

Organizational Form and Asymmetric Competition: The Dynamics of Surgery Center and Hospital Exit

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Abstract

The literature on organizational niche suggests that competition between firms that have overlapping niches tends to elevate mortality risks. Specialists in particular tend to locate in peripheral areas of the market and avoid direct competition with generalists. However, the vast majority of this prior research considers only competition between firms with a similar organizational form. Ambulatory surgery centers (ASCs) represent an emergent class of specialized organizational forms that are leaner versions of generalist forms. We apply theories on resource partitioning to the market for outpatient surgical procedures in order to explore whether ASCs and hospital compete with one another in fundamentally different ways.

By manipulating patient-level datasets from the state of Florida, we were able to measure competition and firm entry/exit with a high level of precision. We broke down our explanatory variables by facility type (ASC vs. hospital) and utilized Cox proportional hazard models to evaluate the impact of competition from each on ASC and hospital exit. Although ASCs do tend to exit markets in which there are high levels of ASC competition, we found weak evidence to suggest that ASCs exit rates are lowest in markets with high hospital density. On the other hand, hospitals not only tend to exit markets with high levels of hospital competition but also experience high exit rates in markets with high ASC density. Our results suggest that specialized organizational forms benefit from the presence of generalist forms while generalists are hurt by the presence of competing specialists.

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I. BACKGROUND

A. Resource Partitioning Theory

The concept of the organizational niche has evolved significantly over time. Drawing from the literature on bioecology, Hannan and Freeman (1997) developed the field of population ecology and defined an organizational niche as the set of environmental conditions in which an organization can grow or at least sustain its numbers (Hannan & Freeman, 1977). Within these environmental conditions, organizations compete for resources. Since resources are scarce, however, each environment is characterized by a carrying capacity that can support a certain number of organizations. When the carrying capacity increases as a result of changes in technology or consumer preferences, successful entry will occur and the organizational population will grow.

Hannan and Freeman (1989) first developed these ideas in order to understand how specialist and generalist organizations compete with one another since the field of bioecology had already developed models to understand how different populations interact. They distinguished between specialists and generalists by defining the niche width of an organization as the range of environmental conditions that an organization is able to survive in (Hannan & Freeman, 1989). Organizations possessing a wide niche are referred to as generalists while organizations possessing a narrow niche are referred to as specialists. Hannan and Freeman theorized that specialists tend to do better in environments that are stable and fare poorly in turbulent environments because they have difficulties outlasting the unfavorable periods. Meanwhile, generalists tend to fare better when environmental variation is high because of their ability to diversify this risk across different product lines.

Over time, resource partitioning theory emerged as an extension to population ecology since it issues predictions about the effect of niche width that were less closely related to environmental risk and than they were to the concentration of organizations within markets comprised of heterogeneous resources (Carroll, 1985). Organizations initially attempt to find a viable position within this market by targeting their products to various resource segments. Because specialists target a narrow band of resource targets, they tend to locate in peripheral areas in order to avoid direct competition with other organizations (Dobrev, Kim, & Carroll, 2002; Dobrev, Kim, & Hannan, 2001). Generalists, on the other hand, tend to locate in core areas and offset the deleterious effects of this direct competition by catering to a broad range of resource targets. A variety of studies have tested these ideas empirically in settings ranging from the newspaper to the automotive industry (Carroll, 1985; Carroll & Swaminathan, 2000; Dobrev et al., 2001).

Baum and Singh (1994) took these ideas one step further and eliminated the distinction between specialist and generalist organizations. They suggested that an organization's probability of survival is not a function of niche width, but rather the extent to which it competes with organizations that have overlapping and non-overlapping niches. This competition is generally asymmetric in that organizations occupying niche i have a different impact on organizations occupying niche j than vice versa (Baum & Singh, 1994a, 1994b). Competition with firms that have overlapping niches – which is termed “niche overlap density” – elevates mortality risks by competing directly with other firms for resources. The presence of firms with non-overlapping niches – termed “niche non-overlap density” – reduces mortality risks by conferring legitimacy benefits and making resources available. Baum and Singh confirmed these theories by studying how niche overlap and non-overlap affected the founding and mortality

rates of Toronto day care centers from 1971 to 1989 (Baum et al., 1994a, 1994b). These ideas form the core hypotheses that we hope to test in this paper.

Hypothesis 1: Firm exit rates are highest in markets with high niche overlap density among similar firms

Hypothesis 2: Firms exit rates are lowest in markets with high niche non-overlap density among similar firms

B. Organizational Form

However, Baum and Singh (1994) considered only competition between firms with a similar organizational form. They did not explore the effect of niche overlap and non-overlap between organizations with different forms. Before suggesting how these competitive effects may differ, we must first define an organizational form. There are several different methods of defining organizational forms that are premised on different approaches to classification (McKelvey, 1982). One common approach distinguishes between the core and peripheral properties of organizational forms. It suggests that new organizational forms are novel recombinations of core organizational features involving goals, authority relations (including organization structure and governance arrangements), technologies, and client markets (Hannan & Freeman, 1984; Scott, 1995). Peripheral features refer to all other organizational attributes. One organizational form differs from another primarily according to the core characteristics of the form, which are defined by the four-dimensional space that was described previously.

This definition of organizational form is typically used to identify instances of organizational speciation in which a new organizational form is created (Rao & Singh, 2001). In this sense, it is the analog to the biological phenomenon of speciation. Much like its biological counterpart, organizational speciation plays an important role in the evolution of organizational diversity. The process by which organizational speciation occurs is closely linked to resource

partitioning theory; a key premise of organizational speciation is that the existence of unfilled ecological niches – places unoccupied by other organizational forms – is an important precondition for the birth of new organizational forms (Rao et al., 2001). These resource spaces may be created by interrelations among existing organizations that influence the branching of new resource spaces and the ability of existing organizations to exploit new resource spaces (Carroll, 1985; Romanelli, 1991).

Depending on the environmental conditions that lead to the creation of new organizational forms, there are several different types of organizational recombination. Rao and Singh (2001) developed a taxonomy for classifying organizational recombination along the lines of whether the organizational form involves: (1) the addition of new organizing elements and/or (2) the deletion of organizing elements. This matrix has been reproduced below in Table 1:

Table 1: A Recombination Typology of New Organizational Forms

	No addition of organizing elements	Addition or new organizing elements
No deletion of organizing elements	Imitative entrepreneurship (followers of Borders)	Partial enlargement (hospitals entering managed care)
Deletion of organizing elements	Partial contraction of elements (point-to-point airlines)	Radical recombination (health maintenance organizations)

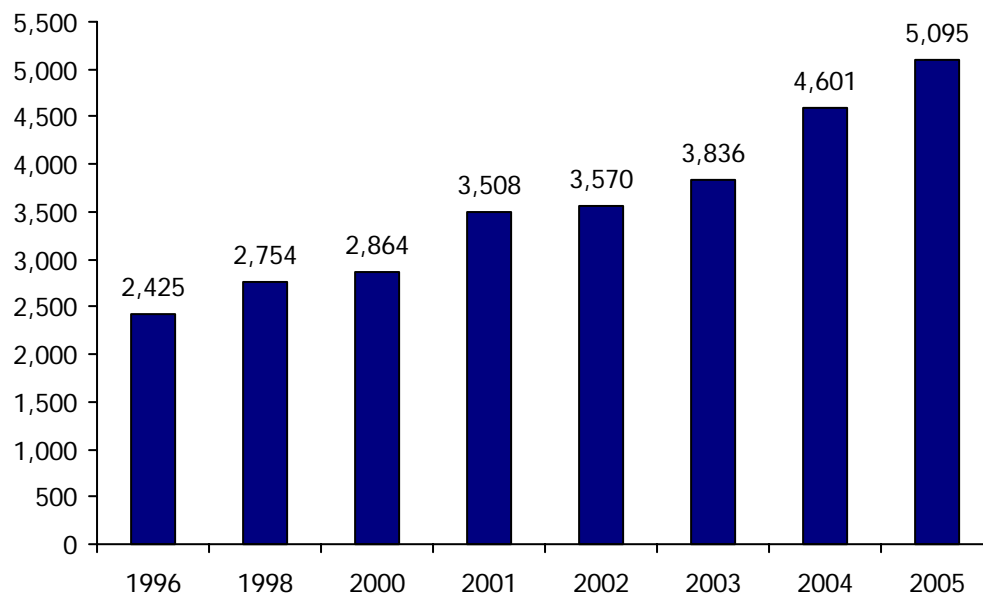
Source: Rao & Singh (2001)

Each cell in the matrix represents a different type of organizational recombination and the authors cite several real-world examples for each one. Rao and Singh (1999) offer up case studies of the creation of the automobile and the biotechnology industries in order gain insight into the different mechanisms that permitted the evolution of each (Rao & Singh, 1999). Others have presented similar case studies describing this phenomenon but none have studied empirically how different organizational forms compete with one another for the same resources (Rao, 1998; Scott, 1995).

C. Ambulatory Surgery Centers

Over the past two decades, ambulatory surgery centers have emerged within the health care marketplace and have exhibited tremendous growth. From 1982 to 1992, the number of surgery centers increased over 600 percent, from 239 to 1,530 facilities. From 1992 to 2002, the number of surgery centers more than doubled from 1,530 to an estimated 3,570 facilities (Baker, 2002). Given that the total number of community hospitals in the U.S. declined from 5,830 to 4,919 between 1980 and 2004, this phenomenon is even more striking. Figure 1 displays this recent growth.

Figure 1: Number of Freestanding Ambulatory Care Surgery Centers (1996, 1998, and 2000 – 2005)



Source: Verispan's Surgery Center Profiling Solution, 2005.

This growth stems in large part from the advances of medical technology that have significantly decreased hospital length of stay and accelerated the movement from inpatient to outpatient models of patient care (Becker & Biala, 2000). Surgeries that were once performed in an 8-hour span and required several days of recovery can now be performed within 90 minutes and permit the patient to return home on the day that he or she was admitted. The other cause of this rapid

growth was a desire for cost containment as reimbursement policies by insurance companies and other third-party payers favored outpatient surgery over hospital admission (Hecht, 1995; Pandit, 1999).

Ambulatory surgery centers represent fundamentally different organizational forms than hospitals. Unlike hospitals, there are clear limits on the type of markets that they can participate in; they cannot perform a surgical procedure when, before surgery, an overnight hospital stay is anticipated (Center for Medicare and Medicaid Services, 2006). Surgery centers require less capital and equipment because outpatient procedures are typically less invasive and technology intensive than inpatient procedures (Balicki, Kelly, & Miller, 1995). In terms of governance, approximately 83% of surgery centers are wholly- or partly-owned by physicians, which may have a strong influence upon physician referral patterns (American Hospital Association, 2006; Lynk & Longley, 2002). Physician ownership of general hospitals, on the other hand, is explicitly prohibited by Stark anti-kickback laws (Casalino, Devers, & Brewster, 2003). Moreover, the vast majority of surgery centers are for-profit entities whereas the majority of hospitals are non-profit organizations (Verispan, 2006). There is little question that surgery centers represent significantly different organizational forms than general hospitals in terms of client markets, technologies, governance, and goals.

Referring back to Rao and Singh (2001) in order to classify the nature of these differences, the emergence of surgery centers represents the deletion of some elements but no addition of new elements, which they refer to as the partial contraction mode of recombination. As an example of this form of organizational speciation, they cite Southwest Airlines since it was the first of the no frills, cut-rate, point-to-point airlines that compete primarily on price and do not have the additional perks that are typically part of a regular, full-service airline (Lumsden &

Singh, 1990). In fact, there are obvious parallels between Southwest airlines and the emergence of more specialized organizations within the healthcare industry (Altman, Shactman, & Eilat, 2006). Rao and Singh (2001) state the following about the relationship between specialization and recombination through partial contraction:

The case of recombination through partial contraction resembles imitative entrepreneurship in several respects. State endorsement may not be problematic to the extent that the new form is eliminating some elements from preexisting blue-prints. Consequently, it is more likely that such forms will be specialists and prone to fare well when there is concentration among generalists (Carroll, 1985). Because forms in this cell represent leaner versions of existing forms financial markets and consumers may also welcome them as low-cost options (Rao et al., 2001).

Surgery centers represent just one example of leaner, specialized organizational forms that typically emerge in response to the presence of generalists. These organizational forms are frequently referred to as “focused factories” since scholars have argued that such firms become exceptional in their area of expertise and are able to operate more efficiently and effectively than generalist forms (Herzlinger, 1997; Skinner, 1974). There are many other examples of these organizations present in manufacturing settings (Hayes & Wheelwright, 1984; Hill, 2000) and service environments (Herzlinger, 1997; Heskett, 1986; Huckman & Zinner, 2005).

Yet it is unclear how these two organizational forms compete with one another for the same procedures. Carroll (1985) suggests that specialists typically locate in peripheral areas in order to avoid direct competition with generalists. However, his research was intended only to describe competition between organizations with a similar form. There is evidence suggesting that surgery centers have entered specialties – ophthalmology, gastroenterology, and orthopedics, for example – that are well reimbursed and highly contested (Shactman, 2005; Verispan, 2006). There is also evidence that surgery centers tend to locate primarily in urban areas where there is already a high concentration of hospitals (Verispan, 2006). There are obvious applications of

resource partitioning theory to the market for outpatient surgery because surgical specialties can be considered niches. Yet this setting also offers an opportunity to test how different organizational forms – surgery centers and hospitals – compete with one another within these niches.

In spite of what resource partitioning theory would predict, there are several reasons to believe that surgery centers benefit from the presence of nearby hospitals with overlapping niches. Hospitals make resources available by producing higher levels of procedure demand and attracting a greater supply of physicians (Harris, 1977; Robinson, 1994). As focused factories, surgery centers maintain lower costs and therefore have a competitive advantage when competing with hospitals for these resources (Baker, 2002). Hospitals also provide surgery centers with an opportunity to segment the market by “cherry-picking” the most profitable procedures, the healthiest patients, and individuals with the most generous insurance coverage (Winter, 2003). For these same reasons, hospitals don’t necessarily benefit from the presence of competing surgery centers (Berenson, Bodenheimer, & Pham, 2006). In this way, competition between these two organizational forms may constitute a type of asymmetric competition such that one organizational form may benefit from competition while the other is hurt. In the parlance of population ecology, this would be considered a parasitic relationship. We hypothesize as to the existence of asymmetric competition between these two organizational forms.

Hypothesis 3: Surgery center exit rates are lowest in markets with high niche overlap density among hospitals.

Hypothesis 4: Hospital exit rates are highest in markets with high niche overlap density among surgery centers.

Table 1 summarizes all of our hypotheses by displaying the predicted effect of competition from surgery centers and hospitals upon market exit by each type of facility.

Table 1: Predicted Coefficients

Niche Overlap Density	Competition from		Niche Non-Overlap Density	Presence of	
	ASC	HOSP		ASC	HOSP
Exit by	ASC	+	Exit by	ASC	-
	HOSP	+		HOSP	-

D. Previous Research

The recent growth in the number of ambulatory surgery centers has been mirrored by the growth of other specialized providers that have caused a variety of health care services to migrate away from the general hospital (Berliner, 2008). Some have suggested that the emergence of these providers signifies a shift to service line competition within the health care marketplace (Berenson et al., 2006). Specialty hospitals and ambulatory surgery centers represent the most prominent example but similarly specialized facilities are beginning to emerge for cardiac catheterization, lithotripsy, radiation therapy, and diagnostic imaging services. The emergence of these specialized providers and uncoupling of these services from the general hospital may push hospitals to a peripheral role as the provider of ever-diminishing acute inpatient services (Robinson, 1994). There is a growing body of research that studies the effect of specialization within the health care industry. However, specialty hospitals have received the vast majority of this attention, perhaps because they are viewed as more of a competitive threat to general hospitals.

In fact, the rapid growth among specialty hospitals in the 1990's led Congress in 2003 to enact an 18-month moratorium on the construction of new specialty hospitals in order to gather evidence regarding whether they treated healthier patients and provided lower quality care (Iglehart, 2005). During the time that this moratorium was in place, a number of studies were

conducted on the differences between specialty hospitals and general hospitals. Several studies found that specialty hospitals tend to treat patients that are healthier than than general hospitals (Barro, Huckman, & Kessler, 2006; Cram, Rosenthal, & Vaughan-Sarrazin, 2005; U.S. Government Accounting Office, 2003). Other studies found that when controlling for these patient characteristics, specialty hospitals produce outcomes that are equal to or better than general hospitals (Cram et al., 2005; Dobson, 2003; Fahlman et al., 2006; Greenwald et al., 2006). Regarding their competitive effects, the evidence suggests that entry by specialty hospitals tends to improve the efficiency of markets and lower the cost of care (Barro et al., 2006; Greenwald et al., 2006). However, there are still outstanding questions regarding their effect on the financial viability of general hospitals and the ability of non-profit hospitals to provide community benefits.

In spite of the fact that there are over 6,000 ambulatory surgery centers and just over 100 specialty hospitals currently operating in the US, surgery centers have received far less attention in the literature. However, a few studies are beginning to emerge that offer a more balanced treatment of ambulatory surgery centers. For example, Winter (2003) found that outpatient departments treat beneficiaries who are more medically complex, which might partially explain why ASCs incur lower costs when providing similar procedures (Winter, 2003). Lynk and Longley (2002) presented a case study of a physician-owned surgery center that opened near a major general hospital, and found that outpatient surgeries performed in the hospital dropped significantly after the surgery center opened (Lynk et al., 2002). Bian and Morrissey (2007) and Plotzke (2008) both found that entry by ASCs is associated with a decline in hospital outpatient surgeries and no significant change in inpatient surgeries (Bian & Morrissey, 2007; Plotzke, 2008). Another study by Bian and Morrissey (2006) showed that there tend to be more surgery

centers in metropolitan statistical areas where there are fewer general hospitals (Bian & Morrisey, 2006). However, they failed to distinguish between facilities with overlapping and non-overlapping niches, and they did not consider whether this outcome results from facility entry or exit. Nevertheless, their study provides a convenient starting point from which to explore the causes of exit by both types of facilities.

II. METHODS

A. Data

We chose the state of Florida as our study site for several reasons. First, it is the state with the second highest number of ambulatory surgery centers in the US. In fact, the number of surgery centers in Florida grew from just 110 in 1993 to 379 in 2006 so it closely mirrors the trends in ASC growth being observed throughout the country. More importantly, the state of Florida requires that health care facilities report data on all inpatient and outpatient surgical procedures that they perform. The availability of this patient-level data is a unique facet of this study because previous empirical work in population ecology has gathered data at the level of the firm and has inferred consumer demand from population demographics and industry velocity. From this patient data, we were able to measure competition, procedure demand, and firm entry and exit with a considerably higher level of precision than previous studies and to directly model the relationship between them.

Patient data reported by Florida health care facilities is compiled by the Agency for Health Care Administration (AHCA) and represents a complete census of all inpatient outpatient surgeries that have occurred within the state from 1997 to 2006. For the inpatient data, surgical procedures are represented by ICD-9-CM/ICD-10-CM procedure codes. Within the outpatient

data, surgical procedures are represented by CPT /HCPCS procedure codes.¹ In order to transform these patient datasets into quarterly procedure counts, we coded these procedures and categorized them within surgical specialties. Clinical Classification Software (CCS) from the Health Care Utilization Project (HCUP) allowed us to classify both ICD-9-CM/ICD-10-CM and CPT/HCPCS codes among 244 different procedure types.² Appendix 1 lists all 244 procedure types included within the CCS software. Each of the 244 single-level CCS procedure types was assigned to one of 15 procedure chapters through the use of a crosswalk that has been reproduced in Appendix 2.³ We cross-tabulated these procedure types with facility IDs and patient county codes in order to produce quarterly procedure counts at the county- and facility-level. Our dependent and independent variables were calculated from these two datasets.

In order model competition and procedure demand, it was necessary to establish some reasonable definition of a health care market. Conveniently, the state also maintains data on the location of all surgery centers and general hospitals, which allows us to assign them to their county of residence. Each of these 67 counties was subsequently assigned to one of 17 health service areas (HSAs) based upon the market boundaries established by the National Center for Health Statistics (Makuc, Haglund, Ingram, Kleinman, & Feldman, 1991). We defined these HSAs to be their own markets for the purposes of this study and all explanatory variables were initially measured at the HSA level.

¹ Both datasets include a field that accounts for the principal procedure that a patient received as well as additional fields representing any other procedures that the patient underwent during the same stay. We dealt with this by generating two different sets of procedure counts; the first set included only the principal procedure codes and the second set treated all procedure codes (principal and other) as equivalent. We ran our analyses from the procedure volume datasets that emerge from principal codes.

² By applying the single-level CCS software to the procedure codes in our patient data, we were able to successfully code 99.9997% of the procedures in the inpatient dataset and 99.9898% of the procedures in the outpatient dataset, which represent very high match percentages.

³ Although the CCS software actually assigns each of the 244 procedure types to one of 16 procedure chapters, only 15 of these 16 chapters describe outpatient surgical procedures. So we only took into account the first 15 chapters and ignored the 16th chapter for the sake of comparability.

Although health service areas provide a convenient starting point from which to define markets, they span very large geographic areas. So we elaborated upon them in order to distinguish between local and diffuse market conditions since travel distances clearly play a role in the market for outpatient services (Kessler & McClellan, 2000; Makuc et al., 1991). We calculated our local measures from the county within which each surgery center resides and our diffuse measures from all other counties within that surgery center's HSA. In the same way that local and diffuse factors are likely to have a different impact upon firm exit, we have hypothesized that competition with surgery centers and hospitals will have different effect on market exit by each type of facility. Thus, our explanatory variables were divided up by facility type and calculated the separately for surgery centers and hospitals in the same manner that we divided these constructs into their local and diffuse components.

B. Dependent Variables

We tabulated quarterly procedure counts by facility ID code in order to produce a panel dataset in which the unit of observation is a facility-quarter and each field represents that facility's procedure count within each of 15 surgical specialties. Facilities enter and exit this panel dataset as they enter and exit the market for outpatient services and so this panel provided us a starting point from which to observe facility entry and exit. The state of Florida also maintains information on all licensed and accredited outpatient facilities in the state. This dataset extends back to the early-1990's and provides the date(s) of opening and closing for all such entities as well as the reason for termination of that facility's ID number. This licensure dataset was merged with our outpatient procedure dataset through AHCA ID numbers in order to validate the patterns of activity produced by our panel dataset with the state's official entry and exit dates.

Since the state also keeps track of the reasons for facility exit, we checked these records in order to ensure that we only attributed an exit to each facility when it went bankrupt/defunct or voluntarily terminated its license. We did not consider merger and acquisition activity that resulted in the termination of a facility license to be a valid exit. Only when there was concordance between the SASD outpatient procedure dataset and AHCA licensure data over exit timing and the facility had a valid reason for exit was a facility exit recorded in our empirical models. From these datasets, we identified a total of 73 exits among 406 ASCs and 18 exits among 222 hospitals from 1997 to 2006, which represent fairly reasonable sample sizes.

C. Independent Variables

1. Niche Overlap and Non-Overlap

Our hypotheses relate the likelihood of surgery center and hospital exit to the level of competition within local health care markets. In order to test these hypotheses, we measured the concentration of outpatient facilities with overlapping and nonoverlapping niches within each market. Following the example of Baum and Singh (1994), we constructed niche overlap weights from the procedure volume of each pair of facilities within the same HSA:

$$(1.1) \quad w_{ij} = \frac{s_{ij}}{s_{ij} + s_i} \quad w_{ji} = \frac{s_{ji}}{s_{ji} + s_j}$$

where s_{ij} and s_{ji} represent the number of procedures they perform within the same surgical specialties while s_i represents the number of procedures performed by firm i in specialties that firm j does not participate in and vice versa.⁴ The weights calculate the extent to which their procedure volumes overlap.

⁴ In the process of studying the predictors of specialty entry and exit for a related paper, we developed a fairly elaborate set of assumptions in order to determine whether a facility participates in a given surgical specialty, which have been outlined in Appendix 3.

Given these weights, the overlap and nonoverlap density for each facility was calculated from the following formulas:

$$(1.2) \quad \text{overlap density}_i = \sum_{j=1}^n w_{ji} \quad \text{nonoverlap density}_i = n - \sum_{j=1}^n w_{ji}$$

where w_{ji} represents the weights that were described previously and n represents the number of outpatient facilities in the health service area occupied by firm i . To calculate overlap and nonoverlap density for firm i , we counted up the number of outpatient facilities its health service area at time t and then assigned them all fractional weights based on the extent to which their procedure volume overlaps with that of firm i at time t . Overlap density was calculated by adding all these weights while nonoverlap density was calculated by subtracting the sum of these weights from the total number of outpatient facilities in firm i 's health service area. We calculated these measures separately by facility type (ASC vs. hospital) and geographic location (local vs. diffuse) in order to evaluate the differential impact of each.

2. Procedure Demand

Having established our measures of niche overlap and non-overlap density, we included a number of additional variables in our models in order to control for a number of other factors that might affect a facility's likelihood of exit. First and foremost was the size of demand within the surgical specialties that a facility serves, which represents the environmental carrying capacity. In order to measure market demand, we generated quarterly procedure counts by patient county code instead of by facility code.⁵ We then aggregated these procedure counts across each specialty that a facility participates in based upon our definition of specialty participation. This procedure generated two separate sets of procedure counts; we included

⁵ We recoded out of state residents with the county for the facility in which they were treated, which was deemed to be a reasonable assumption in light of the fact that the vast majority of patients (81%) visited an outpatient facility in their home county.

outpatient procedure counts within our exit models for ASCs and hospitals while we included the inpatient counts for hospitals only. These procedure counts were deemed to be a reasonable proxy for the level of demand within the markets that a facility serves. As with our measures of competition, each of these demand statistics was broken down by facility type (ASC vs. hospital) and geographic location (local vs. diffuse).

3. Physician Statistics

The setting for this study is unique in that outpatient facilities not only compete for procedures but also for physician referrals. These relationships that exist between surgery centers and their physicians may affect entry and exit probabilities. In fact, transaction cost theory suggests that a facility's likelihood of exit depends on the extent to which the facility depends upon its surgeons and vice versa (Williamson, 1975, 1979, 1985a, 1985b). To that end, we attempted to include some measures that would control for these relationships. Conveniently, there is an ID code representing the operating physician in each record of the outpatient dataset. These physician IDs were cross-tabulated with facility IDs in order to account for how facilities divide procedure volume across surgeons and how surgeons divide procedure volume among facilities.

To begin, we produced a simple count of the number of surgeons operating within a facility in any given quarter. We also included a control that represents the average number of facilities that the facility's surgeons are utilizing for their outpatient procedures. Taking into account procedure volume to represent facility and physician dependence on one another, we also produced a measure – creatively termed the “kick butt ratio” (KBR) – that represents the facility and its physicians' dependence on each other (Feldman & Wholey, 1999; Marsh & Feinstein, 1997; Wholey & Burns, 2000). It was calculated according to the following formula:

$$(2.1) \quad \text{KBR} = \frac{\text{Percent of surgeries in facility } i \text{ coming from physician } j}{\text{Percent of surgeries for physician } j \text{ admitted to facility } i}$$

$$(2.2) \quad \text{KBR} = \frac{\frac{\text{Number of surgeries performed by physician } j \text{ in facility } i}{\text{Total number of surgeries performed in facility } i}}{\frac{\text{Number of surgeries performed by physician } j \text{ in facility } i}{\text{Total number of surgeries performed by physician } j}}$$

Higher values of the KBR indicate that the physician has relatively more leverage over the facility while lower values indicate that the facility has more leverage.

4. Facility Controls

We also included a number of control variables in our model that emerged from our panel dataset as well as the Florida licensure data. The liability of newness suggests that relatively inexperienced firms are more likely to exit than firms that have more experience (Freeman, Carroll, & Hannan, 1983). To control for this effect, we added a covariate representing firm age to our model. Firm age was calculated from the entry dates provided by the Florida licensure dataset, which we validated with the dates produced by our outpatient procedure volume dataset.

We also included variables to control for the possibility that specialists or generalists among either organizational form may have a higher likelihood of exit. We calculated each facility's niche width as the number of surgical specialties that it participates in, and we divided our sample of surgery centers and hospitals in half based upon their median niche width. ASCs participating in four or fewer specialties were considered specialists while ASCs participating in five or more specialties were considered generalists. Hospitals participating in fourteen or fewer specialties were considered specialists while hospitals participating in all fifteen specialties were considered generalists. Having divided up our sample accordingly, we included a dummy variable representing the specialists in our sample and while generalists represented the baseline control group.

The Florida outpatient dataset also includes a field that describes the payer for each procedure in the dataset. Using this field, we cross-tabulated facility procedure counts by payer and divided them by a facility's total procedure volume in each quarter in order to calculate the proportion of a facility's procedure volume that is reimbursed by each type of payer. Although the Florida outpatient dataset utilizes 16 different payer codes, we collapsed these codes into three categories: public, private, and other.⁶ We included variables representing the proportion of a facility's business that is reimbursed by public and private payers while omitting the variable representing other payers as a comparison group.

There are two ways that specialty entry and exit might have an impact upon facility exit. Facilities that change their niches by entering new specialties or exiting specialties they already serve may have a higher likelihood of exit since changes of niche may suggest that its previous niche was not optimal. The process of change may also be a disruptive one that puts the facility at risk of exit (Baum & Singh, 1996). To account for this fact, we included in our models a measure representing the cumulative number of times that a facility has entered or exited any specialty. We also included a measure of the amount of time that has elapsed since the facility last entered or exited a specialty.

D. Empirical Model

Our study assesses a surgery center's likelihood of exit as a function of demand conditions, market competition, and facility characteristics. Therefore, the appropriate unit of observation here is an individual firm. The mathematical representation of this model is presented by the following equation:

⁶ Public payers include Medicare, Medicare HMO, Medicaid, Medicaid HMO, VA, other state/local government, and Kidcare. Private payers include commercial insurance, commercial HMO/PPO, and self pay. Other payers include workers' compensation, CHAMPUS, other, charity, and unknown.

$$(3.1) \quad \Pr(\text{Exit}_{it}) = \beta_0 + \beta_1 \text{OverlapDensity}_{jt} + \beta_2 \text{NonoverlapDensity}_{jt} + \beta_3 \text{DemandSize}_{jt} + \beta_4 \text{PhysicianStatistics}_{it} + \beta_5 \text{FirmControls}_{it} + \varepsilon_{it}$$

where $\text{OverlapDensity}_{jt}$ is a variable representing the overlap density for specialties within market j that are served by facility i , $\text{NonoverlapDensity}_{jt}$ is a variable representing the non-overlap density for specialties within market j that are served by facility i , DemandSize_{jt} is a variable representing the size of demand for specialties within market j that are being served by facility i , $\text{PhysicianStatistics}_{it}$ is a vector of facility-level physicians statistics that we described (e.g., KBR, etc.), and FirmControls_{it} is a vector of facility-level control variables (e.g., age, etc.).

Given that we analyzed exit rates over a short period of time, there were a large proportion of left- and right-censored observations. Thus, an event history model was deemed to be the most appropriate specification (Allison, 1995). In particular, we utilized a Cox proportional hazard model because it avoids the need to choose a functional form and accommodates time-varying covariates (Cox, 1972).⁷ The Cox model estimates a hazard rate of the following form:

$$(3.2) \quad h_i(t) = \lambda_0(t) e^{\beta x_i}$$

which was reformulated to fit our exit model:

$$(3.3) \quad h_i(t) = \lambda_0(t) e^{\left(\begin{array}{l} \beta_0 + \beta_1 \text{OverlapDensity}_{jt} + \beta_2 \text{NonoverlapDensity}_{jt} + \\ \beta_3 \text{DemandSize}_{jt} + \beta_4 \text{PhysicianStatistics}_{it} + \beta_5 \text{FirmControls}_{it} + \varepsilon_{it} \end{array} \right)}$$

The baseline hazard functions cancel out and the proportional hazard takes on the ratio of hazards:

$$(3.4) \quad L_1 = \frac{e^{\beta x_1}}{e^{\beta x_1} + e^{\beta x_2} + \dots + e^{\beta x_n}}$$

⁷ We validated the robustness of our results by running accelerated failure time models with an exponential distribution.

This proportional hazard is estimated through maximum likelihood, which adjusts the β coefficients to maximize the probability that the next event occurred to the observation(s) that actually did experience an event. Thus, only the order of events affects the partial likelihood and so there is some efficiency loss as a result of the fact that the timing of exit is ignored.

Although the unit of observation in our dataset is the facility-quarter, we assigned each of these quarters start and end dates because we had more specific data on the timing of market entry and exit. We replaced these dates with more precise dates from the AHCA licensure database when facilities entered or exited the market.⁸ A separate variable was also coded to represent an exit event where there was concordance between these datasets and the reason for exit was deemed to be valid. When our Cox model encountered an exit, it assumed that the facility remained in the dataset up until the end date listed for that quarter and estimated each facility's probability of exit as a function of the covariate values at that point in time.

Since we broke down each category of explanatory variables by facility type (surgery center vs. hospital) and geographic location (local vs. diffuse), we introduced these distinctions in a relatively gradual manner. The first model included every set of variables at the highest possible level, the second model broke them down by facility type (ASC vs. hospital), the third model broke them down by geographic location (local vs. diffuse), and the fourth model broke them down both by facility type and geographic location. We estimated our Cox proportional hazard models of facility exit with STATA version 10 and reported coefficient estimates instead of hazard ratios. Table 2 and 3 present the results of our Cox proportional hazard models while variables from different models have been lined up horizontally rather than vertically so that similar elements are grouped together.

⁸ The fact that our facility exit dates emerged from AHCA licensure data meant that we rarely encountered ties in our data. Nevertheless, we used the Efron approximation method for handling ties because it is regarded as more accurate than the Breslow method (Allison, 1995).

Table 2: Cox Proportional Hazard Model – Surgery Center Exit

Category	Facility Type	Location	Measure	Model 1	Model 2 Facility Type	Model 3 Geography	Model 4 Facility Type Geography
			Breakdown(s)				
Model Statistics			Observations	10100	10100	10100	10100
			Number of subjects	406	406	406	406
			Number of failures	73	73	73	73
			Log likelihood	-381.0926	-375.7409	-379.2081	-371.3320
			Likelihood Ratio Chi ²	42.39	53.09	46.16	61.91
			Prob > Chi ²	0.0000	0.0000	0.0001	0.0000
Controls			Facility age	0.0000	0.0000	0.0000	0.0000
			Specialist dummy	-0.3180	-0.1980	-0.2430	-0.1000
			Pct public pay	1.2710	1.6180	1.4270	2.2840
			Pct private pay	2.722*	3.070*	2.842*	3.577**
			Cum nbr of ccs entries	0.1060	0.0850	0.1100	0.0789
			Time since last entry	0.0003	0.0002	0.0003	0.0002
Physician Statistics			Total nbr of MDs	-0.0447***	-0.0449***	-0.0481***	-0.0487***
			Avg nbr of facilities	-0.0057	0.0000	-0.0230	-0.0164
			Avg kick-butt ratio	0.0039	0.0041	0.0038	0.0038
Competition	ASC	Local	Overlap	0.0175	0.104**	0.100*	0.282***
			Nonoverlap	-0.0299***	-0.0497*	-0.0337	-0.0212
		Diffuse	Overlap			-0.0218	0.0345
			Nonoverlap			-0.0306*	-0.0784*
	HOSP	Local	Overlap		-0.0812		-0.228*
			Nonoverlap		-0.0121		-0.0553
		Diffuse	Overlap				-0.0268
			Nonoverlap				0.0231
Procedure Demand	ASC	Local	Nbr of procedures	0.0000	-0.000102**	0.0000	-0.00023***
		Diffuse	Nbr of procedures			0.0000	-0.0001
	HOSP	Local	Nbr of procedures		5.78e-05*		0.000129*
		Diffuse	Nbr of procedures				0.0000

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Cox Proportional Hazard Model – Hospital Exit

Category	Facility Type	Location	Measure	Model 1	Model 2 Facility Type	Model 3 Geography	Model 4 Facility Type Geography
				Breakdown(s)			
Model Statistics	Observations			7871	7871	7871	7871
	Number of subjects			222	222	222	222
	Number of failures			18	18	18	18
	Log likelihood			-72.2919	-72.1141	-65.8217	-64.4397
	Likelihood Ratio Chi ²			45.98	46.33	58.92	61.68
	Prob > Chi ²			0.0000	0.0001	0.0000	0.0000
Controls	Facility age			-0.0006	-0.0006	-0.0008	-0.0009
	Specialist dummy			0.8350	0.7530	0.6880	0.5850
	Pct public pay			-1.5070	-1.4780	-0.6270	-1.0120
	Pct private pay			-0.9280	-0.8880	0.1190	-0.0098
	Cum nbr of ccs entries			0.1000	0.1060	-0.0122	0.0257
	Time since last entry			0.0004	0.0004	0.0004	0.0004
Physician Statistics	Total nbr of MDs			-0.0530***	-0.0523***	-0.0680***	-0.0695***
	Avg nbr of facilities			0.0889	0.0790	-0.1610	-0.1730
	Avg kick-butt ratio			-0.0505	-0.0662	-0.0615	-0.0754
Competition	ASC	Local	Overlap	0.0841	0.0782	0.0891	0.0772
			Nonoverlap	0.0002	-0.0123	-0.0710	-0.1150
		Diffuse	Overlap			0.190**	0.253**
			Nonoverlap			0.0483	0.0640
	HOSP	Local	Overlap		0.1360		0.0794
			Nonoverlap		0.0170		0.0135
		Diffuse	Overlap				0.329*
			Nonoverlap				0.0233
Outpatient Demand	ASC	Local	Nbr of procedures	-0.00008*	-0.00007	0.00002	0.00009
		Diffuse	Nbr of procedures				-0.00034
	HOSP	Local	Nbr of procedures		-0.00009		-0.00008
		Diffuse	Nbr of procedures				-0.00018
Inpatient Demand	HOSP	Local	Nbr of procedures	0.00008	0.00006	0.00002	0.00014
		Diffuse	Nbr of procedures			0.00015	0.00002

*** p<0.01, ** p<0.05, * p<0.1

III. RESULTS

The results from our Cox proportional hazard models are presented in Tables 2 and 3. Our Cox proportional hazard models yielded log likelihood statistics that were highly significant ($p \leq 0.0001$). They produced a pseudo R-squared of 0.14 for our ASC exit model (Model 4) and 0.24 for our hospital exit model (Model 4), which represents the explanatory power of the independent variables (Allison, 1995; Magee, 1990). Our models generally produced coefficients with the expected signs. Higher levels of market demand for outpatient procedures from ASCs are associated with a lower probability of ASC exit (Models 2 and 4, $p < 0.05$) while higher levels of demand for hospital procedures are associated with a higher likelihood of exit (Models 2 and 4, $p < 0.10$). Interestingly, hospital exit has only a weakly negative association with levels of outpatient demand (Model 1, $p < 0.10$) and not inpatient demand. For both ASCs and hospitals, a higher number of practicing physicians is associated with a significantly lower likelihood of exit in all models ($p < 0.01$), which may also capture some of the effect of facility size. We ran accelerated failure time models with an exponential distribution to check the robustness of our results and found that none were substantively different, although some gained significance.

Regarding our hypotheses, an encouraging sign is the fact that resource partitioning theory appears to hold true in this setting; competition between similar organizational forms has the expected effect. We find strong support for the hypothesis that niche overlap density tends to elevate exit rates among similar facilities. Niche overlap density among surgery centers lead to significantly higher ASC exit rates (Models 2 and 4, $p < 0.05$) while there is some evidence to suggest that niche overlap among hospitals lead to higher hospital exit rates (Model 4, $p < 0.10$). We find weaker support for the hypothesis that facility exit rates are lowest in markets with high

niche non-overlap density among similar facilities. ASC exit rates are marginally lower in markets where there is high ASC non-overlap density (Models 2 and 4, $p < 0.10$) while niche non-overlap appears to have no effect upon hospitals.

We also find support for hypotheses 3 and 4, which suggest that asymmetric competition exists between different organizational forms. We find weak support to suggest that ASC exit rates are lowest in markets where there is high niche overlap density among local hospitals (Model 4, $p < 0.10$). We also find support for the notion that hospital exit rates are highest in markets with high levels of niche overlap density among diffuse ASCs (Model 4, $p < 0.05$). The confluence of these results offers evidence to suggest that ASCs benefit from the presence of nearby hospitals while hospitals are hurt by competition with ASCs. Table 4 summarizes these results by presenting the predicted coefficients alongside the actual coefficients produced by our models.

Table 4: Predicted and Actual Coefficients

		Niche Overlap Density			Niche Non-Overlap Density		
		Competition from			Presence of		
Predicted Coefficients	Exit by		ASC	HOSP		ASC	HOSP
				ASC	+	-	ASC
		HOSP	+	+	HOSP		-
		Competition from			Presence of		
		Competition from			Presence of		
Actual Coefficients ¹	Exit by		ASC	HOSP		ASC	HOSP
			ASC	+++	-	ASC	-
		HOSP	++	+	HOSP		

¹ Actual results emerge from model 4, which is broken down by facility type and geographic location.
+++ $p < 0.01$, ++ $p < 0.05$, + $p < 0.1$

An interesting illustration of this asymmetric competition emerges from the signs of the coefficients for our niche overlap and non-overlap variables across all four of our exit models. Setting aside standard errors, we find that 12 of the 18 variables in our ASC exit models have negative coefficients while 15 of the 18 variables in our hospital exit models have positive

coefficients. Hospitals clearly experience much stronger selection pressures from competition with other facilities than ASCs.

These findings contradict conventional knowledge about how specialists compete with generalists. Resource partitioning theory suggests that specialists tend to locate in peripheral areas of the market in order to avoid direct competition with other firms (Carroll, 1985; Carroll et al., 2000; Dobrev et al., 2002; Dobrev et al., 2001). However, these results contradict the conventional wisdom and suggest that specialized organizational forms may, in fact, be capable of competing directly with generalists in core areas of the market. Given the recent evolution of the health care industry towards service line competition and the emergence of specialized facilities, these findings carry additional weight. Further research should explore whether the results apply to specialty hospitals and other facilities that are entering markets that have traditionally been served by the general hospital. The findings have implications for the ability of hospitals to treat vulnerable populations and cross-subsidize less profitable lines of service since hospital closures clearly affect patient access to care.

This begs the question: how applicable are these results to settings outside the health care industry? It seems plausible that the mechanisms by which this process occurs are present outside the market for outpatient surgery. For example, generalized forms may make resources available to specialized forms even if they don't necessarily increase the demand for outpatient procedures or the supply of surgeons. Likewise, we suggested that surgery centers could "cherry-pick" from hospitals but this concept is essentially synonymous with segmenting the market, which is a strategy available to other specialized forms. In fact, surgery centers have less of an opportunity to appeal to more price discriminating consumers than specialized forms in other industries since third-party reimbursement makes health care consumers less price

sensitive. This is typically considered to be one of the primary advantages of specialized forms that can emerge as low-cost alternatives within industries populated by more generalized forms. Additional research should apply these methods to other settings in order to ascertain whether specialized and generalized organizational forms exhibit patterns of asymmetric competition outside the health care sector.

IV. CONCLUSIONS

The literature on organizational niche has evolved significantly over time. Whereas population ecologists first suggested that niche width was a product of environmental variation, resource partitioning theorists suggested that it was dictated by market position and organizational concentration. They developed a model of how specialists compete with generalists and found empirical support for these ideas. However, they did not consider the effect of competition between different organizational forms. Likewise, the literature on organizational speciation tends to be fairly qualitative in nature; it describes the evolution of new organizational forms but does not test hypotheses regarding the competitive impact of these new forms on existing forms.

This research extends both bodies of research by identifying a setting in which specialized organizational forms have emerged and then examining how the impact of niche overlap density differs when it describes competition between two different organizational forms. By manipulating patient-level datasets from the state of Florida, we were able to measure competition, market demand, and firm entry/exit with a higher level of precision than previous studies in this area. In keeping with previous research, we found that niche overlap among similar facilities tends to elevate exit risks while there was weaker evidence to suggest that niche non-overlap tends to reduce exit risks. However, we also observed that ASCs had a lower

likelihood of exit in markets with overlapping hospitals while hospitals had a higher likelihood of exit in markets with overlapping ASCs. This asymmetric competition was hypothesized to result from the fact that generalists tend to make resources available while offering specialists an opportunity to segment the market.

These findings pose interesting implications for the emergence of specialized organizational forms. Within the health care industry, the growth of ambulatory surgery centers, specialty hospitals, and other specialized providers signify a change within the competitive landscape that emphasizes service line competition. These facilities may have a competitive advantage when competing with general hospitals as a result of their leaner organizational form. This advantage may be particularly acute in the health care industry since physician ownership may strongly influence referral patterns. Health services researchers may also wish to expand upon this work and calculate the welfare implications of these effects since entry by these specialized facilities may promote competition and efficiency within health care markets but at the cost of hindering non-profit hospitals in their ability to provide community benefits in the form of uncompensated care.

There are other industries – ranging from airlines to mail order computer manufacturers – in which specialized organizational forms are emerging as leaner, low-cost versions of existing forms (Rao et al., 2001). This research represents a critical first step toward understanding how these organizations compete with generalized forms. The competitive advantage that these firms appear to possess, coupled with their success in the health care industry, may indicate that there are even more industries ripe for entry by specialized organizational forms. Additional research should test these ideas in other settings in order to determine whether the results are context dependent or readily generalizable extensions of resource partitioning theory.

APPENDIX 1

Single-Level CCS Procedures

1. Incision and excision of CNS
2. Insertion, replacement, or removal of extracranial ventricular shunt
3. Laminectomy, excision intervertebral disc
4. Diagnostic spinal tap
5. Insertion of catheter or spinal stimulator and injection into spinal canal
6. Decompression peripheral nerve
7. Other diagnostic nervous system procedures
8. Other non-OR or closed therapeutic nervous system procedures
9. Other OR therapeutic nervous system procedures
10. Thyroidectomy, partial or complete
11. Diagnostic endocrine procedures
12. Other therapeutic endocrine procedures
13. Corneal transplant
14. Glaucoma procedures
15. Lens and cataract procedures
16. Repair of retinal tear, detachment
17. Destruction of lesion of retina and choroid
18. Diagnostic procedures on eye
19. Other therapeutic procedures on eyelids, conjunctiva, cornea
20. Other intraocular therapeutic procedures
21. Other extraocular muscle and orbit therapeutic procedures
22. Tympanoplasty
23. Myringotomy
24. Mastoidectomy
25. Diagnostic procedures on ear
26. Other therapeutic ear procedures
27. Control of epistaxis
28. Plastic procedures on nose
29. Oral and Dental Services
30. Tonsillectomy and/or adenoidectomy
31. Diagnostic procedures on nose, mouth and pharynx
32. Other non-OR therapeutic procedures on nose, mouth and pharynx
33. Other OR therapeutic procedures on nose, mouth and pharynx
34. Tracheostomy, temporary and permanent
35. Tracheoscopy and laryngoscopy with biopsy
36. Lobectomy or pneumonectomy
37. Diagnostic bronchoscopy and biopsy of bronchus
38. Other diagnostic procedures on lung and bronchus
39. Incision of pleura, thoracentesis, chest drainage
40. Other diagnostic procedures of respiratory tract and mediastinum
41. Other non-OR therapeutic procedures on respiratory system
42. Other OR therapeutic procedures on respiratory system

43. Heart valve procedures
44. Coronary artery bypass graft (CABG)
45. Percutaneous transluminal coronary angioplasty (PTCA)
46. Coronary thrombolysis
47. Diagnostic cardiac catheterization, coronary arteriography
48. Insertion, revision, replacement, removal of cardiac pacemaker or cardioverter/defibrillator
49. Other OR heart procedures
50. Extracorporeal circulation auxiliary to open heart procedures
51. Endarterectomy, vessel of head and neck
52. Aortic resection, replacement or anastomosis
53. Varicose vein stripping, lower limb
54. Other vascular catheterization, not heart
55. Peripheral vascular bypass
56. Other vascular bypass and shunt, not heart
57. Creation, revision and removal of arteriovenous fistula or vessel-to-vessel cannula for dialysis
58. Hemodialysis
59. Other OR procedures on vessels of head and neck
60. Embolectomy and endarterectomy of lower limbs
61. Other OR procedures on vessels other than head and neck
62. Other diagnostic cardiovascular procedures
63. Other non-OR therapeutic cardiovascular procedures
64. Bone marrow transplant
65. Bone marrow biopsy
66. Procedures on spleen
67. Other therapeutic procedures, hemic and lymphatic system
68. Injection or ligation of esophageal varices
69. Esophageal dilatation
70. Upper gastrointestinal endoscopy, biopsy
71. Gastrostomy, temporary and permanent
72. Colostomy, temporary and permanent
73. Ileostomy and other enterostomy
74. Gastrectomy, partial and total
75. Small bowel resection
76. Colonoscopy and biopsy
77. Proctoscopy and anorectal biopsy
78. Colorectal resection
79. Local excision of large intestine lesion (not endoscopic)
80. Appendectomy
81. Hemorrhoid procedures
82. Endoscopic retrograde cannulation of pancreas (ERCP)
83. Biopsy of liver
84. Cholecystectomy and common duct exploration
85. Inguinal and femoral hernia repair
86. Other hernia repair

87. Laparoscopy
88. Abdominal paracentesis
89. Exploratory laparotomy
90. Excision, lysis peritoneal adhesions
91. Peritoneal dialysis
92. Other bowel diagnostic procedures
93. Other non-OR upper GI therapeutic procedures
94. Other OR upper GI therapeutic procedures
95. Other non-OR lower GI therapeutic procedures
96. Other OR lower GI therapeutic procedures
97. Other gastrointestinal diagnostic procedures
98. Other non-OR gastrointestinal therapeutic procedures
99. Other OR gastrointestinal therapeutic procedures
100. Endoscopy and endoscopic biopsy of the urinary tract
101. Transurethral excision, drainage, or removal urinary obstruction
102. Ureteral catheterization
103. Nephrotomy and nephrostomy
104. Nephrectomy, partial or complete
105. Kidney transplant
106. Genitourinary incontinence procedures
107. Extracorporeal lithotripsy, urinary
108. Indwelling catheter
109. Procedures on the urethra
110. Other diagnostic procedures of urinary tract
111. Other non-OR therapeutic procedures of urinary tract
112. Other OR therapeutic procedures of urinary tract
113. Transurethral resection of prostate (TURP)
114. Open prostatectomy
115. Circumcision
116. Diagnostic procedures, male genital
117. Other non-OR therapeutic procedures, male genital
118. Other OR therapeutic procedures, male genital
119. Oophorectomy, unilateral and bilateral
120. Other operations on ovary
121. Ligation of fallopian tubes
122. Removal of ectopic pregnancy
123. Other operations on fallopian tubes
124. Hysterectomy, abdominal and vaginal
125. Other excision of cervix and uterus
126. Abortion (termination of pregnancy)
127. Dilatation and curettage (D&C), aspiration after delivery or abortion
128. Diagnostic dilatation and curettage (D&C)
129. Repair of cystocele and rectocele, obliteration of vaginal vault
130. Other diagnostic procedures, female organs
131. Other non-OR therapeutic procedures, female organs
132. Other OR therapeutic procedures, female organs

133. Episiotomy
134. Cesarean section
135. Forceps, vacuum, and breech delivery
136. Artificial rupture of membranes to assist delivery
137. Other procedures to assist delivery
138. Diagnostic amniocentesis
139. Fetal monitoring
140. Repair of current obstetric laceration
141. Other therapeutic obstetrical procedures
142. Partial excision bone
143. Bunionectomy or repair of toe deformities
144. Treatment, facial fracture or dislocation
145. Treatment, fracture or dislocation of radius and ulna
146. Treatment, fracture or dislocation of hip and femur
147. Treatment, fracture or dislocation of lower extremity (other than hip or femur)
148. Other fracture and dislocation procedure
149. Arthroscopy
150. Division of joint capsule, ligament or cartilage
151. Excision of semilunar cartilage of knee
152. Arthroplasty knee
153. Hip replacement, total and partial
154. Arthroplasty other than hip or knee
155. Arthrocentesis
156. Injections and aspirations of muscles, tendons, bursa, joints and soft tissue
157. Amputation of lower extremity
158. Spinal fusion
159. Other diagnostic procedures on musculoskeletal system
160. Other therapeutic procedures on muscles and tendons
161. Other OR therapeutic procedures on bone
162. Other OR therapeutic procedures on joints
163. Other non-OR therapeutic procedures on musculoskeletal system
164. Other OR therapeutic procedures on musculoskeletal system
165. Breast biopsy and other diagnostic procedures on breast
166. Lumpectomy, quadrantectomy of breast
167. Mastectomy
168. Incision and drainage, skin and subcutaneous tissue
169. Debridement of wound, infection or burn
170. Excision of skin lesion
171. Suture of skin and subcutaneous tissue
172. Skin graft
173. Other diagnostic procedures on skin and subcutaneous tissue
174. Other non-OR therapeutic procedures on skin and breast
175. Other OR therapeutic procedures on skin and breast
176. Other organ transplantation
177. Computerized axial tomography (CT) scan head
178. CT scan chest

179. CT scan abdomen
180. Other CT scan
181. Myelogram
182. Mammography
183. Routine chest X-ray
184. Intraoperative cholangiogram
185. Upper gastrointestinal X-ray
186. Lower gastrointestinal X-ray
187. Intravenous pyelogram
188. Cerebral arteriogram
189. Contrast aortogram
190. Contrast arteriogram of femoral and lower extremity arteries
191. Arterio- or venogram (not heart and head)
192. Diagnostic ultrasound of head and neck
193. Diagnostic ultrasound of heart (echocardiogram)
194. Diagnostic ultrasound of gastrointestinal tract
195. Diagnostic ultrasound of urinary tract
196. Diagnostic ultrasound of abdomen or retroperitoneum
197. Other diagnostic ultrasound
198. Magnetic resonance imaging
199. Electroencephalogram (EEG)
200. Nonoperative urinary system measurements
201. Cardiac stress tests
202. Electrocardiogram
203. Electrographic cardiac monitoring
204. Swan-Ganz catheterization for monitoring
205. Arterial blood gases
206. Microscopic examination (bacterial smear, culture, toxicology)
207. Radioisotope bone scan
208. Radioisotope pulmonary scan
209. Radioisotope scan and function studies
210. Other radioisotope scan
211. Therapeutic radiology
212. Diagnostic physical therapy
213. Physical therapy exercises, manipulation, and other procedures
214. Traction, splints, and other wound care
215. Other physical therapy and rehabilitation
216. Respiratory intubation and mechanical ventilation
217. Other respiratory therapy
218. Psychological and psychiatric evaluation and therapy
219. Alcohol and drug rehabilitation/detoxification
220. Ophthalmologic and otologic diagnosis and treatment
221. Nasogastric tube
222. Blood transfusion
223. Enteral and parenteral nutrition
224. Cancer chemotherapy

- 225. Conversion of cardiac rhythm
- 226. Other diagnostic radiology and related techniques
- 227. Other diagnostic procedures (interview, evaluation, consultation)
- 228. Prophylactic vaccinations and inoculations
- 229. Nonoperative removal of foreign body
- 230. Extracorporeal shock wave, other than urinary
- 231. Other therapeutic procedures
- 232. Anesthesia
- 233. Laboratory - Chemistry and Hematology
- 234. Pathology
- 235. Other Laboratory
- 236. Home Health Services
- 237. Ancillary Services
- 238. Infertility Services
- 239. Transportation - patient, provider, equipment
- 240. Medications (Injections, infusions and other forms)
- 241. Visual aids and other optical supplies
- 242. Hearing devices and audiology supplies
- 243. DME and supplies
- 244. Gastric bypass and volume reduction

APPENDIX 2

Crosswalk Between Single- and Multi-Level CCS Procedures

CCS Procedure Numbers	ICD-9-CM Procedure Chapters
1-9	1 - Operations on the nervous system
10-12	2 - Operations on the endocrine system
13-21	3 - Operations on the eye
22-26	4 - Operations on the ear
27-33	5 - Operations on the nose, mouth, and pharynx
34-42	6 - Operations on the respiratory system
43-63	7 - Operations on the cardiovascular system
64-67	8 - Operations on the hemic and lymphatic system
68-99	9 - Operations on the digestive system
100-112	10 - Operations on the urinary system
113-118	11 - Operations on the male genital organs
119-121, 123-132	12 - Operations on the female genital organs
122, 133-141	13 - Obstetrical procedures
142-164	14 - Operations on the musculoskeletal system
165-175	15 - Operations on the integumentary system
176-244	16 - Miscellaneous diagnostic and therapeutic procedures

Source: HCUP User Guide (2007)

APPENDIX 3

Definition of Specialty Participation

For our specialty entry and exit models, we developed a special set of procedures in order to define specialty participation. We were initially tempted to assume that a facility participates in a given surgical specialty when it performs one or more outpatient procedures within that specialty. However, procedure volume within certain surgical specialties (e.g., operations of the respiratory or cardiovascular system) was often relatively low. It was misleading to suggest that facilities had entered or exited these specialties when, in fact, procedure volume had simply dropped off or picked up for a single quarter. Instead, we attempted to identify deliberate and permanent changes in the mix of procedures that a surgery center provides and established several heuristic assumptions in order to do so.

By seeking to eliminate patterns of surgical volume that suggested a brief change in procedure demand, we ruled out facilities that entered or exited specialties for one or two quarters. Instead, we looked for three consecutive quarters of consistent procedure volume. If a facility had positive procedure volume within a specialty for three consecutive quarters, it served that specialty. If a facility had no procedure volume within a specialty for three consecutive quarters, it did not serve that specialty. Its specialty participation status within that specialty would persist until there were three consecutive quarters of the opposite status. When we calculated specialty entries and exits in this manner and then visually inspected trends in procedure volume, we found that this method was the most accurate method of capturing specialty participation.

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