

A total of 11 publications that assessed safety of care were identified. Mortality and readmission rates were studied most frequently as safety outcomes. Several studies found a
lower mortality rate (Cram, Rosenthal & Vaughan-Sarrazin, 2005; Chukmaitov, Menachemi, Brown, Saunders & Brooks, 2008; Cram, Bayman, Popescu & Vaughan-Sarrazin, 2010; Greenwald et al. 2006) and readmission rate at specialized facilities (Chukmaitov, Devers, Harless, Menachemi & Brooks, 2011; Cram, Vaughin-Sarrazin, Wolf, Kats & Rosenthal, 2007; Hollingsworth et al., 2012). However, in case of the latter the results of Greenwald et al. (2006) showed that this is not always the case. Although patients treated at orthopedic SHs had lower readmission rates among the moderate-severity admissions, readmissions were higher among patients treated at cardiac specialty hospitals, in particular for the severe category. Besides mortality and readmission rates, Hollingsworth et al. (2012) and Cram et al. (2007) investigated the occurrence of postoperative complications. Both studies concluded that patients experienced fewer postoperative complications at ASCs and specialized hospitals (e.g. postoperative sepsis, postoperative hemorrhage).

However, it is important to note that safety advantages seem to disappear when these outcomes are adjusted for patient characteristics and procedural volume. Patient characteristics are clearly important since patients treated in general hospitals have been found to have higher average risk scores (Meyerhoefer et al, 2012; Winter 2003, Mitchell 2005, Cram et al. 2007), cases are characterized by a higher medical complexity (Cram et al. 2010, Chukmaitov et al. 2008) and treat less healthier patients (Barro et al. 2006; Cram et al. 2005, Hollingsworth et al. 2012). Furthermore, evidence was found in support of volume-safety relationships (Barker, Rosenthal & Cram, 2011; Chukmaitov et al., 2011, Cram et al. 2005) demonstrating that higher volumes of treated cases sometimes improves safety of care delivery.
Effectiveness

Our review identified 13 articles addressing care effectiveness. Two subthemes emerged. On the one hand, the adherence to clinical guidelines and evidence based quality measures was investigated. Andersen & Jakobsen (2011) showed that, from a clinical perspective, patients receive the same treatment in SHs as in general hospitals for hip operations. This was confirmed by Popescu, Nallamothu, Vaughan-Sarrazin & Cram (2008) claiming that compliance to evidence-based treatment guidelines in SHs were similar to other top-ranked hospitals. This contrasts the finding of Cram et al. (2011) who showed that SHs perform more percutaneous coronary interventions for unclear indications.

On the other hand, the financial incentives introduced by physician ownership of specialty hospitals have been studied. Several studies showed that incentives linked to ownership coincided with an increase of procedures on a hospital level (Hollingsworth et al., 2009, 2011; Mitchell, 2008, 2010, 2012 and Yee, 2011). In addition, evidence is available that adjusted population based rates of procedures performed in areas with high market share for ASCs were manifest (Hollenbeck, Hollingsworth, Dunn, Ye & Birkmeyer, 2010), growth rates were higher (Stensland & Winter, 2006) and the entry of SHs in a region substantially increased market utilization rates (Mitchell 2007; Hollingsworth et al., 2011; Nallamothu et al., 2007).

These results suggest that the ownership stakes of either specialized hospitals or ASCs do influence physician practice patterns. Specifically, the frequency of use of surgery, diagnostic and ancillary services increased after physician ownership was established. These findings demonstrate that the threshold to perform medical procedures is lowered by the introduction of ownership stakes and supply-induced demand is thereby increased.
**Equity**

Equity was studied in 9 articles focusing on potential differences in race, gender, insurance status of the treated population and levels of uncompensated and charity care.

Gabel et al. (2008) and Greenwald et al. (2005) studied the insurance status of the patients referred to ASCs and found that physician-owners refer well-insured patients to their facilities and less insured (i.e. Medicaid patients) to general hospital facilities. What is more, Mitchell (2005) and Tan, Wolf, Hollenbeck, Ye & Hollingsworth (2011) found that specialty hospitals treated higher percentages of cases with generous or private insurances. In addition, black patients (Nallamothu, Lu, Vaughan-Sarrazin, & Cram, 2008; Cram, Vaughan-Sarrazin & Rosenthal, 2007, Cram et al, 2010) and women (Cram et al., 2010; Hollingsworth 2012) were less likely to be cared for in ACSs and SHs.

Specialty hospitals provide less uncompensated care (Greenwald et al., 2006). Similarly, uncompensated and charity care in general hospitals was affected downwards after entry of cardiac SHs, this however was not the case for orthopedic and surgical specialty hospitals (Carey, Burgess & Young, 2009).

**Efficiency**

In general, specialized facilities have been argued to be more efficient than competing full-service general hospitals. However, to date, the scientific evidence supporting this claim is scarce when costs of care are compared. Efficiency was addressed by only 2 studies. Carey, Burgess & Young (2008) studied costs of full-service general hospitals and physician-owned cardiac, orthopedic and surgical specialty hospitals. They found no lower costs and thus evidence for increased efficiency in favor of specialty hospitals. On the contrary, in case of orthopedic and surgical specialized facilities it was found they exhibit higher levels of overall
cost inefficiency. This can be explained by competition is in part driven by cost-increasing services and technology. In case of cardiac care this difference was not present.

In addition, Hair, Hussey & Wynn (2012) assessed potential differences in operational performance. Their main outcomes were perioperative times as a proxy for hospital efficiency. Surgery time, operating room time and postoperative time were significantly shorter in ASCs. However it is important to note that clinical outcomes were not considered in this study and an unequal basis of comparison could be present.

**Patient-centeredness & Accessibility**

Evidence regarding the dimensions of patient-centeredness and accessibility was limited to only one quantitative study. Andersen et al. (2011) studied the time between referral and preliminary examination and time between decision and procedure. This study showed that in Denmark, private clinics had shorter waiting times than public clinics for both preliminary examinations and actual surgery. They also found higher patient satisfaction scores in private clinics. Although it can be argued that specialty hospitals target unmet demand, no evidence was found that access increased in market where specialty hospitals emerged.

**Value network**

While the different dimensions depicted above focus on the possible differences in performance of hospitals, it is equally important to measure the corresponding impact of specialized facilities on full-service general hospitals and thus the added value for the system as a whole. This issue emerged in our systematic literature review as a major issue and frequently studied topic. We identified 18 articles focusing on this aspect.
A central argument in the debate of specialized facilities is the potential effect of specialized facilities in promoting healthy competition with other full-service general hospitals, thereby enhancing performance. Indeed ASCs have been more likely to enter markets with lower or insufficient levels of competition among hospitals (Bian & Morrisey, 2006). However empirical results suggests that general hospitals, when confronted with competition from specialized facilities, step up their own offering of services. This was found by Carey, Burgess and Young (2009a) in case of cardiac services and high technology diagnostic imaging. These researchers also examined differences in offerings of safety-net services—(i.e. emergency department and trauma center). They found mixed and inconsistent results. While trauma centers and burn units were positively associated with competition this was not the case for emergency care and crisis prevention. In the field of cardiology they found that a general hospital located in the same market will add angioplasty or cardiac catheterization within two years post entry of specialty hospitals. Results also indicate that hospitals located in markets with orthopedic or surgical specialty hospitals raise their nursing staffing levels (Carey, Burgess & Young, 2009b). Schneider et al. (2007) found that entry of specialized hospitals encourages greater cost efficiency on the part of incumbent hospitals. Hospital operating margins were improved by reducing full service general hospital costs.

Patient characteristics and volume

First, research indicates that volume was shifted from general hospitals to physician-owned specialized facilities only to a limited degree (Bian & Morrisey, 2007; Courtemanche & Plotzke, 2008; Hollingsworth et al. 2012). Second, this shift concentrated primarily on low-severity cases which correspond with more profitable diagnostic related groups (Mitchell 2005; Plotzke & Courtemanche, 2011; Strope et al., 2009) and lower cost risk (Meyerhofer
et al, 2012). Cohesively, evidence was found that SHs treat a greater share of healthier patients (Barro et al. 2006; Cram et al. 2005, Hollingsworth et al. 2009) with less comorbid illness (Cram et al. 2010, Chukmaitov et al. 2008). However, the market of secondary care as a whole has grown. Therefore clear evidence of a decline in volume or an increase in patient case complexity for general hospitals is absent (Lu, Hagen, Vaughan-Sarrazin & Cram, 2009; Hollingsworth et al., 2012). Whereas the studies of Bian & Morrisey (2007) and Couremanche & Polzke (2008) depicted similar results for inpatient procedures, they did find a decrease in hospital outpatient volume.

Third, while physician-owners tend to focus more on cases with generous insurance (Mitchell, 2005) and financially, lucrative procedures (Strope et al., 2009), we did not find evidence of a corresponding impact on full service general hospitals.

Financial effects
The effects of increased competition, changes in patient volume and –characteristics could possibly have a negative effect on full service-general hospital financial health. Cimasi, Sharamitaro, Haynes & Seiler (2008) did not find conclusive evidence of the negative impact of specialized facilities on overall hospital profitability. Carey, Young & Burgess (2011) found that this nevertheless has led to revenue losses and decreased margins. In the long run, hospitals tend to exit markets with high ASC density (Al-Amin & Housman, 2010) and specialized facilities founding rate is related to the closure of general hospitals (Al-Amin, Zinn, Rosko & Aaronson, 2010). This contrast with the findings of Schneider et al. (2008) which question the contention that competition from specialized facilities harms general hospitals financially. Hospital operating margins were improved by a reduction in general hospital costs.
DISCUSSION

Theoretically, it can be argued that physician-owned specialized facilities have certain characteristics that may give them a competitive advantage compared to general hospitals. The focus on a limited number of procedures enables them to realize economics of scale and economies of scope, which could contribute to increased efficiency and quality of care (Schneider et al., 2008). However the results of our systematic review shows that the results of previous empirical studies are mixed and inconclusive. This finding supports the argument that comparing hospital performance is highly complex and inadequate measures of costs and quality are used (Porter & Teisberg, 2006). In addition this evidence suggests that hospital performance depends on factors other than the issue whether or not a hospital is focused or specialized and physician-owned or not (Carey et al., 2008). The mixed findings can also be explained in part by the lack of publicly available data to determine whether or not physicians are owners of a facility, making it not possible to directly identify physician-ownership. The reviewed studies used several proxy measures (i.e. volume of referrals, board membership, information on websites and listings) which complicates the systematic comparison of results.

Related to this is the fact that although physician-owners favor their own specialty hospital, they also refer patients to competitor hospitals in which the size of ownership appears to be an important factor, not the fact of ownership in itself (Greenwald et al. 2006).

Notwithstanding these issues the following findings are significant. Firstly, the reviewed studies show that procedure volume is an important aspect that cannot be neglected. Over the past decades numerous studies have described the relationship between the number of procedures performed and clinical effectiveness and safety (Barker et al. 2011). This issue lies at the center of our research question since the potential advantages in terms of cost and quality could result from the focus on a certain clinical area. However while a volume shift from full service-general hospitals to specialized facilities could be expected no clear
evidence of declines in full service-general hospital volume exists (Bian & Morrisey, 2007; Courtemanche & Plotzke, 2010; Hollingsworth et al., 2012). Secondly, when considering quality and cost of provided care it is important to note that specialized facilities have been found to treat more patients in better health (Hollingsworth et al., 2012), with less comorbid illness (Cram et al., 2009) and characterized by a lower severity of illness (Yee, 2011). This makes a valid and reliable comparison of quality of provided and clinical outcomes difficult. Considering the findings of our systematic review we note that previous research did not detect a fundamental cost or quality advantage in favor of ASCs and SHs. When quality of care is considered it is important to note that with respect to lower severity cases a limited difference in favor of specialized facilities was demonstrates (i.e. Cram et al., 2010; Hollingsworth et al, 2012). In contrast evidence suggests that specialized facilities might not do as well as full service-general hospitals with very sick patients (Greenwald et al, 2006). In addition, even if we assume that specialized facilities outperform general full-service hospitals in the niche they focus on, we argue that the study of the feasibility of the business case of specialized facilities cannot neglect the impact on the delivery system already in place. Moreover it is equally important to reflect on the corresponding impact on the other services not provided by these focused factories. Since specialized facilities do not cover the whole scale of services, the question rises if the business case of general hospitals is still sustainable when high volumes of these procedures would shift away from full service-general hospitals towards specialized facilities (Lu et al., 2009; Hollingsworth et al., 2012). One element is that low-volume hospitals (below a certain threshold volume) could have inadequate experience with the procedures involved, leading to suboptimal clinical outcomes (Elixhauser, Steiner & Fraser, 2003). In light of this concern the question rises if full service-general hospitals will still be able to treat the more complex cases when the basic standardized medical workload shrinks down or even disappears. However, it should be noted that procedural volume of
hospitals does not reflect the number of procedures performed by a certain physician. Considering that most physicians practicing at specialized facilities also practice in a general hospital, this reduces the importance of this quality aspect.

Furthermore the rise of specialized facilities could have an important financial impact on full service-general hospitals (Carey et al., 2011; Schnieder et al., 2008; Simasi et al.; 2008). Firstly, this could lead to an increase of the cost of the delivered care because of the disadvantages in terms of cost-efficiency associated with a small volume of high complex cases. Secondly, general hospitals internally cross-subsidize highly necessary, but unprofitable, services such as emergency care with more profitable activities. This also enables them to provide care to the poor and underinsured. When profitable services are no longer performed at full service-general hospitals the question rises how these hospitals will cover the cost of this activity.

Finally, the impact of the physician-ownership status associated with specialized facilities should be considered. A physician with an ownership stake in a specialized facility receives besides a professional fee, also a share of the facility fee paid to the specialized facility. This increases physicians’ financial self-interest into decisions regarding patient care. In this respect, concerns about the possible supplier-induced demand and self-referral have been put forward (Greenwald et al., 2006; Gabel et al., 2008; Mitchel, 2008). Likewise physicians can maximize profits by treating patients for whom the profit margin is the highest in their specialized facility and refer financial unattractive patients to full service-general hospitals (cream skimming).

Overall, the evidence base does not show competitive advantages in terms of quality and cost of the delivered care in favor of specialized facilities. Since the volume of targeted procedures performed by specialized facilities has not implied an important decline in general hospitals’ volume, the corresponding impact on general hospitals remains limited. However,
if volume of certain procedures should shift significantly towards specialized facilities this could to negative financial effects. Therefore, the development of specialized facilities and the corresponding impact on full service-general hospitals should be monitored carefully.

CONCLUSION

In this study we reviewed the evidence base of the physician-owned specialized facilities (SHs and ACSs) as focused factories. We examined the effects on the quality of provided care within these facilities and the corresponding impact on full service-general hospitals. Our results show that little evidence exists in support of a competitive advantage in favor of these specialized facilities. The findings of previous research are mixed and can be considered to be inconclusive. Moreover, the evidence suggests that comparing costs and quality of care delivery is highly complex and depends on factors other than the issue whether or not a hospital is focused and specialized or whether or not the hospital is physician-owned. Furthermore, even if a competitive advantage should exist in favor of specialized facilities, it is equally important to reflect on the impact on the other services not provided by these focused factories. Full service-general hospitals internally cross-subsidize unprofitable services such as emergency care or highly complex cases. In addition, this enables them to provide care to the poor and underinsured. Since the volume of targeted procedures performed by specialized facilities has not implied an important decline in full service-general hospitals’ volume, to date, the corresponding impact on full service-general hospitals remains limited. However, if volume of certain procedures should shift significantly towards specialized facilities this could undermine the business model of full service-general hospitals. Therefore, the development of specialized facilities and the corresponding impact on full service-general hospitals should be monitored carefully.
REFERENCES


Hollingsworth, J. M, Krein, S. L., Birkmeyer, J. D., Ye, Z., Kim, H. M., Zhang, Y., &


Nallamothu, B. K., Rogers, M. A. M., Chernew, M. E., Krumholz, H. M., Eagle, K. A., &


FIGURE 1
Conceptual Framework

Value Network

Innovative Business Model

Technology, Skills & Knowledge

Regulations and Policy Measures

Quality of Care

- Safe
- Accessible
- Effective
- Equitable
- Patient-Centered
- Efficient
FIGURE 2
Flow Chart of Search Strategy

7,002 records identified through database searching

6,108 records retained after duplicates removed

112 records retained after screening on title

16 records retained after screening on abstract

20 of additional records identified through reference check

45 records retained after screening on abstract

43 records retained based on consensus

12 records retained after consensus and screening on full text

35 records retained after screening on full text

Records excluded N= 4

Records excluded N= 8

Records excluded N= 67

Records excluded N= 4

Records excluded N= 2

Records excluded N= 4

Full text articles addresses for eligibility N= 47
### TABLE 1: Evaluative framework, exemplary outcomes and measurements

<table>
<thead>
<tr>
<th>Theme</th>
<th>Definition</th>
<th>Exemplary outcomes</th>
<th>Exemplary measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe</td>
<td>Delivering health care which minimizes risks and harm to service users</td>
<td>Mortality rate</td>
<td>Likelihood of postoperative complications, likelihood of same day readmission</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Postoperative complications</td>
<td>(Hollingsworth et al., 2012).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unexpected complications</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In-hospital mortality for coronary artery bypass grafting (Cram et al., 2009).</td>
</tr>
<tr>
<td>Effective</td>
<td>Delivering health care that is adherent to an evidence base and results in improved health outcomes for individuals and communities, based on need</td>
<td>Adherence to guidelines</td>
<td>Administration of ß-blockers on arrival and discharge for acute myocardial infarct</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evidence Based Medicine</td>
<td>(Popescu et al., 2008).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Percutaneous coronary intervention indications for treated patients: documented angina, atypical chest pain or a positive stress test (Cram et al., 2012).</td>
</tr>
<tr>
<td>Patient-centered</td>
<td>Delivering health care which takes into account the preferences and aspirations of individual service users and the cultures of their communities</td>
<td>Patient satisfaction</td>
<td>Patient satisfaction (Andersen et al, 2010).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quickly return patients to their Homes</td>
<td></td>
</tr>
<tr>
<td>Accessible</td>
<td>Delivering health care that is timely, geographically reasonable, and provided in a setting where skills and</td>
<td>Waiting times</td>
<td>Diagnosis-procedure time (Andersen et al, 2010).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Expected number of weeks-waiting time</td>
<td></td>
</tr>
</tbody>
</table>
resources are appropriate to medical need

Equitable Delivering health care which does not vary in quality because of personal characteristics such as gender, race, ethnicity, geographical location, or socioeconomic status

Race Gender Uncompensated and charity care

Admitted Black patients for coronary revascularization (Brahmajee et al., 2008).

Uncompensated and charity cardiac care performed (Carey et al., 2009)

Efficient Delivering health care in a manner which maximizes resource use and avoids waste

Cost of care delivery

Peri-operative times (Hair et al., 2012).

Value Network The coalescence of the existing value network around the new delivery model through which care is delivered. The added value for the entire system.

General Hospital Financial Health

General hospitals’ offerings of services and growth in high-technology diagnostic imaging services in general (Carey, Burgess & Young, 2009).

General Hospital Profitability (Plotzke & Courtemanche, 2011)
**TABLE 2: List of criteria used for the quality assessment**

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Study Design</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well explained</td>
<td>Appropriate to address the research question</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cross-sectional or longitudinal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Size and representativeness of the sample</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Quality</th>
<th>Source of data mentioned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quality check reported</td>
</tr>
<tr>
<td></td>
<td>Addressing confounders</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Methods clearly explained</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Appropriate statistics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Discussion</th>
<th>Internal Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>External Validity</td>
</tr>
<tr>
<td></td>
<td>Conclusions supported by findings</td>
</tr>
<tr>
<td>Year</td>
<td>Reference</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
</tr>
<tr>
<td>2010</td>
<td>Al-Amin &amp; Housman</td>
</tr>
<tr>
<td>2010</td>
<td>Al-Amin, Zin, Rosko &amp; Aaronson</td>
</tr>
<tr>
<td>2011</td>
<td>Andersen &amp; Jakobsen</td>
</tr>
<tr>
<td>2011</td>
<td>Barker, Rosenthal &amp; Cram</td>
</tr>
<tr>
<td>2006</td>
<td>Barro, Huckman &amp; Kessler</td>
</tr>
</tbody>
</table>

¹ ASC: Ambulatory Surgery Center
² SH: Speciality Hospital/ Specialized Hospital
<table>
<thead>
<tr>
<th>Year</th>
<th>Authors</th>
<th>Type</th>
<th>Specialization</th>
<th>Research Objective</th>
<th>Outcome Measures</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>Bian &amp; Morrissey</td>
<td>M</td>
<td>Value Network</td>
<td>Specialized Secondary Care</td>
<td>To determine the association of free-standing ASCs with hospital surgery volume.</td>
<td>Hospital in-patient and outpatient surgical volume</td>
</tr>
<tr>
<td>2006</td>
<td>Bian &amp; Morrissey</td>
<td>M</td>
<td>Value Network</td>
<td>Specialized Secondary Care</td>
<td>To determine market effects of health maintenance organization penetration and hospital competition on the growth of freestanding ASCs.</td>
<td>ASCs/10,000 population</td>
</tr>
<tr>
<td>2011</td>
<td>Carey, Burgess &amp; Young</td>
<td>H</td>
<td>Value Network</td>
<td>Specialized Secondary Care</td>
<td>To examine the effects of ASC competition on general hospital financial performance.</td>
<td>Net patient revenue, total operating expenses (costs) and profit margins</td>
</tr>
<tr>
<td>2009</td>
<td>Carey, Burgess &amp; Young (a)</td>
<td>M</td>
<td>Value Network</td>
<td>Cardiology, Orthopedics and General Surgery</td>
<td>To determine the effect of specialty hospital entry on changes in service provision by general hospitals.</td>
<td>Competition level of single specialty hospitals high technology, safety net</td>
</tr>
<tr>
<td>2009</td>
<td>Carey, Burgess &amp; Young (b)</td>
<td>M</td>
<td>Value Network</td>
<td>Specialized Secondary Care</td>
<td>To determine the effect of SH entry on nurse staffing levels in general hospitals.</td>
<td>Nurse staffing level (FTE registered nurses and FTE licensed practical nurses)</td>
</tr>
<tr>
<td>2009</td>
<td>Carey, Burgess &amp; Young (c)</td>
<td>M</td>
<td>Equitable</td>
<td>Cardiology, Orthopedics and General Surgery</td>
<td>To determine changes in the provision of uncompensated care and charity care in hospitals competing with ASC.</td>
<td>Costs of uncompensated care and charity care</td>
</tr>
<tr>
<td>2008</td>
<td>Carey, Burgess &amp; Young</td>
<td>H</td>
<td>Efficient</td>
<td>Cardiology, orthopedics and general surgery</td>
<td>To perform a comparative cost analysis of full-service hospitals and ASCs.</td>
<td>Hospital total costs</td>
</tr>
<tr>
<td>Year</td>
<td>Authors</td>
<td>Type</td>
<td>Setting</td>
<td>Objective</td>
<td>Study Design</td>
<td>Key Findings</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td>-----------</td>
<td>--------------</td>
<td>--------------</td>
</tr>
<tr>
<td>2011</td>
<td>Chukmaitov, Devers, Harless, Menachemie, Brooks</td>
<td>H</td>
<td>Safe</td>
<td>To examine the impact of ASC strategies and structures on their quality performance.</td>
<td>2 Common Procedures: Arthroscopy and colonoscopy procedures</td>
<td>30-day unplanned readmissions</td>
</tr>
<tr>
<td>2008</td>
<td>Chukmaitov, Menachemi, Brown, Saunders &amp; Brooks</td>
<td>H</td>
<td>Safe</td>
<td>To compare quality outcomes of ASCs vs. Hospital based outpatient departments.</td>
<td>12 (most common) Surgical Procedures (i.e. arthroscopy, biopsy of the liver, cataract removal, colonoscopy, debridement of skin or other tissues)</td>
<td>Risk-adjustment 7-day and 30-day mortality and 7-day and 30-day unexpected readmissions</td>
</tr>
<tr>
<td>2008</td>
<td>Cimasi, Sharamitaro, Haynes &amp; Seiler</td>
<td>M</td>
<td>Value Network</td>
<td>Specialized Secondary Care</td>
<td>To investigate the effect on profitability of short term general acute care hospitals after entry of ambulatory surgical area.</td>
<td>Profitability indicators: operating income to beds, operating income to discharges, net income to beds, net income to discharges</td>
</tr>
<tr>
<td>2008</td>
<td>Courtemanche, Plotzke</td>
<td>H</td>
<td>Value Network</td>
<td>Specialized Secondary Care</td>
<td>To estimate the effect of ASC entry on hospital outpatient surgical volume.</td>
<td>Hospital outpatient surgical volume</td>
</tr>
<tr>
<td>2011</td>
<td>Cram, House, Messenger, Piana, Horwitz &amp; Spertus</td>
<td>H</td>
<td>Effective</td>
<td>Cardiology: Percutaneous Coronary Interventions</td>
<td>To investigate inappropriate use of PCI procedures.</td>
<td>Unclear indications of PCI (adherence to guidelines: without documented angina, typical of atypical chest pain or a positive stress test)</td>
</tr>
</tbody>
</table>

A higher level of specialization and volume of procedures may be associated with a decrease in unplanned hospitalizations at ASC.

Neither ASC nor hospital based outpatient department performed better overall, but important variations for certain procedures were found. When risk-adjustment is applied for both primary and secondary diagnosis ASCs performed better for upper gastrointestinal endoscopy on 30-day mortality a hospital outpatient department performed better in all five procedures (colonoscopy, debridement of skin and other tissues, repair of inguinal hernia, laparoscopic occlusion as fulguration of oviducts and spinal injection for myelography and/or computed tomography) for 7-day and 30-day readmissions.

No conclusive evidence was found that SHs negatively impact profitability of acute care hospitals.

An influence of ASC entry on hospitals outpatient surgical volume was apparent if facilities are situated within a few miles of each other. This effect is stronger for large ASCs and the first ASC to enter the market. The reduction in hospital volume is not nearly large enough to offset the new procedures performed by the entering ASC. No evidence was found that entering ASC reduce hospital inpatient surgical volume.

Specialty hospitals were found to perform somewhat more PCI for unclear indications. Wide variation across hospital.
2010 Cram, Bayman, Popescu & Sarrazin

H Equitable Safe
Cardiology: Acute Myocardial Infarction, Coronary Artery Bypass Grafting
To compare characteristics and outcomes of patients hospitalized in specialty cardiac hospitals and general hospitals.
Differences in patient demographics, comorbidity, risk-standardized mortality
Race, gender

2007 Cram, Vaughan-Sarrazin & Rosenthal

H Equitable
Orthopedic Surgery: Total Hip Replacement and Total Knee Replacement
To determine whether physician ownership versus non-ownership differ in hospital characteristics and patient population served.
Race (black or white patients), insurance status.
Procedural volumes, hospital teaching status, for profit status, severity, comorbid conditions, nurse staffing ratios

2007 Cram, Vaughan-Sarrazin, Wolf, Katz & Rosenthal

H Safe
Orthopedics: Total Hip Replacement, Total Knee Replacement and Revision of Total Knee Replacement
To compare patients characteristics and outcomes between specialty hospitals and general hospitals.
Outcomes occurring within 90 days of surgery (sepsis, hemorrhage, pulmonary embolism, deep vein thrombosis, wound infections requiring readmission or death), Length Of Stay and the proportion of patients requiring transfer to another acute care hospital
Mortality rate
Demographic characteristics (age, gender, race and socioeconomic status), comorbidity, high-risk conditions and admission source

2005 Cram, Rosenthal & Vaughan-Sarrazin

H Safe
Cardiology: Percutaneous Coronary Intervention and Coronary Artery Bypass Grafting
To compare patients characteristics, hospital procedural volumes and patient outcomes between specialty hospitals and general hospitals.

2008 Gabel, Fahlman, Kang, Wozniak, Cram & Vaughan

M Equitable
General Surgery
To investigate the referral patterns by patient insurance (ASCs vs hospital outpatient department).
Referral patterns of physicians by patient insurance status
Facility type, physician ownership status, patient characteristics (gender, age and race), discharge status (i.e. home), diagnosis, procedure, source of admission, referring physician, payer mix (self-pay, Medicaid, Medicare, commercial)

2006 Greenwald, Cromwell, Adamache, Bernard, Drodz, Roor & Devers

M Equitable
Cardiac, Orthopedic and Surgical Procedures of Circulatory System, Musculoskeletal System, Connective Tissue and Surgical DRGs
To compare referral patterns, quality, patient satisfaction and community benefits of physician-owned specialty versus competitor hospitals.
Referral volume, patient preferences and service needs, severity of illness, mortality rates, readmissions and patient safety indicators
Participating in taking emergency call in competing community hospitals,

SH have a lower proportion of women and blacks and patients with less comorbid illness. In-hospital mortality in specialty hospital was lower than in general hospitals for acute myocardial infarction.

Patients who underwent major joint replacement in physician-owned SHs were less likely to be black than patients in non-physician owned SHs (although higher proportion of black neighborhood of physician-owned SHs). Patients treated in physician-owned SHs had lower rates of most common comorbid conditions (heart failure and obesity). Physician owned SHs performed fewer major joint replacements on Medicare patients and were less affiliated with medical school.

SHs had a greater mean procedural volume. After adjusting the composite outcome (the six described outcomes occurring within 90 days of surgery) was significant better in SHs compared to general hospitals.

The mean volumes were higher in SH than general hospitals. After adjusting for patient characteristics the odds-ratio for death after percutaneous coronary intervention was similar in both settings. The odds-ratio for death after coronary artery bypass grafting was lower in SH than in general hospitals. After adjusting for procedure volume no significant differences were found. Specialized hospitals treated healthier patients.

Physicians at physician-owned facilities were more likely to refer well-insured patients to their facility and route Medicaid patients to hospital out-patient clinics.

From the analysis, it was found that ownership by physicians is positively related to the likelihood of referring patients to specialty hospital. Physicians at physician-owned facilities were more likely than other physicians to refer well-insured patients to their facilities and to a healthier population. SH provided generally high-quality care to satisfied patients, but provided less uncompensated care in specialty hospitals.
<table>
<thead>
<tr>
<th>Year</th>
<th>Authors</th>
<th>Type</th>
<th>Procedures</th>
<th>Aim</th>
<th>Data</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>Hair, Hussey &amp; Wynn</td>
<td>Efficient</td>
<td>Procedures of the Nervous - Eye - Cardiovascular - Digestive - Musculoskeletal - Integumentary System and Miscellaneous Diagnostic and Therapeutic Procedures</td>
<td>To compare ASCs to hospitals by efficiency measures.</td>
<td>Time in surgery, time in operating room, time in postoperative care, total perioperative time</td>
<td>Age, gender, number of diagnoses, symptoms related to surgery (hypertension, nausea, ...), use of anesthetics</td>
</tr>
<tr>
<td>2010</td>
<td>Hollenbeck, Hollingsworth, Dunn, Ye &amp; Birkmeyer</td>
<td>Effective</td>
<td>To determine the relationship between ASC market share and rates of procedure.</td>
<td>Procedures rate (number of patients)</td>
<td>Age, gender, race, insurance status, socioeconomic status, comorbidity, ASC market share</td>
<td>For all 4 procedures, adjusted rates of procedures performed were significantly higher in hospital service areas with high market share for ASC. The greatest difference was found in patients undergoing cystoscopy. The age-adjusted rate of cystoscopy was nearly 3-fold higher than in areas with low ASC market share.</td>
</tr>
<tr>
<td>2012</td>
<td>Hollingsworth, Kein, Birkmeyer, Ye, Kim, Zhang &amp; Hollenbeck</td>
<td>Value Network</td>
<td>Urology: Stone Surgery</td>
<td>To determine how the opening of ACS impacts stone surgery use in health care market and assess the effects of its opening on the patient mix by nearby hospitals.</td>
<td>Stone surgery use (relative value unit and annual hospital service area level rate of stone surgery/population in hospital service area)</td>
<td>Age, gender, race, primary payer, socioeconomic status, comorbidity status and multiple ASCs in hospital service area.</td>
</tr>
<tr>
<td>2012</td>
<td>Hollingsworth, Saigal, Lai, Dunn, Strope &amp; Hollenbeck</td>
<td>Safe Equitable</td>
<td>Urologic Surgery (i.e. prostate biopsy, urethra dilation, endoscopic bladder)</td>
<td>To compare quality of surgical care between hospitals and ASC.</td>
<td>Adverse events: 30-day mortality, unexpected readmission rate (same day and 30 days), postoperative complications</td>
<td>Case mix, age, gender, race, comorbid status, area of residence</td>
</tr>
<tr>
<td>2011</td>
<td>Hollingsworth, Kein, Ye, Kim &amp; Hollenbeck</td>
<td>Effective</td>
<td>4 Common Procedures: Cataract Surgery, Colonoscopy, Upper Gastro-Intestinaltract Endoscopy, Cancer-directed Breast Surgery</td>
<td>To determine the impact of the opening of an ASC in a health market on the rates of procedure performed.</td>
<td>Annual surgical volumes</td>
<td>Age, gender, race, year, presence of multiple ASCs within hospital service area, comorbidity, socio-economic status, insurance status</td>
</tr>
</tbody>
</table>
A significant association between physician-ownership of surgicenters and greater use of the five common outpatient procedures (carpal tunnel release, cataract excision, myringotomy with tympanostomy tube placement, colonoscopy, knee arthroscopy) was found.

A significant association between physician-ownership of ASCs and increased surgery use was apparent. Owners performed a greater proportion of their surgeries in ASCs than non-owners, and their utilization rates were over twofold higher. For every 10 percent increase in the penetration of owners within a urologist's local healthcare market, the annual caseload increased by 3.32.

No clear evidence that entry of physician-owned specialty orthopaedic hospitals resulted in declines in total hip arthroscopy or total knee arthroscopy volume or increases in patient case complexity for the competing general hospital.

Self-referring urologists billed more specimens with pathology tissue cores per prostate biopsy than non-self-referring urologists. However, lower cancer detection rate are linked to self-referring urologists.
**AOM**

**2010** Mitchell M Effective Orthopedics: Carpal Tunnel Repair, Rotator Cuff Repair, Arthroscopic Knee Surgery To evaluate if financial incentives linked to physician ownership influence frequency of outpatient orthopedic surgical procedures. Frequency of use (number of patients treated by procedure/number of patients with such diagnosis) Age, gender, year, physician ownership

**2008** Mitchell L Effective Back and Spine Disorders To compare practice patterns for physician owners and non-owners. Practice patterns: frequency of use of surgery, diagnostic and ancillary services (i.e. simple and complex spinal fusion, MRI, Epidurals, physical therapy.) None

**2007** Mitchell M Effective Spinal Fusion Procedures (Simple and Complex) To compare the utilization rate of spinal fusion in two markets. Utilization rate (complex and simple) spinal fusion per 1000 back-spine cases in treatment. None

**2005** Mitchell H Value Network Equitable Safe Cardiac surgery To compare practice patterns of physician-owners of limited-service cardiac hospitals and physician non-owners at competing full-service community hospitals. Volumes of cases and severity of illness of case mix Payer mix (DRG cases treated each year with different types of insurance coverage

**2008** Nallamothu, Lu, Vaughan, Sarrazin & Cram H Equitable Cardiology: Coronary Revascularization (Coronary Artery Bypass Grafting, Percutaneous Coronary Intervention) To examine whether black patients were less likely to undergo coronary revascularization at cardiac hospitals compared to white patients. Patient characteristics (gender, race, age) Geographic proximity to the nearest hospital, procedural acuity, comorbidities, admission type (elective, urgent, emergent) and admission source. None

Age- and sex-adjusted odds ratios indicate that the likelihood of having carpal tunnel repair was 54% to 129% higher for patients of surgeon owners compared with surgeon non-owners. For rotator cuff repair, the adjusted odds ratios of having surgery were 33% to 100% higher for patients treated by physician owners. The age and sex-adjusted probability of arthroscopic surgery was 27% to 78% higher for patients of surgeon owners compared with surgeon non-owners. Higher use rates by physician owners across time suggests that financial incentives linked to ownership of either specialty hospitals or ambulatory surgery centers influence physician practice patterns.

Findings suggest the introduction of financial incentives linked to ownership coincided with a change in the practice patterns of physician owners. These changes were not evident among physician non-owners. The frequency of use of surgery, diagnostic and ancillary services increased significantly after physician established ownership in a SH.

The entry of SHs was followed by substantial increases in market area utilization rates for complex spinal surgery. Such changes did not occur in another region where physician-owned SHs do not exist. For simple spinal surgery this was not the case.

Physician-owners treated higher volumes of profitable cardiac surgical DRGs, higher percentages of low-severity cases and higher percentages of cases with generous insurance compared with physician non-owners.

Black patients were less likely to be admitted at cardiac hospitals for coronary artery bypass grafting and percutaneous coronary intervention. However, this relationship was substantially attenuated if patients lived in close proximity to cardiac hospitals.
The opening of cardiac hospitals within an hospital referral region is associated with increased population-based rates of coronary revascularization. These findings are consistent with rates for coronary bypass grafting and percutaneous coronary intervention were considered separately. For PCI, this growth appeared largely driven by increased utilization among patients without acute myocardial infarction.

Higher profit surgeries have a higher probability of being performed at an ASC compared to a hospital. After controlling for surgery type, a 10% increase in surgery's profitability is associated with a 1.2 to 1.4 percentage point increase in the probability the surgery is performed at an ASC.
2007 Schneider, Ohsfeldt, Morrisey, Li, Miller & Zelner

**Value Network**

**General Surgery, Orthopedic Surgery, Cardiac Surgery**

To determine if the presence of SHs in the market affect general hospitals’ financial performance.

Hospital patient care revenue, patient care cost, patient care operating margins

Hospital size, mean length of stay, teaching status, mean cost/unit, ownership status, discharges, % Medicare and Medicaid, case mix, staffing level (general, RNs, MDs), occupancy rate, outpatient visits, wage rates, per capita income, population density, unemployment rate, number of specialty hospitals (new and established), number of physicians

Presence of SHs is associated with higher general hospital patient care margins and lower patient care operating costs. No difference was found for hospital patient care revenue.

2006 Stensland & Winter

**Effective Cardiology: Heart Hospitals**

To determine whether physicians investment in heart hospitals was followed by an increase in the number of relatively profitable cardiac surgeries and/or a shift towards operating on healthier patients.

Number of high-margin services (coronary bypass grafting), moderate margin surgery (acute myocardial infarction) and low margin surgery (implantation of cardioverter-defibrillators) performed and severity of patients treated at both types of hospitals

None

Although markets with physician owned SHs had slightly above-average growth rates in profitable cardiac surgeries, this was only statistically significant for bypass surgery. There was no increase in surgeries performed on healthier patients.

2009 Strope, Diagnault, Hollingsworth, Ze, Wei & Hollenbeck

**Value Network**

87 Procedures of the Genitourinary System (i.e. cystoscopy)

To evaluate the relationship between ownership and use of ASCs (procedure volume and share of financial lucrative procedures).

Rates of ambulatory surgery

Ownership status, financial incentives and location of practice

In general, rates of ambulatory surgery increased. This was primarily the case in ASCs (in contrast to hospitals). Physician ownership was associated with this increased use. The share of financially lucrative procedures increased more when ownership was present.

2011 Tan, Wolf, Hollenbeck, Ye & Hollingsworth

**Equitable Urology:** Uretroscopy

To determine ureteroscopy rates decreased following the expansion of lithotripter ownership.

Use of ureteroscopy (number of procedures/population)

Comorbidity, age, gender, race, socio-economic status and primary payer

The introduction of physician ownership was not associated with increased or decreased rates of ureteroscopy but might have influenced treatment selection among certain patient groups. After ownership expansion patients who underwent ureteroscopy were older, sicker, less likely to be white or to have private health insurance.

2003 Winter

**Safe**

Cataract and Eye Procedures, Colonoscopy, Cystoscopy, Endoscopy, Interventional Pain Management Procedures, Arthroscopy, Ambulatory Musculoskeletal and Ambulatory Skin Procedures

To compare the medical complexity of patients treated in ASCs and outpatient departments.

Medical complexity (risk score)

Age, gender, diagnosis, setting (inpatient, outpatient and physician visits)

In each procedure category, patients in ASCs had lower average risk scores than those treated in outpatient departments.
To investigate physician ownership of ASC on procedure volume and referral behavior.

Physician procedure volume, referrals

Patient health risk score

Physician board membership had a significant impact on physicians medical decisions and overall utilization of ASC. Specifically, physicians who were member of the board had an increased procedure volume and refer and treat more lower risk patients.