O Safety, Where Art Thou: Do Physicians Migrate to ASCs in Response to Poor Safety at Hospitals?

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Abstract

Recent growth in the number of physician-owned ambulatory surgery centers (ASCs) and similar specialty hospitals has led to research regarding overutilization of surgical services (Courtemanche and Plotzke (2010), conflicts of interest due to potential of self-referral (Mitchell (2008), Hollingsworth et al. (2010), Jon R. Gabel et al. (2008)), the consequences for healthcare costs (Barro et al. (2006)) and negligible welfare benefits (Weber (2010)). This study confronts many measurement issues of physician and hospital quality as a concomitant issue. The focus of this study is to examine quality measures of both hospitals and their physicians in the light of recent growth in the number of physician owned Ambulatory Surgery Centers (ASCs). The key questions that we ask are: what role does patient safety at the hospitals play in the choice of practice-setting by the physicians and how does the profit-motive (for doctors with ownership shares) affect this relationship? We exploit the 15-year trend in migration of physicians from hospital outpatient departments (HOPD) to ASC settings.

We hypothesize - 1) that the migration is a response to poor safety at the hospital, and 2) that the high quality physicians are more likely to lead the change and therefore, may be at the forefront of this migration. Preliminary results indicate that when hospitals are found to have above-normal rates of unnecessary patient care complications, the likelihood of physician migration increases by as much as 41 percent. Further, we find that high quality physicians are more likely to choose ASCs over HOPDs. Finally, we find that physicians who have an ownership interest in an ASC are significantly more likely than non-owners to respond to poor performance by the hospital where they have been practicing.

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1. Introduction

Recent growth in the number of physician owned medical care facilities, such as, specialty hospitals and ambulatory surgery centers (ASCs), has led to concerns regarding over utilization of health services, conflict of interest due to potential of self-referral (Mitchell (2008), Hollingsworth et al. (2010), Jon R. Gabel et al. (2008)) and the overall impact on health care costs (Barro et al. (2006). The health literature has largely focused on the role played by physicians as entrepreneurs and the possible adverse impact of their ownership decisions on patient welfare in the form of higher costs, cherry-picking and demand-inducement. Further, in context of ASCs, recent literature has failed to find favorable evidence of the impact on patient welfare. Results have indicated that ASCs either lead to increased number of procedures (Courtemanche and Plotzke (2010), Plotzke and Courtemanche (2010)) or provide a welfare benefit that is not substantial (Weber (2010)). However, in asking the question of ASC impact on patient welfare, the role of low hospital quality in motivating physicians to move their practices to ASCs has been ignored. Similarly, other factors that may induce a decline in physician's hospital based activity in favor of ASC based practice have not been studied either.

In this study, we examine the potential welfare implications of ASC growth, while highlighting the importance of physician incentives as the driver of competition and change. We focus specifically on the movement of physicians from hospital outpatient departments to ASC settings and the various motivations that drive such decisions. For instance, it is important to evaluate whether these developments are a response to safety concerns at acute care hospitals, or if they induce higher quality of care in hospitals. In a similar vein, one of the key issues is the direct effect of the match between physician quality and hospital quality, on the physician's choice of practice setting. The underlying hypothesis being that relatively high quality physicians may be more likely to lead the change and therefore, may be at the forefront of the migration from a hospital based practice to an ambulatory surgery center environment. The result, good doctors fleeing poor quality hospitals.

To explore this hypothesis, reliable measures of physician and hospital quality are required. Burke et al. (2007) measure physician quality by defining "star" status for a physician which is, a physician who has completed residency at a top-ranked hospital. Authors find that the diffusion of stents in angioplasty by the physicians without star status depends positively on the number of stars they interact with at the same hospitals, whereas no social influence was found in the opposite

direction. These results extend to doctor quality measures that include age of the surgeon, the overall volume of surgeries performed and whether he or she was an early adopter of technology (Burke et al., 2009). Measures along these lines may show distinct patterns among physician selecting ASCs as primary choice of practice location.

In our recent work, we find initial evidence that ASC entry is more likely if more patients in an area are treated at high-risk hospitals (Dua & Fournier, 2011). This lends credit to the hypothesis that high quality physicians operating in an incumbent hospital can profitably disassociate from quality or safety problems by establishing a separate ASC to achieve better control. We imagine a model of profit maximizing physicians who initially are not affiliated with an ASC and perform all outpatient surgeries at the hospital outpatient department. Over time, some portion of these physicians will migrate to ASCs. The timing of their first migration to ASC and their degree of integration may entail different business considerations; e.g. building a new facility would require a certain threshold volume of surgeries, ownership interests entail organizational capital, while a contract relation with an existing owner may include incompleteness. In all cases, however, the ability to profitably move to an ASC setting may be viewed differently for high quality physicians relative to low quality ones, and further depend on perceived safety of existing care in the market. Similarly, the kind of ASC that a physician moves practice to, multi-specialty or single specialty, may also shed light on physician incentives.

The medical cases that we include in the study are confined within the specific categories of services that are amenable to be performed in a freestanding outpatient setting like ASC. For example, operations on the digestive system, on eyes, and on the nervous and musculoskeletal system. We use a panel data set from 1997-2008 including a census of outpatient visits identifying the physician performing them in hospital outpatient departments as well as ASCs in Florida. State of Florida provides physician profile database that includes biographical data on individual physicians and helps us construct quality measures on the physician. We use Agency of Healthcare and Research Quality (AHRQ) software to construct safety measures for the hospitals in the study. Safety is measured with covariates most closely associated with surgical care, and includes measures on post-surgical infection and complication rates due to nursing care. If physicians utilize knowledge of relative quality of local hospitals when choosing surgery setting, then the AHRQ measures will have explanatory power in physician choice of surgery setting. Further, if high-quality physicians recognize potential reputational damage from practicing at low-quality hospitals, they will be more likely to move practice to an ASC where they can achieve much higher control on quality as well as

other important operational decisions. In this case then, physician involvement with ASCs may be a welfare enhancing characteristic of such facilities and welfare computations must account for it. This paper is organized as follow: Section 2 reviews some relevant literature on ambulatory centers. The next two sections discuss our empirical methods and results and conclusions. A separate appendix supplies details about data and sampling used for this study.

2. Background & Literature

The hospital-physician relation in United States is often not defined with the help of an employer and employee contract, but based on a mutual understanding that serves interests of both the parties. Hospitals are supposed to provide infrastructure, such as, equipment and nursing staff, for physicians to treat patients who cannot be treated in a clinical setting, while, physicians in turn serve the hospital by practicing as the medical staff, performing on-call services in the emergency department, taking positions on the various administrative bodies inside the hospital, attracting patients (in case of specialist physicians famous in their line of medical practice) and by playing a role in quality control at the hospital. In such a setting, the importance of the match between hospital performance and physician expectations of the work environment cannot be overemphasized. We hypothesize that patient safety at hospitals interacts with the physician quality in a way that impacts the physician decision to set up or move practice and therefore, plays an important role in determining the strength of the hospital-physician relationship. When hospitals fail to maintain adequate safety standards, high quality physicians may get concerned about their own reputation getting negatively influenced and therefore likely to move their practice to other hospitals or specialty facilities such as ASCs.

In context of ASC growth, besides safety at hospitals, other reasons may also motivate physicians to move away from hospitals and must be empirically examined. For instance, physicians performing a high volume of procedures in hospital outpatient departments may find investing in an ASC as a profit earning opportunity, wherein they can benefit from the fee-for-service payment system as they get to earn facility fee over and above the physician fee. Such physicians may decide to capitalize on the reputation that they have earned in the community due to experience and a well-known high volume practice, by setting up their own ASC or moving practice to an existing one. Casalino et al. (2008) using results from a longitudinal community tracking survey (CTS) find that there is an increasing trend in hospital-physician relations wherein, physicians end up choosing one out of two mutually exclusive tracks - hospital employment or separation from

hospital. Hospitals hire a large number of specialist physicians and those physicians who are not employed at the hospital prefer to separate themselves from the hospital by refusing to serve on medical staff committees or emergency call and by investing in specialty facilities. Their study also highlights the importance of entrepreneurial behavior in fostering the growth of ASCs, as physicians who seek to gain more regular work hours and shelter from an increasingly complex and unstable market prefer to be employed by the hospitals.

Burns and Wholey (1992) apply a behavioral approach to study physician loyalty and state that physicians have a peculiar relationship with hospitals as they are both members of the hospital as well as consumer. They perform as medical staff as well as consume hospital services by utilizing equipment and staff at the hospital in their own practice. They suggest and test physician convenience, inertia and organizational commitment in the form of decision making role at the hospital as the important factors affecting physician loyalty to the hospital. They also hypothesize that access to other alternatives as well as dissatisfaction from the hospital may also serve to motivate a physician in exiting the hospital environment or reducing her share of work at the hospital. Carlson and Greeley (2010) list results from various surveys indicating growing dissatisfaction among physicians towards their hospital and it's negative impact on health care quality. The similar hypothesis applies to our study as easy access to new and convenient (to both patient and physician) forms of care delivery such as ASCs and poor safety record of hospitals may be a potent combination in driving physicians to invest in or join ASCs.

In another paper, Burns et al. (2001) study the trend in strategic alignment between hospitals and physicians. They categorize physician commitment into two types, one that is driven by instrumental or utilitarian considerations and the other that is driven by administrative involvement of the physician within the hospital. Older physicians, physicians with a long tenure, salaried employees, and those who admit a higher percentage of their patients at the hospital or exhibit more inpatient activity fall in the first category and are more likely to be committed than others. Similarly, physicians with decision making roles within the hospital in the form of administrative committee members or board members may also be more committed. Their results, understandably, show that the utilitarian reasons are stronger drivers of commitment. We also hypothesize that utilitarian measures are more likely to drive physicians to move practice. Physicians are more likely to leave when they have more alternatives available to them, when they are dissatisfied with the hospital environment and/or when they seek to gain more control over their practice. However, with respect to inpatient volumes, we believe that inpatient activity by the doctor is also a measure

of physician quality as such cases are generally more complex and therefore higher volume indicates physician skill. It is therefore an empirical question as to how does high inpatient volume affect physician decision to move practice.

Literature suggests that a hospital physician's motive to join an ASC can be thought of in terms of 'push' and 'pull' factors and how these factors interact with the physician's own practice. Push factors are those that are at operation within the hospital and include hospital quality/safety, hospital profit type, teaching status and volume of patients treated by the physician at the hospital inpatient and outpatient departments, while pull factors are those operating outside the hospital and include variables such as the availability of alternatives in the physician's geographic location, profit potential by earning facility fees as an owner of an ASC, and convenience of practicing at a smaller facility with less administrative hassle. These factors further interact with attributes of the physician's practice such as, reputation and skill measured by the quality of physician's education and training, board certification, inpatient practice and staff privileges. These attributes collectively indicate the overall quality of the physician. Previous literature like, Burke et al. (2007), Burke et al. (2009) and Gardner and Vishwasrao (2010) have relied on widely used and accepted US News & World Report ranking system to rate the residency program attended by the physician and ascribe quality to the physician based on the rank of the residency hospital. Besides using the same ranking system we also utilize NIH rankings that are based on the research funding earned by the residency school of the physician. Further, we also claim that measures like number of staff privileges, number of publications and number of state licenses that a physician has, indicate a high demand for her services and therefore, are evidence of reputation and quality.

One of the key hypotheses we lay down in this study is that high quality physicians are more likely to leave poor safety hospitals for ASCs. This response requires that physician's be aware of the safety record of the hospital, be affected by it and take it into account when taking important practice related decisions. Barr et al. (2008) in a qualitative study, looked into physician views on public reporting of hospital quality. They found that referring physicians primarily rely on hospital volume and outcome information as well as patient experience and safety measures to decide upon hospital quality. Also, most physicians in their study claimed to be aware of their own hospital's quality reports. In another study, Blendon et al. (2002) point out the results from the report by the Institute of Medicine. The report stated that each year, more Americans die as a result of medical errors made in hospitals than as a result of injuries from automobile accidents. It is such preventable complications (AHRQ measures) and errors that we use in this paper as a measure of hospital safety.

The majority of the physicians in Blendon et al. (2002) study suggested two solutions to control errors, and laid primary responsibility on the hospital administration. Physicians believed that hospitals need to develop systems for preventing medical errors and need to increase the number of nurses. Both these solutions should be relatively easy to apply at small focused facilities such as ASCs and hence, the proposition of joining ASCs may be more attractive for physicians tired of safety problems at hospitals.

The physician move to ASCs, however, is akin to new technology adoption, as the ASC environment is different from and lies somewhere between the traditional clinic and hospital environment in terms of size and scope. The technological developments in the fields of minimally invasive surgery and anesthesia, (Poole (1999), Mechanic et al. (2005)) have made it possible for physicians to carry out specific procedures like colonoscopy, upper gastrointestinal endoscopy, and cataract surgeries in a smaller but focused ASC environment. The move for physicians to ASCs gradually picked up speed during the last decade. Although Medicare started covering procedures at ASCs in 1980, the real growth came during the 1990's. The number of Medicare certified ASCs grew at an accelerating rate from 2,314 in 1996 to 3,400 in 2002 and 4707 in 2006 (Winter (2003), Mechanic et al. (2005), Casalino et al. (2008)). Nationally, physicians now own 80% of these ASCs either alone or in joint venture with a hospital or other corporation (Casalino et al., 2008).

High quality physicians ("Stars") and community leaders are often the first ones to adopt new changes in the field of medical care. This strengthens our belief that the growth of ASCs may have also been impacted by such behavior. Burke et al. (2007) studied the diffusion of medical innovation by looking at the adoption of 'stents' (for coronary angioplasty) by the physicians, after FDA approval in 1995. In their case, the adoption behavior was characterized by asymmetric social influence where "Star" physicians had a strong influence on "Non-Stars" while, there was no influence in the opposite direction. Star physicians, the paper claims, have also a higher ability and opportunity to learn about new methods from external sources as well as personal experience. Similarly, in the case of ASCs, heterogeneity among physicians based on their incentives, practice profile, location and unobserved entrepreneurial zeal is a driving factor.

Burke et al. (2007) applied a hazard model to examine the hazard of stent adoption by all physicians and even when they did not find much difference in propensity to adopt between stars and non-stars, they did find evidence for influence of star physicians. Hazard models are particularly suited for studying such technology adoption behavior as they can account for censoring of information for units of analysis that do not witness the relevant event during the recorded data

period. Escarce et al. (1995) also applied a proportional hazard model to the case of diffusion of laparoscopic cholecystectomies. They studied various attributes of physicians that may make them more susceptible to adopting the new technology. For instance, younger physicians and those graduated from a US school are more likely to be technology friendly, fee-for-service physicians and large practice physicians were considered to be more likely to adopt early and so were physicians practicing in more competitive markets. Their results supported competitive behavior on the part of the physicians and financial reasons as primary drivers of adoption.

In contrast to physician-hospital studies, the economic literature on physician-ASC relations is still in a nascent stage with only a handful of studies delving into physician behavior in the context of ASC growth. One of the recent studies by David and Neuman (2011), presents an interesting analysis of the division of practice by physicians (mainly, Gastroenterologists) across different settings, primarily between hospital outpatient departments (HOPDs) and ASCs. Authors use the same data as we do, provided by the Agency of Healthcare Administration (AHCA) of Florida. Their hypothesis is that physicians who are exclusively ASC-based ("non-splitters") are more likely to treat patients with *higher-risk* profile at the ASC as compared to those who work at both the HOPD and ASC locations, i.e. "splitters." Using the Charlson comorbidity index, authors show that the colonoscopy patients treated by splitters at ASCs are on average less complex cases than those treated by non-splitters. Their results are limited, however, to a small proportion of physicians not splitting (approximately 5% of their physician sample) and further confined to a narrow range of medical risk as the mentioned non-splitter behavior weakens with increasing medical risk. Further, an important factor unaccounted in their study is the differences in the type of ASCs. Analysis of ASC licensure data from Florida (provided by AHCA) shows that almost half of the ASCs are multi- specialty facilities employing various doctor owners specializing across different medical specialties. Non-splitters working at such ASCs may be exposed to lower risk than those who are practicing at single specialty ASCs.

2.1. **ASC Ownership.** The role of ASC ownership in treatment patterns is not well understood. The licensure data obtained from Florida show that approximately 40% of ASCs in the state are owned by corporations like HCA, AmSurg, Health South, Novamed, Symbion etc. Among these, there are also ASCs owned by hospitals such as Baptist System, Morton Plant and Naples Collier Health System. Physicians who choose to work at an ASC, their choice of the type of ASC may shed light on their incentives. For instance, hospital-owned as well as HCA-owned ASCs are mostly multi-specialty facilities, with approximately 40-60 physician joint investors practicing across different

specialties. ASCs that are owned by AmSurg and Symbion, on the other hand, are generally single specialty ASCs with focus on selected procedures in the area of eye care, orthopedics and digestive system. The number of physician joint-owners at such facilities is much smaller, ranging between 2 to 6. Physicians who choose single specialty ASCs over multi-specialty ASCs to set up practice, among other things, must desire a higher degree of control over their practice and may be more likely to leave a hospital with a poor safety record. Alternatively, physicians who are working at a hospital-owned ASC may actually be only extending their relation with the hospital by joining its ASC and not reacting to quality or safety changes within the hospital. We account for such differences in incentives by using the licensure data that provides detail on ownership, along with the physician profile and practice data.

3. Empirical Methodology

The objective of this study is to explore and understand the physician motivation behind the move to ASCs. Although the opportunity to invest in an ASC is lucrative for entrepreneurial physicians for various reasons such as profit share in the facility fee and a higher degree of control on own practice, there are other important characteristics of the health market and its players that are overlooked and ignored by the critics of ASCs. The hospitals and physicians have a two-pronged relationship, where they collaborate and compete with each other at the same time. We hypothesize that poor safety at the hospitals plays a role in motivating physicians to search for or invest in other outlets of health care delivery such as ASCs and further, that high quality physicians are more likely to get frustrated with poor hospital environment and choose setting up their own independent practice at an ASC. High quality physicians are also more likely to be motivated by gaining authority on administrative aspects of the practice as well as the ease of scheduling that they can achieve by moving to an ASC.

The decision to set up practice or divide it across different avenues depends on, among other things, the breadth and depth of physician's practice. Physicians who treat patients with health status and medical complexity ranging across a wide spectrum find it in their own as well as in patient interest to maintain simultaneous practice at hospitals. Medically intensive cases need to be treated in an environment where access to the emergency department is easy and instant and therefore, hospital practice is often an integral part of physician's practice. Poor safety control at the hospital where a physician carries out the majority of her work, however, is likely to adversely affect the hospital-physician relationship and even when the physician cannot completely sever the

ties with the hospital, she may react to safety problems by reducing the share of her work performed at the poor safety hospital.

To account for this behavior, our empirical strategy is divided into two parts. In the first part, we model the initial decision to adopt an ASC as a practice setting with a hazard rate model. The decision depends on, among other things, lagged information on hospital safety performance as well as physician's own quality. Next, once a physician has joined an ASC or ASCs, we ask the following question - what determines the split of physician's work between a hospital outpatient department and the ASCs? The question is similar in vein to the one raised by David and Neuman (2011) in their work on splitter and non-splitter physicians. It is feasible here, however, to explore the splitting decision by physicians more finely, utilizing ASC ownership data broken down by individual physicians as well as by joint ventures between physicians and national level chains.

3.1. **Hazard Model.** We imagine that at the start of each quarter, there is a group of physicians who can be considered at-risk for joining an ASC or equivalently investing in one. Such physicians should have a substantial involvement in medical specialties for which procedures and surgeries can be carried out in the outpatient setting. This means that physicians specializing in oncology or cardiac surgery are excluded from the at-risk group. The decision to adopt an ASC setting depends on, besides other physician and hospital characteristics, the safety performance of the physician's principal hospital. Principal hospital is defined as the hospital where physician performed the largest share of his overall hospital work in the previous quarter. Every quarter a certain number of physicians adopt the ASC practice, where the ASC adoption timing, as previously explained, is measured as the quarter where the physician treated 30 or more patients in an ASC environment for the first time. Thus, the hazard for adoption can be written in the form of a cox proportional hazard model as:

$$h(t|x_j) = h_0(t) \exp(\alpha_0 + \alpha_j \, x_j) \tag{1}$$

The vector x_j represents the set of variables included in the hazard analysis in Table 1. We include key variables on physician quality, physician practice profile and hospital safety performance. The number of hospital staff privileges, board certification, the number of publications and post graduate training from a school ranked among the top 30 in US are used as measures indicating different aspects of physician quality. To capture the practice profile, we use an experience variable (measured as number of years since residency) along with the variables measuring average inpatient and hospital outpatient volumes of the physician over the previous 6 quarters. Further, to account

for the availability of an opportunity to move practice to an ASC or to another hospital, two separate measures are included, the number of hospitals and the number of ASCs situated within six miles of the physician address in the previous quarter. We assume that the physician is likely to choose practice location taking travel convenience into account, using a six miles measure as the most relevant for the adoption hazard. (We also checked another measure based on 10 mile radius of the physician). We use hospital fixed effects for the main results and also include interaction terms in some of the specifications. The ASC adoption behavior by physicians, summarized in table 2, reveals that the cumulative adoption rate over 44 quarters is about two-thirds.

Physicians who joined an ASC at the start of the first quarter in 1997 or who joined an ASC directly after obtaining Florida medical license have been excluded from the hazard analysis as there are not enough quarterly observations on their practice to explore their reasons for doing so. It is, however, possible that these physicians were influenced to make the decision of joining an ASC for similar reasons as those who joined after a substantial time had passed. Information on hospital safety is likely to travel within communities through physicians who practice at the hospital as well as through hospital staff like nurses. If the hospital safety in certain communities is exceptionally bad, then physicians who are starting out in such communities, may be predisposed towards ASC practice. We are able to include these physicians along with those who have been analyzed in the hazard analysis in the second part of our empirical analysis.

3.2. **Utilization Model.** In the second model, we use data on physicians who join an ASC during our data period (1998-2008), starting from the period after they have joined and evaluate the impact of hospital safety as well as physician ownership status on the "splitting" decision, i.e., the allocation of patient-surgeries between HOPDs and ASCs. The second stage model allows us to further utilize time-varying information on ASCs that the hazard rate model does not as the ASC patient volumes are reported in periods after ASC adoption. Thus, our sample is confined to physicians who have adopted ASC practice.

Our primary interests here are to evaluate the role of patient safety and ownership status and the effects on physician responses to news about the safety at hospitals. The safety performance of the hospital h in the area of nursing and surgery care is represented by $Nursing_h$ and $Surgery_h$. Details on the construction of these measures is discussed in the data appendix. Ownership data have always been elusive, yet essential, to research on alternative ownership arrangements, as well

as physician-owner incentives and reactions to safety problems. For this study, the physician ownership data from more than 1200 ASC licensure files were extracted and matched with Florida's Department of State annual reports as well as ASC business websites helped to infer the ownership structure of these facilities.

There are primarily four types of ownership arrangements that exist in the ASC industry. First are joint ventures between the national hospital chains and multiple physician groups as well as individual physicians. Corporations involved here are primarily, HCA, Health South and Surgical Care Affiliates[1]. Physicians at such ASCs in general do not have a controlling interest (greater than 5% ownership share) and almost always have a small ownership interest (roughly, 0.5-2%). Second are joint ventures where there are national-level ASC corporations like AmSurg, Symbion and NovaMed involved. The ownership pattern here is much more balanced as the corporation tends to own majority interest (51%) and handles the management side of the ASC, while, physicians (generally part of the same group practice, typically with no more than 5-10 physicians) also own a controlling interest. The third type is non-corporate physician ownership either in the form of solo physician owner, physician group owning the ASC or joint venture between two or more physician groups. The common factor for the third type is that physicians involved all own a controlling interest and most such ASCs tends to be specialty facilities. Finally, the fourth type is the residual category of multi-specialty facilities owned by various physicians and physician groups and no physician enjoying a controlling interest.

We observe at the outset that owner-physicians typically divide the outpatient practices such that majority of their surgery visits take place at the ASC, while a residual amount occurs at the hospital outpatient department. We hypothesize that, relative to facilities not owned by physicians, owner physicians are more likely to react negatively to safety problems at the hospital and to react by treating more patients at their ASC as a response to poor safety at the hospitals. Strong reaction from controlling interest owners would be noteworthy because the profit incentive is compatible with the with a desire to treat one's own patients in the best possible environment. In this context, the presence of physician profit incentives yields the right responses to poor safety at the hospital, and may actually be beneficial for general patient welfare. By sanctioning hospitals in this manner, hospitals may be more likely to correct their own safety problems.

[1]Health South owned Surgical Care Affiliates until the middle of year 2007 and therefore, we treat both these as the same corporation for analysis purposes.

We test this hypothesis with the help of a hospital panel fixed effects regression, where the dependent variable is the log odds of physician share of outpatient work (p_h) done at the HOPD vis-a-vis that done at the ASCs. This dependent variable captures the split of work for a physician practicing at both HOPD and ASC. The fixed effects regression can simply be expressed as:

$$\begin{aligned} log\left(\frac{p_h}{1-p_h}\right) &= \beta_0 + \beta_1\, Nursing_h + \beta_2\, Surgery_h + \beta_3\, Distance_{ih} + \beta_4\, InVol_i + \\ & \beta_5\, H_j + \beta_6\, Quality_i + \beta_7\, Ownership_i + \\ & \beta_8\, Ownership_i * Nursing_h + \beta_8\, Ownership_i * Surgery_h \end{aligned} \tag{2}$$

The explanatory variables, other than the ownership information, in the model are similar to the ones used in the proportional hazard analysis. The safety performance of the hospital h in the area of nursing and surgery care is represented by $Nursing_h$ and $Surgery_h$, as discussed on the data appendix. *Distance* measures the straight line distance from the physician primary address to the HOPD. The variable $InVol_i$ measures the number of inpatients treated at the hospital during the last quarter by the physician i. Physicians who treat a larger number of inpatients, other things the same, are more likely maintain their hospital privileges and more likely to have a stronger relationship with the hospital even during the period when the hospital performs poorly on safety. The variable H_j accounts for hospital characteristics such as profit status and size (number of beds). These variables are excluded in the fixed effects specification as they stay fixed over time. Physician quality is represented by $Quality_i$ as in the hazard model. Finally, ownership is measured by dummies for hospital corporation & physician joint venture, ASC corporation and physician joint venture and controlling interest physician ownership with the base (omitted) category formed by non-controlling interest physician ownership type. These dummies are interacted with the hospital safety measures of nursing and surgery care to measure the differential impact of safety on the ownership type.

For the log-odds analysis, we drop those quarters where a physician treats less than 30 patients overall including inpatient and outpatient practice as overall low volume quarters may involve periods of low activity, vacation or absence due to training. We also drop physician-facility-quarter combinations involving less than 10 patients. One of the major complications that come up with measuring the impact of safety on a physician's HOPD-ASC split of practice is that a high proportion of physicians tend to work at more than one HOPD and more than one ASC during the same quarter. Since our interest is in measuring a physician's response to poor safety at the hospital, we combine the ASC quarterly volumes done by the physician and compute the log odds

of the share of work at each HOPD where the physician operates to that of her share of work done at all ASCs. Thus, for instance, there will be effectively two observations in each quarter for a physician who serves at two HOPD's. Further details of our sampling procedures are provided in the appendix.

4. Results

The main results are divided into two sections, with the first one describing results from cox proportional hazard analysis and the second detailing the outcome of the fixed effects analysis on physician splitting behavior between HOPD and ASCs. One of the major issues we face with measuring hospital safety is that the distribution of the safety measures tends to center closely around the state mean value with a long right tail. This means that even when the absolute number of complications is high, the physicians may not have a lot of choice in terms of choosing a practice setting because the hospitals may be similar to each other in safety record. Figure 1 highlights this trend and shows that this is more of a problem for the surgery safety measure and not so much for the nursing safety measures of the hospital. A likely outcome of such performance across hospitals is that there may be a safety threshold above which it is easy to spot a poor performer for both physicians as well as their patients. To account for this likelihood then, we discretize the safety measures and consider a hospital as high-risk, for nursing or surgery care, when the corresponding safety rate is one standard deviation above that of the average safety rate in the hospital's cohort. The data appendix provides more details on how these measures are constructed.

The hospital cohort is defined using the physician's primary address. Physicians, like their patients, are likely to travel small distances to their practice location and therefore, when choosing a hospital to practice at and send their patients to, they will choose out of those hospitals that are located close to their own primary address. Similarly, the relative quality of these hospitals is what matters the most to a physician when accounting for patient safety issues. We found that a Florida physician on average travels 12 miles, with the median distance of 3 miles, to her principal hospital. Therefore, to be inclusive we constructed a 15 mile radius around the physician's primary location and used the average nursing and surgery safety rate of all hospitals in the radius to construct the one standard deviation measures (nursing and surgery) of hospital safety. One of the issues with the method could be the rare event when a physician chooses or adjusts location based on the safety the hospitals. This is not a problem in our analysis, as we find that the physicians choose office address depending upon where the main office of their group practice is located and when not a

part of a group practice they use their home address as the primary address. Another safeguard built in the analysis is the fact that in our sample the physician address stays constant throughout the analysis period.

4.1. **Results from the Hazard Analysis.** The empirical estimates from our hazard model are presented in Table 3. After accounting for the physician location specific safety measures, we are left with a total of 1336 physicians who form the overall at-risk group across the time period of 1997-2008.[2] Out of these, 737 physicians adopt ASC practice by the end of the period in 2008. We basically estimate three specifications, differing from each other due to the different 'star' status measure included. All the specifications include fixed effects for the physician's principal hospital. The variables are divided into four major groups, reflecting physician practice profile, physician quality measures including 'star' status, opportunity for or ease of moving practice and hospital safety. Specification (1) uses post graduate training from a top 30 school as the 'star' status measure, specification (2) includes the US News 'honor roll' schools to define 'star' status while, the last specification (3) uses the 'Castle Connolly' list of top doctors to identify 'stars'. The coefficient estimates are found to be quite similar across the three regressions with the exception of the coefficients on 'star' status measures.

On the key variables of hospital safety, we find support for our main hypotheses. The impact is, however, concentrated largely on the nursing measure as the safety measure is positive but insignificant. The interpretation of the safety measure has to be understood in terms of the impact of increasing complications at the hospital on physician's probability of adopting ASC practice. The hazard results indicate that if a physician's principal hospital is reported to be a high-risk hospital due to a high number of nursing complications then there is a 41% higher probability that the physician will adopt ASC practice. The result is significant at 5% (p value 2%). This result also makes sense in the context of the anecdotal evidence from the health care market. One of the reasons ASCs have become popular among physicians and patients is the convenience factor. Due to their smaller size, and a higher nurse to patient ratio than hospitals, it is easier for them to attract business. Further, physicians cannot exercise much of a administrative control on nursing quality and nursing intensity issues at the hospitals and therefore, when frustrated with the quality, may find it easier to divide their work over more hospitals or between hospitals and ASCs.

[2] A total of 207 physicians are dropped from the analysis as a result of using physician location specific safety measures. To check if the hazard results were affected by this change in the sample size, we estimated the same model specification but with actual safety rates from the last year on two different samples, one with 1553 physicians and the other with 1336 physicians. The results were found to be qualitatively similar suggesting no bias was introduced due to the change in sample size as a result of inclusion of discretized safety measures

The majority of the variables on physician quality seem to support our main hypotheses. The exception is that 'star' status fails to provide a strong evidence in the hazard results. We find that the physicians who have been granted practice privileges at various hospitals are significantly more likely to adopt ASC practice. As mentioned before, we consider the variable to be an important measure of physician quality as the hospital boards have their own credentialing mechanism that aims at providing privileges to good quality doctors. Physicians with a postgraduate degree from a top 30 school are also 15% more likely to adopt ASC practice, but the coefficient estimate is not found to be significant (p value of 11%). The number of publications has been entered with a square term and captures the convexity of the impact of the number of publications by physicians who do not have faculty appointments on their probability of adopting ASC practice. Both the stand alone term as well as the squared term are significant at 10% (p value 7%) and 1% respectively indicating that the physicians with the number of publications greater than 10 have a significantly higher probability of adopting ASC practice. 'Star' status measures constructed using 'honor roll' and 'Castle Connolly' list have a positive but insignificant impact on the hazard of ASC adoption. The dummy variable indicating board certification status of the physician is also insignificant as more than 90% of the physicians in the at-risk group are board certified.

In results not presented here, we also interact the hospital safety measures with the doctor quality measures to evaluate the hypothesis that high-quality doctors may be more likely to leave poor safety hospitals. We did not find evidence for the hypothesis as the interaction terms turn out to be insignificant. It is difficult to comment on the precise reason behind lack of evidence for this hypothesis.

Turning to other control variables in the model, physician practice profile is primarily summarized by her average hospital inpatient and outpatient volume in the last six quarters. Physicians with a substantial inpatient component to their practice are not as likely to join ASCs given that the majority of their work is based at the hospital and it is far more convenient to carry out the outpatient work at the same hospital's outpatient department. A big outpatient component, on the other hand, pulls the physician towards the ASC setting by providing an incentive to gain not only more control on the practice but to also benefit from the profit opportunity in the form of ASC ownership as the physician can then benefit from an already established reputation in the outpatient arena. The results in all three specifications in the Table 3 support this claim. We find that an increase in the average quarterly outpatient volume by 100 patients increases the probability of

joining ASC practice by 9%.[3] The estimated impact of lagged hospital inpatient volume is even larger and as hypothesized, works in the opposite direction. An average increase of 100 inpatients in a quarter, decreases the probability of joining an ASC by approximately 31%.

We expected that the hazard of joining an ASC will be weaker for the physicians with faculty responsibilities as they are likely to be involved with conflicting task of teaching and research besides handling their own medical practice. Also, hospital environment is more likely to suit faculty pursuits. However, we do not find a significantly negative impact of faculty appointment on the probability of joining an ASC. Experienced physicians, on the other hand, are found to be more drawn towards hospital practice as a 1 year increase in experience decreases the likelihood of joining an ASC by 3%.

In summary, the results from the proportional hazard model generate the first thread of evidence supporting the claim that high-quality doctors are the first ones to adopt ASC practice and poor safety at the hospitals is one of the driving factors behind the migration to ASCs. However, we also find that physicians tend to move only part of their outpatient practice to ASCs and not the complete practice indicating that hospital privileges still remain an important aspect of physician's practice. Results suggest that physicians may get frustrated with the safety issues at the hospital, but their punishment to the hospital by the way of taking business out of the hospital may vary with their own characteristics as well as their ownership status at the ASC. The next section provides further analysis of physician decision of splitting outpatient work between hospital (HOPD) and ASC, once the physician has moved part of the practice to an ASC.

4.2. **Results from the Utilization Analysis.** The second part of the analysis focuses only on physicians who have previously adopted the ASC setting and moved part of their practice to an ASC or multiple ASCs. The main objective of the second stage logistic model is to explore the factors that affect the ratio of physician practice split between HOPDs and ASCs, primarily the role of ASC ownership.[4] The dependent variable in the regression is the log odds of the work done at an HOPD versus all the ASCs where the physician practices. There are 3 specifications estimated,

[3]The table presents coefficient estimates that can be converted to hazard ratios by taking the exponent of the coefficient term. For instance, the coefficient on lagged outpatient volume measure in specification (1) exp(0.08815) is equal to the hazard ratio of 1.092 implying a 9% increase in the hazard.

[4]Due to the restrictions mentioned in the data appendix, section 7.1, we were not able to account for a certain number of physicians in the hazard analysis who adopted the ASC practice because either there were not enough number of quarters on them before they adopted ASC or because they started out their practice at an ASC. In this analysis, we include those physicians too which brings up the number of physicians who split their practice to 1097.

just as in the case of hazard analysis, varying by the 'star' status measure included. The results are presented in the Table 4.

Most of the variables in the second stage regression are similar to the ones used in the hazard analysis. Since the outpatient volumes will be endogenous in this model, to account for the physician practice profile, we use inpatient volumes in the previous quarter at the same hospital where the outpatient department is located. The inpatient volumes indicate the depth of a physician's practice and may also make the physician relatively more loyal to the hospital. Physicians for whom inpatient treatment is a major practice component, maintaining relationship with the hospital should be more important and as a result their response to the safety performance issues at the hospital may be less elastic.

We include the same physician quality measures as before and also include a variable indicating the distance of the physician to the HOPD. The additional set of variables in this regression are the ownership indicators and their interaction with the hospital safety measures. The ownership variables, as defined before, include indicators for physician owners with controlling interest in an ASC with no corporate involvement, physician owners without controlling interest in a joint venture (JV) with a hospital corporation and physician owners with controlling interest and in a JV with a corporation specializing in ASC business (ASC Corporation). The residual (omitted) category is physicians without controlling interest in an ASC that has no corporate involvement either (non-owners). These ownership measures are interacted with the safety indicators for the hospital to test whether there is a differential impact of hospital safety on practice splitting across facilities by physician owners with and without controlling interest an ASC.

The results in this part provide further insight into the physician-hospital-ASC dynamic. We find that the physician 'star' status measures are much more informative in this analysis. Physicians who completed postgraduate training at a top 30 school or were listed as a top doctor in the 'Castle Connolly' publication have approximately 5% lower odds of practicing at a HOPD vis-a-vis an ASC. However, physicians graduating from a 'honor roll' school have 14% higher odds of favoring an HOPD over the ASC environment. A possible reason for this discrepancy is that the 'honor roll' ranking includes only 14 hospitals from across the nation and may be a little too selective when indicating physician quality (While 35% of physicians graduated from top 30 school, 16% are listed as top doctors in 'Castle Connolly' publication, only 11% graduated from an 'honor roll' school). The measure on publications by physicians without faculty privileges, unlike the hazard model,

is not significant in its impact on the physician decision of splitting practice between HOPD and ASCs.

The most interesting results, however, come from the ownership variables and their interaction with safety. Physicians who have a controlling interest in an ASC (JV with ASC corporations like AmSurg and Novamed or without a JV) are significantly less likely to practice at a HOPD even when there are no safety issues at the HOPD. The odds are 44% lower in case of only physician control and 52% lower when a ASC corporation is involved, compared to non-owners. This finding is in line with conventional wisdom as ownership provides the profit incentive and therefore the physicians prefer to perform majority of the services at the ASC. However, interestingly, the odds of practicing at an HOPD decrease further to 57% and 64% lower when the HOPD in question is high-risk due to nursing complications. Surgery complication rates, on the other hand, turn the odds of practicing at the HOPD to 50% lower in case of controlling interest physicians. In case of ASC Corporation JVs, the surgery complications do not seem to impact the physician's choice of practice setting. In contrast, physicians who do not have a controlling interest and are operating at an ASC jointly owned by a hospital chain do not seem to get affected by the safety issues and also have roughly 13% higher odds of practicing at the HOPD when compared to non-owners. This makes sense if one considers the fact that for many physicians, ownership in a joint venture with a corporation like HCA or with a hospital entity could just be an extension of the hospital practice and therefore, be guided by purely profit earning incentives or by the administrative decisions that were originally taken at the hospital.

Turning to the other covariates, inpatient volume in the last quarter has the same qualitative effect as the inpatient volume measure in the hazard analysis. As in this case, physicians with big inpatient component are also more loyal to the hospital's outpatient department and an extra 10 inpatients increase the odds of choosing a HOPD over ASC by 9%. Physicians are also sensitive to the travel distance and an increase in travel distance by 1 mile decreases the odds by 4%. Board certified physicians and those who have a faculty appointment are more likely to choose HOPD's. In case of faculty members, the tilt of the split in favor of HOPDs makes sense as the faculty responsibilities and incentives are more tightly aligned with the hospital setting as both teaching as well as research work is better suited for the hospital environment. Higher numbers of hospital staff privileges are likely to bring the odds of practicing at a HOPD lower. However, unlike the hazard model, it is difficult to interpret the staff privileges as only a physician quality measure in this case. Physicians who are practicing at various locations are also likely to divide their work

in smaller proportions across each of the facilities they practice at. Somewhat different from the hazard analysis is the result that conditional on adopting ASC practice, experienced physicians have a small but significantly higher preference for ASCs over HOPDs. A 1 year increase in experience implies 1% lower odds of working at a HOPD.

5. Conclusion

Physicians, hospitals and national hospital chains and ASC chains have all played a role in the dramatic growth of outpatient surgical care industry. The debate until now has centered only around the cost and utilization issues that have come forth due to the growth of these specialty facilities. This research adds another dimension to the debate by bringing safety issues at the hospitals into focus and how they have motivated physicians to set up practice at and invest in specialty centers like ASCs. The recent national health care quality report submitted by AHRQ to the Congress finds that the problems of adverse events and patient safety in hospitals have not gotten much better in recent years (AHRQ, 2010). One out of seven inpatient Medicare patients experienced an adverse event during hospitalization, and particular concerns also remain about the rate of hospital acquired infections (HAIs).

Our findings indicate that poor nursing care safety is one of the leading causes behind the physician motivation to adopt ASC practice. There is a 41% higher probability of a physician adopting an ASC when the principal hospital she works at has a high number of medical complications due to nursing errors. The actions of the ASC industry provide a promising source of market-shunning mechanisms for sanctioning poor quality hospitals. The results in this study put a positive light on the physician ownership of such facilities and how ownership generates incentives to avoid patient safety risks that seem well aligned with patient welfare.

We do not find evidence supporting the hypothesis that the best quality or 'star' physicians are the first movers in the migration to ASCs, but we do find that once a 'star' physician has joined an ASC, the odds of her treating patients at the ASC are significantly higher and more responsive to poor safety conditions in the hospital. Evidence about high quality physicians being more responsive to safety issues is even stronger with other physician quality measures that either themselves are based on a peer review system (Castle Connolly measure) or rely on graduation from a medical school ranked among the top 30 schools in US.[5] These results also bring forward

[5]Other physician quality measures relying on number of hospital staff privileges and publications also indicate that high-quality physicians are more likely to adopt ASC practice but in case of publications the evidence favors only physicians with substantially higher number of publications.

the importance of hospital-physician relationships and the imperfect or incomplete substitutability between HOPDs and ASCs. Physicians who treat a wide variety of patients with different medical risk backgrounds are reliant on their hospital privileges and need access to inpatient and outpatient facilities as well as the emergency departments at the hospital. This reliance in some cases may weaken their response to the safety issues at the hospital.

Further, our results capture the often-elusive impact of ownership on the physician's splitting of practice across different facilities - HOPDs and ASCs. We find that physicians who have controlling interest at an ASC are much better positioned to respond to the safety problems at the hospitals. Their profit incentives strengthen the proper responses, practice substitution away from hospitals with poor safety control. Both poor surgery and nursing care safety at the hospital significantly increases the likelihood of an owner shifting patients away from an HOPD to the ASC. Understandably, this impact is weaker or non existent for non-owners and those who are non-controlling interest owners at a hospital run ASC. An ASC practice for the latter physicians is likely to be just an extension of their relationship with the hospital.

It is important to note that all the results presented in this paper account for the unobservable hospital characteristics with the use of hospital level fixed effects. We also use safety measures lagged by a year to study the impact on individual physician decisions. However, it is possible that hospitals learn about and keep track of their own safety performance from year to year and take steps to improve. Such steps will then be time varying measures that cannot be accounted for with the help of fixed effects. In such a case, the impact of prior safety performance on the physician decision to migrate patients to an ASC may be weakened. If such a reaction exists, then the results in this paper present a lower bound on the size of physician response to safety issues and further research can rely on instrumental variables to account for this possibility.

6. Tables and Figures

Table 1. Summary of the Main Variables

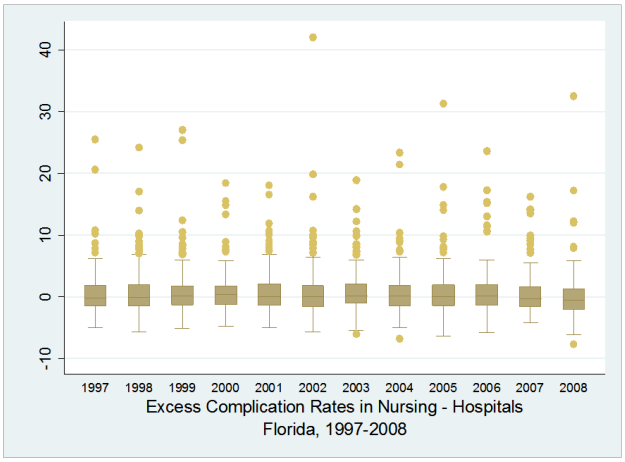
Variables	All Physicians		ASC Adopters		Non Adopters	
	Statistic	Std. Dev	Statistic	Std. Dev	Statistic	Std. Dev
Means						
Overall Volume[1]	166	*115.34*	182	*126.86*	141	*88.18*
Outpatient Volume[2]	137	*108.19*	154	*119.56*	111	*79.47*
Hospital Outpatient Volume[3]	93	*82.25*	83	*82.09*	109	*79.89*
Hospital Inpatient Volume[4]	34	*32.70*	32	*30.01*	36	*36.46*
No. of Hospitals within 6mi	4	*3.47*	4	*3.07*	5	*3.97*
No. of ASCs within 6mi	5	*3.86*	5	*3.81*	5	*3.95*
Number of Staff Privileges	3	*2.08*	4	*2.16*	3	*1.87*
Publications	5	*22.14*	2	*11.07*	9	*30.39*
Publications (Non Faculty Physicians)	1	*4.19*	1	*4.79*	1	*3.29*
Proportions						
Faculty Appointments (%)	20		15		26	
Board Certification (%)	92		94		90	
Postgraduate - Top 30 School (%)	33		33		33	
Postgraduate - US News 'Honor Roll' School (%)	10		10		10	
Castle Connolly Top Doctor (%)	21		23		20	
Started at an ASC Owned by a Hospital Chain[5] (%)	–		38		–	
Started at a Specialty ASC[6] (%)	–		34		–	
Number of Physicians	1543		855		688	

Notes:

1. Total volume served by the physician has been averaged over all the quarters during 1997-2008 when the physician was practicing in Florida.
2. Total outpatient volume served by the physician has been averaged over all the quarters during 1997-2008 when the physician was practicing in Florida. This includes pre and post ASC adoption period.
3. Total hospital outpatient volume served by the physician has been averaged over all the quarters during 1997-2008 when the physician was practicing in Florida. This includes pre and post ASC adoption period.
4. Total inpatient volume served by the physician has been averaged over all the quarters during 1997-2008 when the physician was practicing in Florida. This includes pre and post ASC adoption period.
5. A physician is considered to be starting out at an ASC owned by a hospital chain when the first ASC that the physician starts practice at is owned by a hospital or hospital chain like HCA.
6. A physician is considered to be starting out at a specialty ASC when the first ASC that the physician starts practice at specializes in a major body part or body system. For eg: Eye care centers, gastroenterology or urology centers.

TABLE 2. Summary of ASC Adoption Behavior

Period	Physicians at risk	Adopters (exits)	Censored	New Entrants	Kaplan Meier Survivor Function	Cumulative Adoption Probability
1998, q1	1030	27	0	0	0.974	0.026
1998, q2	1003	37	1	0	0.938	0.062
1998, q3	965	24	2	1	0.915	0.085
1998, q4	940	21	5	14	0.894	0.106
1999, q1	928	34	4	41	0.861	0.139
1999, q2	931	42	3	26	0.822	0.178
1999, q3	912	30	3	9	0.795	0.205
1999, q4	888	25	4	3	0.773	0.227
2000, q1	862	33	2	24	0.743	0.257
2000, q2	851	27	1	13	0.720	0.280
2000, q3	836	14	5	8	0.708	0.292
2000, q4	825	23	1	8	0.688	0.312
2001, q1	809	17	1	30	0.674	0.326
2001, q2	821	18	3	15	0.659	0.341
2001, q3	815	15	2	8	0.647	0.353
2001, q4	806	25	2	7	0.627	0.373
2002, q1	786	19	3	25	0.612	0.388
2002, q2	789	23	5	11	0.594	0.406
2002, q3	772	22	6	6	0.577	0.423
2002, q4	750	23	2	10	0.559	0.441
2003, q1	735	35	2	25	0.532	0.468
2003, q2	723	22	5	12	0.516	0.484
2003, q3	708	19	4	7	0.502	0.498
2003, q4	692	18	4	3	0.489	0.511
2004, q1	673	21	2	21	0.474	0.526
2004, q2	671	14	3	9	0.464	0.536
2004, q3	663	9	1	3	0.458	0.542
2004, q4	656	13	4	4	0.449	0.551
2005, q1	643	20	1	18	0.435	0.565
2005, q2	640	24	3	10	0.419	0.581
2005, q3	623	16	3	11	0.408	0.592
2005, q4	615	17	1	8	0.397	0.603
2006, q1	605	3	3	19	0.395	0.605
2006, q2	618	19	2	9	0.382	0.618
2006, q3	606	6	6	12	0.379	0.621
2006, q4	606	18	6	10	0.367	0.633
2007, q1	592	15	3	22	0.358	0.642
2007, q2	596	15	6	15	0.349	0.651
2007, q3	590	8	3	3	0.344	0.656
2007, q4	582	11	1	3	0.338	0.662
2008, q1	573	11	3	14	0.331	0.669
2008, q2	573	10	7	6	0.326	0.674
2008, q3	562	6	3	7	0.322	0.678
2008, q4	560	6	557	3	0.319	0.681



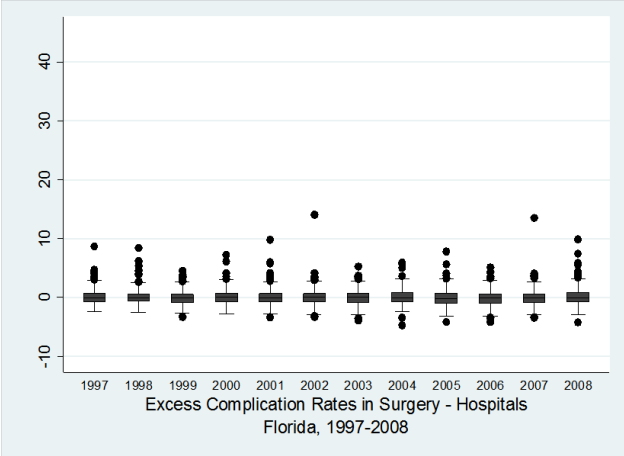


FIGURE 1. Excess Nursing and Surgery Complications, Florida Hospitals 1997-2008

TABLE 3. Coefficient Estimates from Cox Proportional Hazard Analysis

	Specifications[1]		
Variables	(1) Top 30	(2) Honor Roll	(3) Castle Connolly
Hospital Safety[1]			
High Risk (Nursing)	0.346[b]	0.346[b]	0.347[b]
	(0.146)	*(0.146)*	*(0.146)*
High Risk (Surgery)	0.039	0.044	0.043
	(0.143)	*(0.143)*	*(0.143)*
Physician Quality			
'Star' Status	0.143	0.084	0.021
	(0.092)	*(0.139)*	*(0.1)*
Staff Privileges	0.079[a]	0.081[a]	0.081[a]
	(0.027)	*(0.027)*	*(0.027)*
Publications[3]	-0.037[c]	-0.034[c]	-0.034[c]
	(0.021)	*(0.02)*	*(0.02)*
Publications Squared	0.001[a]	0.001[a]	0.001[a]
	(0.000)	*(0.000)*	*(0.000)*
Board Certification	-0.004	-0.008	-0.013
	(0.096)	*(0.095)*	*(0.096)*
Physician Practice Profile			
Outpatient Volume (Avg. last 6 qtrs)	0.088[c]	0.094[c]	0.095[c]
	(0.052)	*(0.052)*	*(0.052)*
Inpatient Volume (Avg. last 6 qtrs)	-0.369[b]	-0.386[a]	-0.39[a]
	(0.154)	*(0.154)*	*(0.154)*
Faculty Appointment	-0.114	-0.098	-0.094
	(0.13)	*(0.13)*	*(0.13)*
Experience	-0.03[a]	-0.03[a]	-0.03[a]
	(0.005)	*(0.005)*	*(0.005)*
Hospitals within 6 mi	-0.079[a]	-0.080[a]	-0.082[a]
	(0.031)	*(0.031)*	*(0.031)*
ASCs within 6 mi	0.012	0.014	0.015
	(0.024)	*(0.024)*	*(0.024)*

Notes:
1. All specifications include principal hospital fixed effects
2. High-Risk Nursing and Surgery variables are binary indicators of high-risk status of the hospital due to nursing or surgery complications. A high-risk hospital has a surgery complication rate 1 standard deviation greater than the average complication rate of its cohort.
3. The variable publications measures the number of articles published by physicians who do not have faculty appointments.
[a] p-value < 0.01
[b] p-value < 0.05
[c] p-value < 0.10

TABLE 4. Coefficient Estimates from the Log Odds Regression

Dependent Variable : Log Odds of HOPD Practice v/s ASC	**Specifications**[1]		
	(1)	(2)	(3)
Explanatory Variables	Top 30	Honor Roll	Castle Connolly
Physician Ownership & Hospital Safety[2]			
Controlling Interest Owner[3]	-0.590[a]	-0.599[a]	-0.591[a]
	(0.024)	*(0.024)*	*(0.024)*
Controlling Interest Owner * High-Risk (Nursing)	-0.260[a]	-0.233[a]	-0.243[a]
	(0.062)	*(0.062)*	*(0.062)*
Controlling Interest Owner * High-Risk (Surgery)	-0.118[b]	-0.123[b]	-0.116[b]
	(0.060)	*(0.060)*	*(0.060)*
Controlling Interest Owner (ASC Corp JV)[4]	-0.741[a]	-0.740[a]	-0.735[a]
	(0.030)	*(0.030)*	*(0.030)*
Controlling Interest Owner (ASC Corp JV)* High-Risk (Nursing)	-0.299[a]	-0.286[a]	-0.300[a]
	(0.076)	*(0.076)*	*(0.076)*
Controlling Interest Owner (ASC Corp JV)* High-Risk (Surgery)	-0.028	-0.056	-0.033
	(0.074)	*(0.075)*	*(0.074)*
Non Controlling Interest Owner (Hosp Corp JV)[5]	0.120[a]	0.119[a]	0.123[a]
	(0.022)	*(0.022)*	*(0.022)*
Non Controlling Interest Owner (Hosp Corp JV)* High-Risk (Nursing)	-0.058	-0.047	-0.052
	(0.054)	*(0.054)*	*(0.054)*
Non Controlling Interest Owner (Hosp Corp JV)* High-Risk (Surgery)	0.038	0.031	0.035
	(0.053)	*(0.053)*	*(0.053)*
High-Risk (Nursing)	0.171[a]	0.156[a]	0.166[a]
	(0.046)	*(0.046)*	*(0.046)*
High-Risk (Surgery)	0.036	0.042	0.036
	(0.045)	*(0.045)*	*(0.045)*
Physician Quality			
'Star' Status	-0.054[a]	0.128[a]	-0.048[a]
	(0.016)	*(0.024)*	*(0.019)*
Publications[6]	0.001	0.001	0.001
	(0.002)	*(0.002)*	*(0.002)*
Board Certification	0.082[a]	0.084[a]	0.087[a]
	(0.019)	*(0.019)*	*(0.019)*
Physician Practice Profile			
Inpatient Volume Previous Quarter	0.009[a]	0.009[a]	0.009[a]
	(0.001)	*(0.001)*	*(0.001)*
Staff Privileges	-0.014[a]	-0.013[a]	-0.014[a]
	(0.005)	*(0.005)*	*(0.005)*
Faculty Appointment	0.162[a]	0.152[a]	0.160[a]
	(0.023)	*(0.023)*	*(0.023)*
Experience	-0.002[a]	-0.002[b]	-0.001[c]
	(0.001)	*(0.001)*	*(0.001)*
Distance to the HOPD	-0.038[a]	-0.040[a]	-0.038[a]
	(0.002)	*(0.002)*	*(0.002)*
Number of Physicians = 1097			

Notes:
1. All specifications include fixed effects for the HOPD
2. High-Risk Nursing and Surgery variables are binary indicators of high-risk status of the hospital due to nursing or surgery complications. A high-risk hospital has a surgery complication rate that is 1 standard deviation greater than the average.
3. Controlling Interest Owners are physicians who have a 5% or greater ownership share in the ASC. Such ASCs are either individually owned or by a small group of physicians and many of these ASCs are either single specialty facilities or small size multi-specialty facilities.
4. Controlling Interest Owners in a JV with a ASC Corporation such as AmSurg or Novamed. These physicians also have a 5% or greater ownership share in the ASC. The corporation tends to own the management with 51% share and the rest is generally owned by physician group(s).
5. Non-Controlling Interest Owners are in a JV with a Hospital Corporation such as HCA or Health South. These physicians do not own a controlling interest and generally at such ASCs, the corporation tends to own the management with greater than 51% share and the rest is divided among 40-60 physicians.
6. The variable publications measures the number of articles published by physicians who do not have faculty appointments.
[a] p-value < 0.01
[b] p-value < 0.05
[c] p-value < 0.10

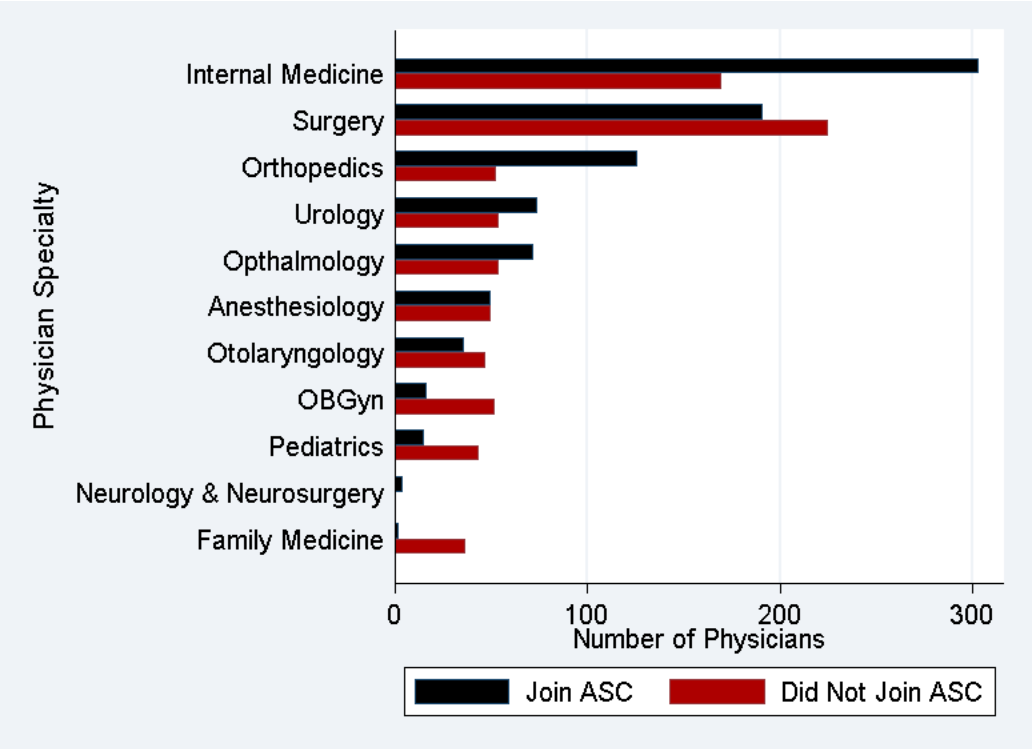


FIGURE 2. Specialty Wise Break-up of Physicians, Florida 1997-2008

7. Appendix on Patient Data and Physician Profile

The data for this study comes from two different sources - the Agency of Healthcare Administration (AHCA) and the Department of Health(DOH), Florida. Hospital financial data and the patient level data was acquired from the AHCA. We use patient records from 1997 to 2008, from both inpatient discharge and outpatient visit data collected by AHCA. Besides the patient level variables such as age, race, gender, procedure and diagnosis, the data also includes the operating room physician's Florida medical license number. These license numbers in turn are linked to the second data source which is the physician profile information collected by the DOH. The profile data includes information on physicians, such as, name, address, education, post-graduate training, state level medical licenses, staff privileges, faculty appointments etc. These three data sets give us a rich insight into the practice profile of each physician and help us take into account not only the site of practice of the physician for outpatient work, but also her inpatient practice. Further, it helps us build a panel data set on physicians through their various practice sites over a long period of 12 years, quarter by quarter.

7.1. **Sample Selection.** As explained later in the section (empirical section), the empirical analysis is divided into two parts. The first part includes a hazard model while, the second consists of a logistic regression model. The unit of analysis in both the models is a physician quarter i.e. quarter by quarter practice information on each physician in the sample. The sample itself is selected using the inpatient and outpatient practice information on the physicians from 1997 to 2008. During this period Florida also witnessed entry and exit of physicians from the market because of which we do not have a balanced panel. We choose to model only Medical Doctors and their decision to choose practice location and ignore those who are either Podiatrists or Osteopathic Medicine Doctors. Physicians who treat less than 360 outpatients over the entire period from 1997 to 2008 or are present in the data for less than 6 consecutive quarters (out of 48 total) are dropped from the sample. Also dropped are physicians who treat less than 60 patients a quarter on average across quarters during which they practice in Florida. These conditions leave us with a total of 3159 physicians and ensure that we have included only those physicians who have had a substantial presence in Florida during the time period coinciding with our data. Further, to specify the group of physicians that can be considered at-risk for joining an ASC at the start of the data observations in 1997, physicians who were already treating majority of their patients at an ASC are excluded from the sample. The act and timing of a physician moving practice to an ASC is defined as that

quarter in which a physician treats 30 or more patients at an ASC for the first time and accordingly, any physician who was already treating more than 30 patients in the first quarter of 1997 is also not included in the at-risk sample. Next, since ASC environment is suitable only for outpatient services and procedures and major surgeries like Cardiovascular or Cancer are fairly complicated and suited only for an inpatient environment, physicians who specialize in such procedures are also not included in the sample. Similarly, physicians with specialization in Emergency Medicine are also excluded.

For hazard model, there are some additional restrictions imposed on the sample. Physicians are considered to be included in the data set from the first quarter when they treat 10 patients in Florida, inpatient, outpatient or both. Since for hazard analysis we need lagged volume information on the physicians, we include a physician in the analysis only from the 7th quarter after he or she first treats 10 patients in Florida. Any physician who joins an ASC before the 7th quarter is excluded form the hazard analysis. This rule is applied differently for physicians who were practicing in Florida at the beginning of 1997 and were licensed to practice in Florida in 1996 or before. Such physicians are included in the analysis from the 5th quarter onwards (i.e. 1st quarter of 1998). This again ensures that we include those physicians in the at-risk category who have practiced for a substantial period in Florida and who we can observe for a continued period of time before they decide to change practice pattern. Analogous to the ASC joining definition, physicians who do not treat at least 30 patients in any of the observation quarters are considered Non-Joiners and their decision to join an ASC is assumed to be censored at the end of 2008. Physicians who retire or decease before the end of 2008, their decision to join an ASC is also censored. Further, physicians who do not reside in Florida anymore are excluded from the analysis. This exclusion decision helps us take into account the impact of physician distance to hospitals and ASCs on practice setting decisions. Since we are using individual level behavioral data, there are a few physician cases where the practice information is somewhat scattered over time with considerably large periods of time that the physician was missing from the data. This could happen because a physician moved to another state and returned after a long period, or because she decided to get post graduate training in a particular specialty or for simple reasons like taking a sabbatical or going on a long vacation. Observations on such physicians are not included in the analysis. All the above conditions, finally leave us with a total number of 1543 physicians out of which 855 join an ASC at some point during 1998 to 2008.

Using latitude-longitude information, we compute travel distances from the physician's primary address to each of the hospitals and ASCs in Florida using the Euclidean method, also known as the "as the crow flies" method. Having the distances to all facilities helps to account for the opportunity factor behind the move to an ASC. Since physicians are likely to choose practice locations closer to their own address, we control for the number of hospitals and ASCs located, in the previous period, within a small radius of the physician's primary address. Higher number of ASCs or hospitals in close proximity indicate availability of different options to the physician and should increase the probability of a physician moving practice to an ASC or alternatively, choosing primarily a hospital practice over ASC.

The physicians included in our sample are found to be specializing in various medical areas, as shown in figure 2. Roughly one third of the physicians are Internal Medicine specialists who are generally involved with, in our case, procedures in Gastroenterology. Orthopedists form one tenth of the sample while, the next two major specialties are that in the area of Ophthalmology and Urology. Raw data also indicates that physicians specializing in Internal Medicine, Ophthalmology, Orthopedics and Urology are more likely to adopt ASC as a practice location.

7.2. **Physician Quality and Hospital Safety Measures.** There are two categories of quality measures that we are interested in. First is an indicator of physician quality while the second is of hospital quality. The underlying hypothesis, as stated before, is that high quality physicians should be more inclined to disassociate themselves from quality problems at the hospitals. Even if that's not the case, it is still likely that high quality physicians have an incentive to move to an ASC and achieve a tighter control on their own practice as well as a direct control on patient safety and facility environment. Further, physicians irrespective of their own quality, when working at low quality hospitals have it in their interest to move practice to an ASC to protect self reputation and to capitalize on the profit opportunity that exists in the form of poor performing hospitals.

There is no general consensus in literature on the best method to measure physician quality. In case of major inpatient procedures and surgeries, patient outcome data can be used to construct procedure specific measures on physician quality, for instance, use of beta blockers for cardiac patients or use of DVT prophylaxis for stroke rehabilitation patients (CMS.gov, 2011). Such measures, however, cannot be aggregated in a useful way to indicate overall physician quality. A few of the major health insurers like, Aetna and United publish basic physician rankings but detailed information is neither easy to come by nor can it be compiled in a way to cover a complete roster of

physicians practicing within a state. Hence, in this paper, we apply a set of physician specific measures that together indicate various dimensions of physician quality. Following Burke et al. (2007), we first create a 'star' physician indicator. A 'star' physician is a medical doctor who completed her most recent post graduate training (residency or fellowship) at a top 30 medical school. The definition of a top 30 school is based on both NIH research funding (ResidentPhysician.com (2005)) as well as the US News & Health Report (2005 & 2010) and is different by physician's medical specialty. A physician is recorded as a 'star' if her medical school was among the top 30 in any of the three listed ranking systems. Alternatively, a highly selective ranking is also used to define a good quality physician and is based on US News & Health Report's honor roll system. Under this system 14 medical schools nationwide are considered to be top schools across all major medical specialties. Although US News & Health Report measures of hospital quality are widely accepted in the health care industry and are scientifically constructed[6], it is still impossible to be completely objective about measuring individual physician quality based on the ranking of the residency hospital. Similar problems will exist with any method used to measure individual physician quality in a precise manner. So for the robustness of our analysis, we include another alternative measure of physician quality that relies on top quality doctor reports published by 'Castle Connolly'. (Talk about Castle Connolly measures and how they are constructed)

Besides the 'star' physician measure, we control for three more measures. First, is an indicator for board certification (Based on American Board of Medical Specialties (ABMS)) in physician's primary specialty. Brennan et al. (2004) point out the importance of certification in the entire quality movement. They focus on the empirical evidence that shows validity of board certification and the close relationship of certification examination scores with measures of physician competence and clinical outcomes. They also highlight the results of a Gallup poll that demonstrated that certification and its maintenance by the physician is highly valued by general public. The measure, however, is somewhat problematic in our case as among the selected physician sample a large proportion of physicians are board certified and therefore, there may not be enough variation in the measure to yield reliable results. Second measure relies on the number of hospital medical staff privileges held by the physician as a signifier of physician quality. The underlying hypothesis is that high quality physicians in a community are more likely to be in demand at different hospitals and may also find it easier to be accepted for staff position across different hospital medical boards. Staff privileges are considered to be a good indicator of physician quality due to the process involved in getting staff

[6]Methodology for constructing these measures is available on the website of RTI International, the research company that builds these measures.

privileges. Generally, a physician seeking staff privileges at a hospital needs to make an application to the board after which a credentialing committee takes into account various qualifications of the physician before granting her request. For instance, a hospital board is likely to judge an applicant using board certifications, recommendations, state licensure, residency training etc. (Marshall et al. (2002)). Finally, we also include a measure of physician's publication record constructed using Web of Science database. Although, this measure also indicates physician quality, it is more directly related to a physician's research skills and physicians who have faculty appointments are more likely to produce a higher number of publications. As a result, physicians with faculty appointments and a high number of publications may actually be less likely to move practice and lack the incentive to invest in an ASC or to practice at one. To correct for this behavior, we include in our analysis the number of publications by physicians who do not have any faculty appointments as a measure of quality.

Next, we need hospital level quality measures that vary with time. We rely on AHRQ measures on patient safety. According to AHRQ guide on patient safety indicators (AHRQ (2003)), patient safety is an alternative measure of hospital quality that is concerned with measuring the risk-adjusted incidence of potentially preventable complications that result from patient exposure to health care system. The measure is different from AHRQ provided inpatient quality measures as those measures are focused on inpatient outcomes of mortality as well as utilization of procedures at the hospital while, the safety measures are more general in nature and apply to the overall culture of safety at a hospital. Safety complications take place due to poor medical management at the hospital and not due to the underlying medical condition of the patient and therefore, measures focusing on safety are much more likely to have a direct relation with physician's decision to set up practice.

Using the AHRQ, patient safety indexes (PSIs), we construct two aggregate level hospital safety safety measures - the nursing safety and surgery safety indexes. Following closely the methods detailed in Encinosa and Bernard (2005) and Bazzoli et al. (2008), we compute risk-adjusted Patient Safety Indexes[7] (PSIs). The Florida hospital inpatient data file includes all patient discharges with a major surgery diagnosis-related group (DRG). The AHRQ-provided algorithm uses this data for computing the safety indexes. These indexes track the occurrence of adverse events and focus on conditions and complications experienced by patients during their hospital stay. Using the PSIs, we

[7]Risk adjustment is based on computed hospital fixed effects. First, using logistic model predicted value of complications is calculated for each discharge and then subtracted from the actual outcome. Then, this difference is averaged over each hospital to get the risk adjusted rate.

construct, by year and by hospital, two aggregate measures of patient safety over all major surgery discharges. The first measure, surgery safety index, consists of nine PSIs that are most closely related to the actual surgery, while largely independent of post-operative nursing care. These include complications in anesthesia, postoperative hemorrhage or hematoma, postoperative hip fracture, postoperative physiologic and metabolic derangements, postoperative pulmonary embolism or DVT, postoperative respiratory failure, postoperative sepsis, postoperative wound dehiscence and finally, accidental puncture or laceration. The second measure, nursing safety index, is constructed from three PSI indicators previously recognized as related to the nursing activity - post operative hip fracture, decubitus ulcer, and selected infections due to medical care.[8]

These two measures distinguish nursing and surgery as sources of adverse events in hospital, and may produce different effects in the model. Further, as in Bazzoli et al. (2008) we construct aggregate nursing and surgery complication rates. After computing the individual PSIs we subtract from each hospital's rate the overall average rate, for the same PSI, of hospitals in the Florida data set.[9] This gives us a measure of excess number of incidents that took place in the hospital. Finally, we weight each of these excess measures (as mentioned above, 9 for surgery and 3 for nursing) by the proportion of patients at risk for the indicator. To illustrate for the case of the nursing indexes, first, the excess measure for each of the three nursing PSIs is weighted by the number of patients at risk at the hospital. These weighted excess measures are then summed up and divided by the total number of patients at risk for all 3 nursing related PSIs.

7.3. **Physician Ownership Data and Other Key Variables.** Besides the patient level data and physician profile data, we also obtained ASC licensure files from AHCA that contain important details on the ASC management, address, profit status, controlling interest[10] owners and their names, and names of corporate owners in case of joint ventures. Licensure files also contain information on the closest hospital that the ASC has an agreement with to send patients requiring emergency inpatient care. Any changes in the facility ownership are also accounted for with the help of these files as ASC owners need to renew the license every two years.

The major difficulty, however, in using information from licensure files is that there are approximately 400 ASCs in Florida and each has multiple file submissions, over the years, which are saved as digital documents that need to be perused and required information has to be extracted

[8] As explained in Bazzoli et al. (2008), postoperative hip fracture is used in both type of indicators as it can occur because of either nursing or surgery errors.

[9] Only those individual PSIs are used for which the population at risk was at least equal to 30 patients at the hospital.

[10] AHCA defines controlling interest owners as any owners with greater than or equal to 5% share in the organization

manually. The main variable of interest in the licensure files is physician owner identity and ownership share. The owner identity is easier to track in case of specialty ASCs that are smaller in size and are in general owned by fewer physicians. We find that multi-specialty ASCs are often owned by large groups of physicians or groups of physicians in joint venture with corporations like HCA, Health South, Surgical Care Affiliates etc. Some of the multi-specialty ASCs are also owned by hospitals. The structure of corporate owned multi-specialty ASCs is such that the corporation owns more than 50% interest in the ASC and rest is shared by on average 40-50 physicians who all also practice at the Asc. There is some fluidity in physician ownership at such ASCs as we observed some of the owners leaving after 2-3 years at the ASC which makes it even more difficult to keep track of owner identity. However, it is safe to assume that any physician who is practicing at a major corporation owned ASC, also owns a small ownership interest in the ASC and is in all probability a less than 5% shareholder (i.e. not a controlling interest owner). There are some other corporations too that are quite active in Florida market and these are - AmSurg, Symbion and Novamed. These corporations are more likely to be owning specialty ASCs in joint ventures with a few physicians. For instance, AmSurg tends to partner with 5-6 physicians at a time with established practices. In such venture, we found AmSurg to be owning 51% interest while rest is generally divided equally among physician owners. Novamed on the other hand tends to specializes in eye surgery centers while, Symbion's interests span over both specialty and multi-specialty ASCs. In some cases, we also ascertain owner identity using annual reports submitted to the state department of Florida. The department requires annual reporting by all organizations in Florida and the information is available to the general public through state's website.

Using the licensure files, we are able to track approximately 1800 physician owners who have a controlling interest. These numbers further come down when we apply other conditions listed previously in the section **??**. The physician owner names have to be searched on the state department's website to identify ME license numbers which then are linked with the patient level data for empirical analysis.

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