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Effects of Physician-Hospital Integration on Malpractice Claims

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by

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Abstract

Recent increases in physician-hospital (i.e., vertical) integration has spurred both opposition on the grounds of anti-trust concerns and support on the basis of lowering transaction costs and improving communication. This paper examines the effects of vertical integration on quality of care as measured by malpractice claims.The study employs four data sets from the state of Florida (FL AHCA Financial Data, AHA Survey Data, FL AHCA Discharge Data, and FL Malpractice Claims from the Office of Insurance Regulation) culminating in an unbalanced panel dataset for the years 1998 to 2013. I utilize a linear model with hospital and year fixed effects as a well as a negative binomial model with hospital and year fixed effects. I find that vertically integrated hospitals have 7% fewer claims per year as compared to hospitals that are not vertically integrated. In addition, vertically integrated hospitals see a decline of about $522,000 in costs associated with malpractice claims per year. These results provide support for previous literature that finds vertical integration improves communication among health care providers, thereby avoiding events that lead to malpractice suits. In addition, these results indicate that vertical integration stands to benefit both patients (through fewer claims and improved quality of care) as well as hospitals (through a decline in claims and costs).

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1 Introduction

Physician-hospital integration is defined as an "ownership relationship" between hospitals and physician practices as opposed to a "contractual relationship" [Baker et al (2014)]. Physician-hospital integration appeared in the 1980s and 1990s as a response to rising health care costs and as "a response to rapidly expanding managed care health insurance" [Cuellar et al (2006)]. "Mergers, acquisitions, internal restructuring, and new inter-organizational relationships occurred at a record pace" [Bazzoli (2004)] at that time. Managed care plans contract with selected physicians, hospitals, and other health care providers. The rise of managed care plans made it financially sensible for both physicians and hospitals to form close knit relationships - partnership allowed for greater bargaining power. As explained by Berenson, "Hospitals and physicians... realized that by working more closely together, they could acquire managed care contracts and sometimes accept and manage financial risk" [Berenson (2017)]. Changes in compensation structure led not only to the development of physician-hospital integration, but also to the formation of other integrated systems such as "management services organizations (MSOs), foundations, and integrated healthcare organizations (IHOs)" [Morrisey (1996)].

Although the late 1990s experienced rapid increase in integration, integration decreased drastically by the turn of the century. As explained by Martin Gaynor, "Integration between hospitals and physician practices peaked in 1996 at approximately 40% of all hospitals, and declined thereafter" [Gaynor (2006)]. Integration between hospitals and physicians picked up again around the mid-2000s. A study with hospital data from 240 metropolitan statistical areas (MSAs) found that physician-hospital integration "increased from 2008 to 2012 by a mean of 3.3 percentage points" [Neprash (2015)].

Rising administrative costs, spikes in emergency room utilization coupled with spikes in uncompensated care, and the malpractice crisis of the early 2000s lead to sky rocketing hospital costs. It seems intuitive that rising health care costs followed

with an increase in vertical integration. In comparing American and Canadian medical spending, Cutler and colleagues (2011) find that spending is "$1,589 per capita higher - that is, 120 percent higher - in the United States than in Canada" [Cutler (2011)]. As explained in the paper, this difference can be attributed to "44 percent more administrative staff in the U.S. healthcare system than in the Canadian system" [Cutler (2011)]. If vertical integration allows physicians and hospitals to cut down on administrative costs, it seems rational that providers would explore integration as a cost saving option.

Although, vertical integration features consolidation of services and, therefore, increases in market share of a given hospital/organization, the benefits associated with vertical integration may outweigh competition concerns. In this paper, I exploit variation in hospital adoption of integration to examine the effects of physician-hospital integration on health outcomes and quality of care as measured by prevalence of malpractice claims.

This paper proceeds as follows: First, I discuss results and implications from previous literature, both for and against vertical integration. Next, I describe the steps and data sets used to construct the final unbalanced panel data set. Then I discuss the model and covariates used in analysis. Then I proceed to discuss results. I conclude with an overview of limitations and discussion of result implications.

2 Literature Review

2.1 Prices and Spending

Literature against the integration of physicians and hospitals presents evidence of reduced competition and increased prices. In a study with data from the American Hospital Association (AHA) Survey and 2.1 million claims from Truven Analytics MarketScan, Baker, Bundorf, and Kessler have found that a one-standard deviation increase in the market share of vertically-integrated hospitals is associated with an increase in prices of 3.2 percent [Baker et. al 2014]. Among the explanations discussed

for observing such an effect is the ability to "bundle services", thereby pressuring insurance companies to pay higher prices for the same services. The higher prices charged to insurance companies can be carried over to the individual, manifesting as higher prices for insurance premiums for individuals. Another study, with data on 7, 391,335 nonelderly enrollees, concluded that vertical integration is associated "with a mean increase of $75 (95% CI,$38-$113) per enrollee in annual outpatient spending (P¡0.001) from 2008 to 2012... This increase in outpatient spending was driven almost entirely by price increases because associated changes in utilization were minimal" [Neprash (2015)]. Furthermore, Cuellar and Gertler have also found that vertical integration "is associated with an increase in prices, especially when the integrated organization is exclusive and occurs in less competitive markets" [Cuellar (2006)].

Although most literature argues that vertical integration has shown to increase prices, other literature presents support for lowering prices. For example, another study, which uses Medicare data, physician integration data from SKA, and American Hospital Association survey data, finds that having "an integrated PCP does not increase health care spending" [Wagner (2016)]. Another study with data from California for the years 1994-2001 finds that "Integration among rural hospitals is associated with large price decreases" [Ciliberto (2006)]. However, the authors admit that the pool of rural hospitals in their sample is small. When using the entire dataset, they "find that neither integration nor disintegration was associated with significant changes in prices" [Ciliberto (2006)].

2.2 Transaction Costs

Advocacy for or against vertical integration also considers the relationship between vertical integration and transaction costs. Transaction costs are costs associated with the coordination between different providers in the health care delivery system. This includes negotiating contracts, monitoring, and enforcing agreements [Robinson (1996)].

Literature that supports vertical integration finds that it decreases transaction costs. Literature against vertical integration has shown that decreases in inter-market

transaction costs are supplanted with increased costs from intra-market transactions. For example, in a study comprised of interviews with physicians and hospital administrators, monitoring, coordination, and cooperation costs are new transaction costs associated with the structural change [Cho (2015)]. In addition, another paper has asserted that there is "little if any gain in shifting the transaction costs of negotiating, monitoring, and enforcing agreements from the external market to the internal pseudomarket" [Robinson et. al (1996)].

2.3 Health Outcomes

An additional argument prevalent in literature against physician-hospital integration rests on the premise that integration not only increases spending and prices, but that it also does not improve health outcomes as theoretically expected. Observing the impact of physician-hospital affiliations on "the treatment of Medicare patients with a diagnosis of acute myocardial infarction admitted to general medical-surgical hospitals between 1994 and 1998" reveals that integration is associated with higher prices, "while little evidence exists that hospital–physician affiliations in the aggregate have... any measurable impact on patient treatment or outcomes" [Madison (2004)].

However, as additional literature on this topic emerges, so too does more support for vertical integration as improving health outcomes. In the paper ""Effect of physician-hospital financial integration on health outcomes and spending", the author observes the impact of having an integrated primary care physician on the following health outcomes: "death, an unplanned hospital admission, and an appropriate emergency department visit" [Wagner (2016)]. The sample of patients in the study have conditions for which preventative care, such as PCP visits, should diminish the need for hospital care. As explained in the paper, these conditions are referred to as "ambulatory care sensitive chronic conditions" (ACSCCs). The study concludes the following: "having an integrated primary care physician (PCP) does not significantly affect average mortality risk, but does reduce the risk of less severe adverse health outcomes attributable to conditions that are treatable in primary care settings" [Wagner (2016)].

In addition, older studies on the effect of integration on health outcomes lacked crucial additional data that may have severely biased results. The paper referenced directly above used better and broader data as compared to other literature, which had reached conclusions of no effect on health outcomes. In fact, Wagner directly cited the paper by Madison (2004) as lacking adequate information on physician practices. Furthermore, other literature considered only inpatient data in analysis, while Wagner included information for patients from inpatient facilities as well as "outpatient facilities, ... skilled nursing facilities, and physician office settings" [Wagner (2016)].

2.4 Quality Improvement Mechanisms

Physician-hospital integration is thought to improve quality of care (and health outcomes) via several mechanisms such as better care coordination and improved communication, shared electronic medical records (EMRs), and realigned physician incentives. When coordination and communication between physicians and hospitals is fragmented, patients are more likely to receive conflicting treatment plans that can impede progress in health status at best, and incite adverse events at worst. Using data from a survey of 253 clinicians for about "1,614 patient visits between May and December 2003", Smith and others have found that clinicians "reported missing clinical information in 13.6% of visits; missing information [for] laboratory results (6.1% of all visits), ... radiology results (3.8%), history and physical examination (3.7%), and medications (3.2%)" [Smith (2005)]. Better coordination and communication can improve health outcomes by reducing excessive test duplication. Reducing the unnecessary repetition of the same exams for a single patient can improve health outcomes because some tests, such as radiology tests, can have dangerous side effects, such as radiation poisoning. Furthermore, test errors of type II (false positive) can lead to unnecessary additional testing and emotional damage.

EMRs can further aid communication and coordination between providers by providing an easily accessible platform where patient information can be shared between participating facilities. In fact, integrated hospitals are more likely to use health IT

[Lammers (2013)] than nonintegrated hospitals. Since physician-hospital integration consolidates physicians and hospitals into a single system, integrated physicians and integrated hospitals share EMRs. Shared EMRs can improve quality of care by reducing complications and deaths from events such as adverse drug interactions.

Additionally, integration can improve quality of care by augmenting the physician role to lean more towards medical provider rather than entrepreneur. As further explained by Wagner, "shifting the 'business aspects' of a physician practice to a hospital may allow physicians to specialize in patient care, which could result in higher quality primary care" [Wagner (2016)]. Hospital ownership of physician practices removes administrative concerns, which allows physicians to devote more time and effort to patients. In addition, if physician salaries are fixed, physicians no longer have the incentive to see many patients as fast as possible. "Physicians as entrepreneurs stand to capture the full financial benefit of activities in their practice, unlike physicians who are employees" [Wagner (2016)].

2.5 Quality of Care and Malpractice Claims

Literature on the relationship between malpractice claims and quality of care predominately discusses this topic in the context of how malpractice liability impacts physician behavior and delivery systems rather than in the context of how malpractice damages patients directly. For example, Baicker and Chandra examine the impact of malpractice costs on the size of the physician workforce. They find that "malpractice payments made on behalf of physicians... may deter marginal entry, increase marginal exit, and reduce the rural physician workforce" [Baicker (2005)]. Reduction in the supply of physicians, while demand remains the same, can negativity impact quality of care by increasing waiting times.

Brook and colleagues posit three channels through which malpractice claims can impact quality of care, albeit the first two of these three channels also do not reflect implications of actual damages on quality of care. The three channels are the following: premium differentials, sanctions against a health care provider facility; and damage to

"the physician-patient relationship" [Brook (1975)].

Another paper examines a more direct effect of malpractice claims on quality of care rather than on physician workforce size and physician malpractice premiums. Safety is among the six domains of health care quality reported by the Agency for Healthcare Research and Quality (AHRQ). This safety domain is described as "Avoiding harm to patients from the care that is intended to help them" (AHRQ 2018). Negligence is a violation of patient safety. Therefore, the malpractice claims filed in response to negligence are indicators of safety violation. Using Patient Safety Indicators from the AHRQ for rates of 17 adverse events for Florida and Texas, revealed "a strong association between PSI rates and malpractice claim rates" [Black 2015]. This implies that "hospitals that improve patient safety can reduce malpractice payouts" [Black 2015]. Improvement of Patient Safety Indicators can happen via the quality improvement mechanisms of integration discussed above (such as care coordination and communication).

3 Data

3.1 Data Description

This study draws from four different datasets. The end goal is an unbalanced panel dataset of hospitals from 1998 to 2013 with information on the integration status and the total count of claims for each hospital in each year. The data on malpractice claims is downloaded from the Florida Office of Insurance Regulation [1]. This dataset contains claims of two types, those against physicians working in hospitals and those against hospitals directly. In order to merge the malpractice claims data with the vertical integration data, both must contain a Medicare number corresponding either to the hospital in which the sued physician works or to the sued hospital itself.

The vertical integration data from the AHA Survey contains a plethora of binary variables for several integration types. However, I follow the definitions from Baker et

[1] https://apps.fldfs.com/PLCR/Search/MPLClaim.aspx

al. (2014) and focus on the following four integration types: fully integrated organizations, closed physician-hospital organizations, open physician-hospital organizations, and independent practice. The primary integration type of interest in this paper is "fully integrated organizations." Observing the integration data in detail reveals many missing values for any type of integration, largely because hospitals do not respond to the AHA survey every year. Given this data limitation, I imputed integration types based on hospital responses in the preceding and succeeding years to fill in the missing values. For example, if a hospital had indicated that it was not fully integrated (vertically-integrated) in 2011 and in 2016 and if this hospital was also missing a response for any integration type for the years in between, then a value of 0 was imputed for those intermediate years (2012 to 2015). After combining integration data for years 1998 to 2013, imputing, and de-duplicating values, the data set yields 3,588 observations. After combining the FL AHCA financial data for all years (1998 to 2013) and de-duplicating values, the data set yields 4,637 observations.

In the malpractice data, the variable "InsuredLicenseNumber" provides the state license numbers for malpractice claims against physicians. Claims with missing values for this variable are claims against hospitals (or other types of health care facilities). The malpractice data set does not contain the facility number or the Medicare number needed to merge with the survey data on vertical integration. For this reason, I separated the claims with and without "InsuredLicenseNumber". Next, my advisor and I used the FL AHCA patient discharge data to find out where physicians worked. The FL AHCA patient discharge data contains the universe of inpatient visits and ambulatory surgery center (ASCs) visits in Florida, and every record contains an attending physician license number corresponding to the physician who provided services. My advisor merged the malpractice claims against physicians with the FL AHCA discharge data, and then collapsed the data to the hospital-year level. The resulting data set contained the number of malpractice claims against physicians working in each hospital in each year. Then I merged the hospital-year data set with the FL AHCA hospital financial data using facility numbers to obtain each hospital's Medicare number. Then

the data set with claims against physicians contained the Medicare numbers for all hospitals. Hospitals with no claims were not dropped from the merge, but were instead kept to include the entire universe of hospitals in Florida. The resulting dataset contained 3,245 observations (this is not the same as total count of claims) and was then merged with the vertical integration data from the AHA Survey, culminating with 2,879 observations. Chart 1 details the changes in the number of observations after keeping only claims with license numbers, applying restrictions, and merging.

Claims against medical facilities (claims missing physician license numbers) could not be merged to the FL AHCA patient discharge data. Instead, this group of claims required imputation of facility numbers by hand. Ambulatory surgery centers (ASC) and hospital inpatient (IP) lists taken from the AHCA provide yearly data including facility number and facility name. The variable "InsuredName" in the malpractice dataset includes the name of the hospital/surgery center. Imputing by hand required matching the hospital name listed under "InsuredName" with the name listed in the ASC/IP list. To make merging with the FL AHCA hospital financial data and AHA survey data possible, the dataset with claims against hospitals was collapsed by facility number and year. After collapsing, the total number of observations decreased to 2,216; however, the total number of claims was still 11,442. The claims with imputed facility numbers were then merged with the FL AHCA hospital financial data using facility number and year to obtain the corresponding Medicare number. Finally, merging with the AHA Survey data left 6,136 total claims and 1,027 observations. The malpractice claims that were dropped from the sample were claims against facilities other than hospitals (e.g., physician practices, clinics, etc.) Chart 2 summarizes the changes in observations and count of claims after applying restrictions, imputing data, and merging.

After conducting the appropriate merges to obtain the Medicare number for each group of malpractice claims, the two groups of claims were merged together to comprise a complete set of malpractice claims against both physicians and hospitals. Combining the two data sets yields a total of 2,929 hospital-year observations. This dataset con-

tains the entire universe of hospitals, meaning that some hospitals may have 0 claims for both types. Additionally, some hospitals may have only claims against hospitals directly or only claims against physicians. When constructing the variable for total claims, I added the two types of claims together for each hospital in each year.

3.2 Data Statistics

Table 1 includes descriptive statistics on the dependent and independent variables used in the analysis. As mentioned previously, all outcome variables are derived from malpractice claims downloaded from the Florida Office of Insurance Regulation. Information on hospital integration status and the number of hospital beds comes from the AHA Survey. Information on patient race is derived from the FL AHCA discharge data. About 18% of hospitals in the sample from 1998 to 2013 were vertically integrated.

Percent of each race type is calculated by dividing the count of each race type by the total number of inpatient and outpatient visits to the hospital in a given year. The averages reported for %White Patients, %Black Patients, %Hispanic Patients, and %Other Race Patients in Table 1 indicate the average share of each race type in the entire sample from 1998 to 2013. The shares are consistent with race shares reported by the US Census Bureau for Florida. The majority of patients in the sample are white (73%). Black, Hispanic, and Other race types constitute the remaining share, 13%, 11%, and 3% respectively.

The average number of claims against physicians, claims against hospitals, and total claims for vertically integrated hospitals is 15, 3, and 18 respectively. The average number of claims against physicians, claims against hospitals, and total claims for non-integrated hospitals is 13, 2, and 15 respectively. Although higher claim averages for vertically integrated hospitals may initially seem counter intuitive to the results of this paper, hospitals that vertically integrated may have been larger, and hence more likely to have claims because they treat more patients.

4 Methodology

The study utilized a linear model with entity and time fixed effects and a negative binomial model with entity and time fixed effects to examine the effects of vertical integration on malpractice claims. Outcome variables include the count of claims, cost of claims, and claims of different severity type. Independent variables include a binary variable indicating whether the hospital is vertically integrated in a given year, the number of hospital beds at a hospital in a given year, and percent of visits by patients of different races by hospital per year. The following race type categories are included: white, black, and Hispanic. Other race types are excluded and the coefficients on white, black, and Hispanic are interpreted relative to "other race".

The vertical integration variable equals 1 if a hospital is vertically integrated in a given year, and 0 otherwise. Larger hospitals may receive more claims and may have higher costs associated with claims because they receive a larger influx of patients. To control for hospital size, I included the count of hospital beds for each hospital in each year. I divide the count of hospital beds by 100 to ease interpretation of the associated coefficient. Other characteristics of hospitals can also impact the count, cost, and types of claims that hospitals receive. Excluding these characteristics from the model results in omitted variable bias. However, if these characteristics are constant within hospitals over time, then using entity fixed effects should difference out the unobserved effects. This should reduce omitted variable bias.

Similarly, including time fixed effects should control for omitted variables that change over time, but are common to all hospitals. For example, in 2003 the governor of Florida, Jeb Bush, signed a bill aimed at reducing medical malpractice costs. This bill placed a cap on the amount that plaintiffs can sue for in a malpractice case. Excluding variables related to this bill can result in omitted variable bias. However, since this bill applied to the entire state of Florida, it should have impacted all hospitals in the same way. Therefore, including year fixed effects ought to reduce omitted variable bias from these types of policy changes. Figure 1 plots the average cost of

total claims per hospital per year. The average cost of total claims peaks around the year 2000 and then begins to decline around the time the bill took effect. This presents further support for including year fixed effects into the model.

Although this study is aggregated to the hospital level, the types of patients that sort into each hospital may vary demographically. Therefore, the likelihood that a claim is filed at each hospital for the same type of negligence may vary. In addition, the likelihood for negligence to occur in the first place may vary for patients with different conditions; patients with more problematic conditions and patients that require riskier procedures are more likely to experience a complication. Given this, controlling for patient demographics may be important to the model. Other papers have controlled for patient demographics by controlling for patients with certain chronic conditions. Another study that observes the impact of PCP-hospital integration on health outcomes, used "asthma, chronic obstructive pulmonary disease (COPD), diabetes, heart failure, and hypertension" [Wagner (2016)] to control for patient demographics. The FL AHCA discharge data provides Diagnosis Related Group (DRG) codes. DRG codes assign patients to over 500 different groups based on "principal diagnosis, specific secondary diagnoses, procedures, sex and discharge status" (CMS 2016). Therefore, utilizing these codes would be a good way to capture the overall health of patients as well as the likelihood that patients will experience adverse events. In light of previous literature, I attempted to control for the following conditions using associated DRG codes: asthma, chronic obstructive pulmonary disease (COPD), diabetes, heart failure, and hypertension. The count of patients for each DRG code per hospital per year were included as additional controls. Unfortunately, the DRG codes available in the data set are MS-DRG codes, which are specific to Medicare patients only. Since the analysis observes claims for patients with Medicare, Medicaid, private, and other insurance types, only using the MS-DRG codes does not capture the total count of patients in the data set with these conditions. As expected, the counts of patients for each condition per hospital per year are very low. Including variables for counts of each condition (asthma, COPD, diabetes, heart failure, and hypertension) does not

yield significant results nor does the inclusion of these variables significantly change the results of other coefficients. For this reason, MS-DRG code variables are removed from the model as covariates.

Counts of physicians per hospital per year was an additional covariate explored. This variable was included in an attempt to control for hospital size. However, number of hospital beds is a better control for this purpose. Since count of physicians and count of hospital beds per hospital per year are highly correlated, count of physicians was removed from the model.

Other control variables explored include the percentage of visits by patients with different types of insurance. Insurance types included in the FL AHCA discharge data set are the following: Private Insurance, Medicaid, Medicare, Self, and Other. Insurance type captures inherent differences between patients that can influence the outcome variables in this analysis. For example, patients with Medicare are older and are more likely to have co-morbidities as well as more complicated conditions. In addition, patients with private insurance usually have higher socioeconomic status than patients with Medicaid or Medicare. Socioeconomic status can determine capacity to bring a malpractice suit against a physician or a hospital. Therefore, hospitals with larger volumes of patients with payer type "private" may be more likely to generate claims. I convert counts of each payer type into percentages by dividing each count by the total number of inpatient and outpatient visits to the hospital. Coefficients for percentages of each payer type are usually not significant in the model. In addition, payer types are highly correlated with the race variables included in the model. Whites are more likely to have private insurance. Minorities such as blacks and Hispanics have lower incomes on average than whites and are more likely to have the insurance type "Medicaid". To avoid high multicollinearity, I removed the payer type variables from the model.

Figure 2 reveals that the distribution of total claims per hospital around the mean is not the same in each year, indicating heterogeneity in the data. Similarly, Figure 3 sheds light on heterogeneity in total costs associated with claims. To address this, I

specified the robust standard errors option for all models. The linear model with entity and time fixed effects is

$$Y_{it} = \beta_0 + \beta_1 VI_{it} + \beta_2 \#HospitalBeds_{it} + \beta_3 \%WhitePatients_{it} + \beta_4 \%BlackPatients_{it} + \beta_5 \%HispanicPatients_{it} + \gamma_i + \delta_t + U_{it} \quad (1)$$

where Y_{it} is the dependent variable. The indices $_i$ and $_t$ indicate entity and time, respectively. VI_{it} is the independent variable for vertical integration status and β_1 is the coefficient estimate for the impact of vertical integration on the outcome variable. $\%WhitePatients_{it}$, $\%BlackPatients_{it}$, and $\%HispanicPatients_{it}$ indicate the percent of each race type in each hospital in each year. The percent of each race type is multiplied by 10 to interpret the unit change for these variables as 10%. γ_i are the hospital fixed effects. δ_t are the year fixed effects. The form of the mean function for a negative binomial model with entity and time fixed effects is

$$E(Y_i|X_i) = \mu_i = exp(\beta_0 + \beta_1 VI_{it} + \beta_2 \#HospitalBeds_{it} + \beta_3 \%WhitePatients_{it} + \beta_4 \%BlackPatients_{it} + \beta_5 \%HispanicPatients_{it} + \gamma_i + \delta_t) \quad (2)$$

A negative binomial model is an appropriate model for this sample because most of the outcome variables in this study are count data. In addition, the outcome variables are over dispersed (the conditional variance exceeds the conditional mean). For example, observing Figures 2 and 3 clearly shows greater variation in the number and cost of claims as compared to the mean number of claims and costs in each year.

5 Results

Columns 1, 2, and 3 of Table 2 report output from the linear model. Although the coefficients are not statistically significant, the coefficients for vertical integration are consistently negative. Column 4 of Table 2 reports results from a negative binomial estimation. The outcome variable is Total Claims. The coefficient for vertical integration is statistically significant at the 5% level. The results indicate that vertically

integrated hospitals have 7% fewer claims per year as compared to hospitals that are not vertically integrated. As can be seen in Figures 4 and 5, the average total claims per hospital steadily decline after peaking in the year 2000 while the share of vertically integrated hospitals begins to increase around this time.

Table 3 reports the effects of vertical integration on the costs of malpractice claims using the linear model. The outcome variable in Column 1 of Table 3 is Total Cost of Claims. The results indicate that vertically integrated hospitals see a decline of about $522,000 in costs associated with malpractice claims per year. When alternating the outcome variable to the log of the total cost of claims, total cost per visit, and the log of total cost per visit, the coefficient on vertical integration is no longer significant. However, the sign estimates are consistent with the results of Column 1.

Table 4 reports the estimates from regressions on malpractice claims of different severity types. All regressions in this table use a negative binomial model. The coefficient on vertical integration is not significant when regressing on any of the distinct severity types. However, the magnitude of the coefficient on vertical integration is negative, which is consistent with the results of Table 2 and Table 3. In addition, lack of significance when Claims w/Deaths is the dependent variable is consistent with the results Wager (2016) finds when exploring the impact of PCP-integration on mortality.

Coefficients on %Black Patients are significant and negative across all models, except when the outcome variables are Claims Against Hospitals and Claims w/Emotional Damage (Table 2 Column 2 and Table 4 Column 4). Table 2 Column 4 indicates that a 10% increase in visits by black patients decreases the total number of claims by 35%. Table 3 Column 1 indicates that a 10% increase in visits by black patients decreases the cost of claims by about $1.8 million. Increases in the percent of black patients visits to a hospital may cause a significant decrease in claims and costs if black patients are less likely to sue. Differences in socioeconomic status and the corresponding capacity to bring a lawsuit against a hospital may be the mechanism driving this relationship. Patients from lower socioeconomic backgrounds may have less access to, and may be less familiar, with the legal system. Minorities (such as blacks) are more likely to have

a lower socioeconomic status. Therefore, an increase in visits from a population with a smaller likelihood of suing would yield a decline in the number of claims.

The share of vertically integrated hospitals per year (Figure 5) is consistent with the integration trends reported in the literature. Previous literature describes a decline in the prevalence of vertically integrated hospitals in the late 1990s. As can be seen in Figure 5, the share of vertically integrated hospitals in the sample was the lowest in the 1990s and early 2000s (below 10%). Other literature also describes a rapid increase in the prevalence of vertically integrated hospitals in the mid-2000s. As can be seen from Figure 5, the share of integrated hospitals in the sample drastically increases after 2005. Conversely, the average total claims per year (Figure 1) and the average cost of total claims per year (Figure 4) begin to drastically decrease after 2005. This provides additional visual representation for the inverse relationship between integration and malpractice claims suggested in this paper.

6 Limitations

Limitations to consider in this study stem from data issues as well as external policies. Gaps in integration status responses from the AHA survey required the imputation of integration status for several hospitals over several years. Although the method of imputation is consistent with the methods in the literature, the model most likely has high measurement error. If the measurement error is classical, then there may be attenuation bias in the estimates. However, if the measurement error is more complicated or correlated with other time-varying characteristics of hospitals, then the bias in the coefficient estimates is less predictable.

Although I attempted to control for differences in the severity of patients' medical conditions across hospitals, I ultimately was not able to do so due to data limitation and time constraints. If sicker patients sort into integrated hospitals, the impact of integration on outcomes variables may be understated. If instead sicker patients sort into non-integrated hospitals, then the impact of integration on outcomes variables

may be overstated.

In addition, the cap placed on malpractice payouts by Governor Jeb Bush in 2003 may be an additional source for concern. Although including time fixed effects in the model should account for this policy change, the actual impact of the cap may not have impacted all hospitals equally. If the cap impacted larger hospitals more than smaller hospitals and if larger hospitals also receive more claims than smaller hospitals and larger hospitals were more likely to integrate, then the reduction in costs associated with malpractice claims may be falsely attributed to change in physician-hospital integration status rather than the cap.

7 Discussion

The results of this paper indicate an inverse relationship between vertical integration status and the count, as well as the total cost, of malpractice claims. On average, vertically integrated hospitals have 7% fewer claims per year compared to hospitals that are not vertically integrated. In addition, vertically integrated hospitals experience a decline of about $522,000 in costs associated with malpractice claims. Vertical integration can lower the count and costs of claims via the following mechanisms: better care coordination and improved communication, shared EMRs, and realigned physician incentives. As mentioned previously, fragmented or conflicting treatment plans can lead to redundant medical testing. In addition, provider gaps in knowledge can lead to prescribing drugs with severe interactions or contraindications. Excessive medical testing and conflicting prescriptions create opportunities for adverse events to occur, and adverse events that result from negligence can lead to malpractice suits. Physician-hospital integration encourages provider communication because it consolidates physicians and hospitals into a single system. In addition, shared electronic medical records help keep track of recent testing and prescriptions assigned to patients. The coordination improvements brought about by integration decrease the chances for repetitive testing and injuries or deaths from conflicting medications - thereby reducing

the likelihood of events that can lead to a malpractice suit.

The coefficient on vertical integration is consistently negative across all models (except when Claims w/Emotional Damage is the dependent variable). However, the impact of vertical integration on count of claims is only significant when using a negative binomial. The impact of vertical integration on claims against physicians, claims against hospitals, or total claims is not significant when using a linear model. These results indicate that the relationship between integration status and claims is not linear – it seems rational that it would not be. Structural changes associated with physician-hospital integration may decrease malpractice claims only up to a certain point. Hospitals with large quantities of suits may benefit less than hospitals with moderate or low quantities of suits. Most likely, hospitals which experience an overwhelming number of claims every year also have organizational and clinical problems that may not necessarily be easily solved by integrating. In fact, since integration requires even more coordination between providers, and if coordination is already an issue, integration may actually further increase the number of total claims brought against a hospital. Hence, I suspect the relationship between integration and malpractice claims may be parabolic and convex. Further research could test other, possibly more appropriate, models.

As mentioned in the literature review section of this paper, previous literature does not focus on the direct implications of malpractice claims on quality of care, but instead observes impacts on physician premiums and other facets. This paper contributes to the literature with more direct focus on the implications of claims for quality of care. Reduction in malpractice claims implies improvement in the quality of care because it signals a decline in adverse events. As mentioned previously, safety is one of the six components of quality of care, as defined by AHRQ, and Patient Safety Indicator rates provide information on "hospital complications and adverse events" (AHRQ 2018). Black (2015) and colleagues have found "a strong association between PSI rates and malpractice claim rates" [Black (2015)]. If vertical integration reduces adverse events via coordination improvement (and other mechanisms stated above), then integration

should decrease PSI rates, thereby also decreasing malpractice claims.

Although some current literature on vertical integration suggests that transaction costs are not decreased, but are instead shifted elsewhere, results from this paper suggest that decreased costs from malpractice claims may supplant increased intra-market transaction costs. Other literature suggests that there is "little if any gain in shifting the transaction costs" [Robinson et. al 1996], however, if the source of costs carries implications for associated quality of care, then there is gain in shifting transaction costs. If transaction costs associated with internal maintenance are paired with improvements in quality, while transaction costs associated with maintaining external relationships are not, then it may be sensible to shift the cost source. Furthermore, improved quality may improve hospital reputation. This may attract more patients and may increase profits in the long-run.

8 Conclusion

The implications of physician-hospital integration can be positive or negative as seen from the literature. However, this paper focuses on the positive implications, specifically for quality of care. Although vertical integration may increase prices for services, the corresponding benefits from a decline in adverse events and improved quality of care may be worth the cost.

9 Charts

Chart 1: Constructing Dataset with Claims Against Physicians

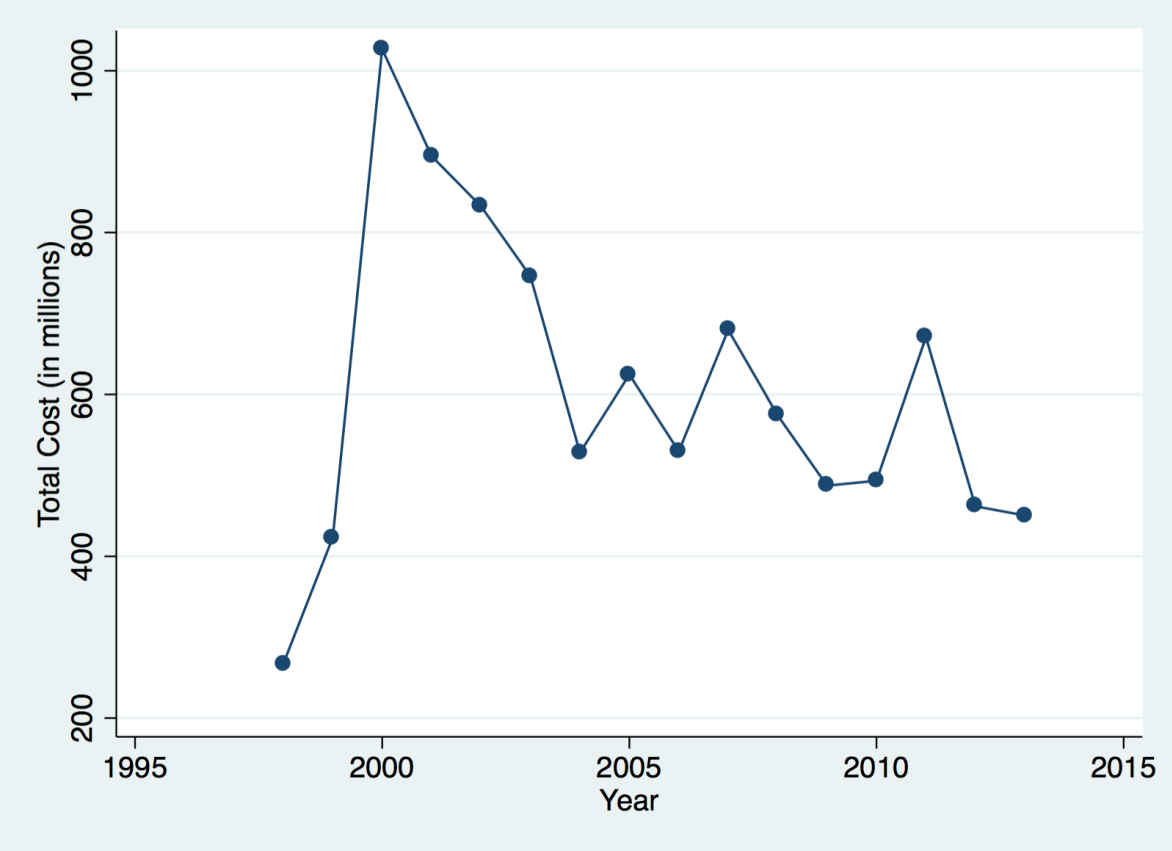
Action	Original	Removed	New
Keep Claims w License Numbers	44,671	18,097	26,574
Keep Claims w ME and OS License Numbers	26,574	4,257	22,317
De-duplicate	22,317	643	21,674
Keep Only 1998 to 2013	21,674	1,352	20,060
Collapse, Merge to Discharge and Financial Data	20,060	NA	3,245
Merge with AHA Survey Data	3,245	563	2,879

Chart 2: Constructing Dataset with Claims Against Hospitals

Action	Original	Removed	New
Keep claims with out License Numbers	44,671	26,574	18,097
De-duplicate	18,097	542	17,555
Keep only 1997 to 2013	17,555	1,696	15,859
Keep Only Claims with Imputation	15,859	4,567	11,342
Collapse by Facility Number and Year	11,342	NA	2,172
Merge with Financial Data	11,342 / 2,172	1,590 / 440	9,779 / 1,732
Merge with AHA Survey Data	9,779 / 1,732	3,719 / 743	6,136 / 1,027

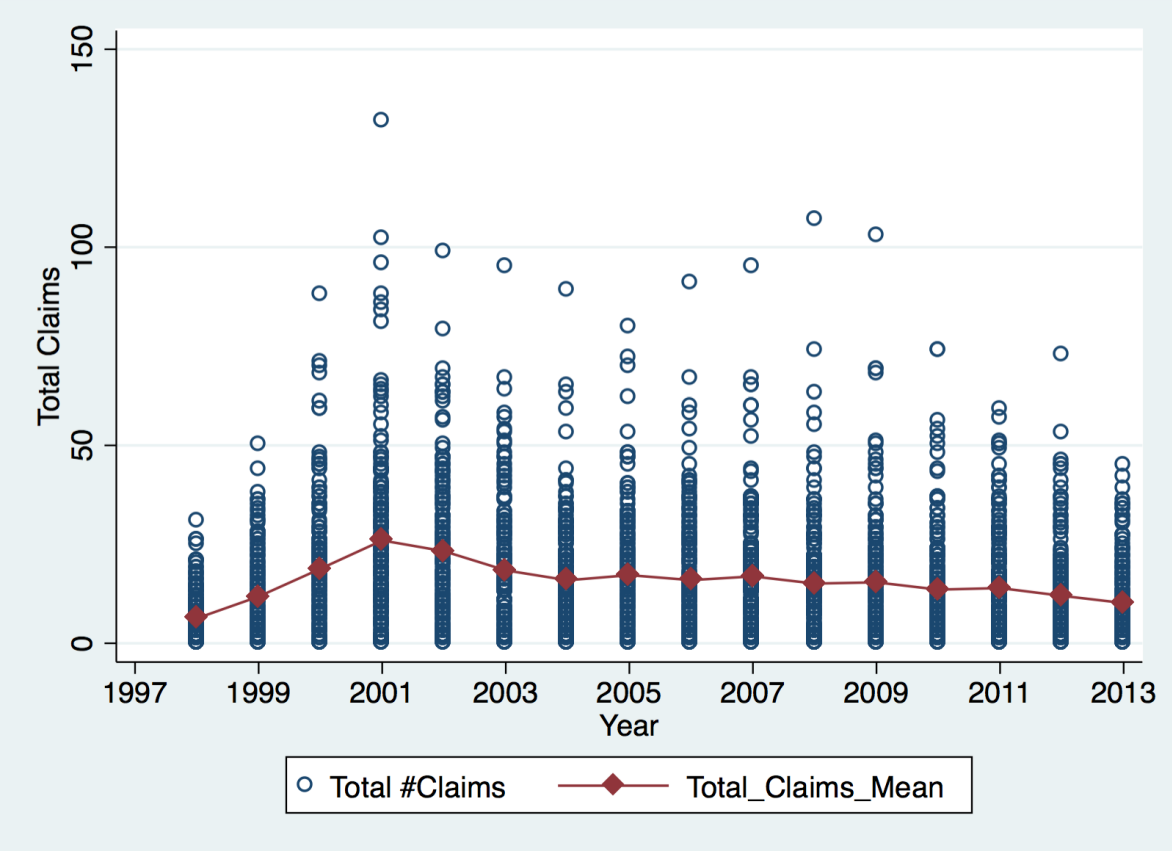
10 Figures

Figure 1: Total Cost per Year



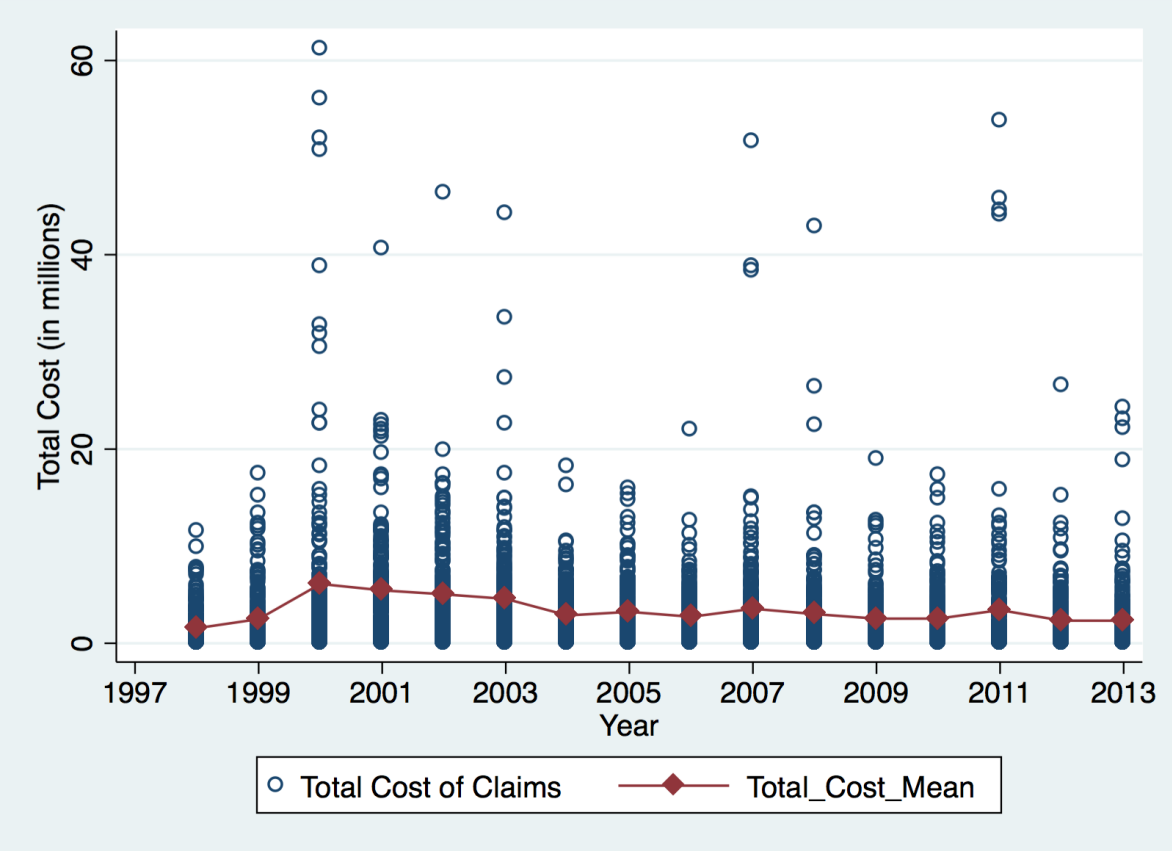
Source: Constructed using FL AHCA Financial Data, AHA Survey Data, FL AHCA Discharge Data, and FL Malpractice Claims from the Office of Insurance Regulation for the years 1998 to 2013.

Figure 2: Heterogeneity in Total Claims



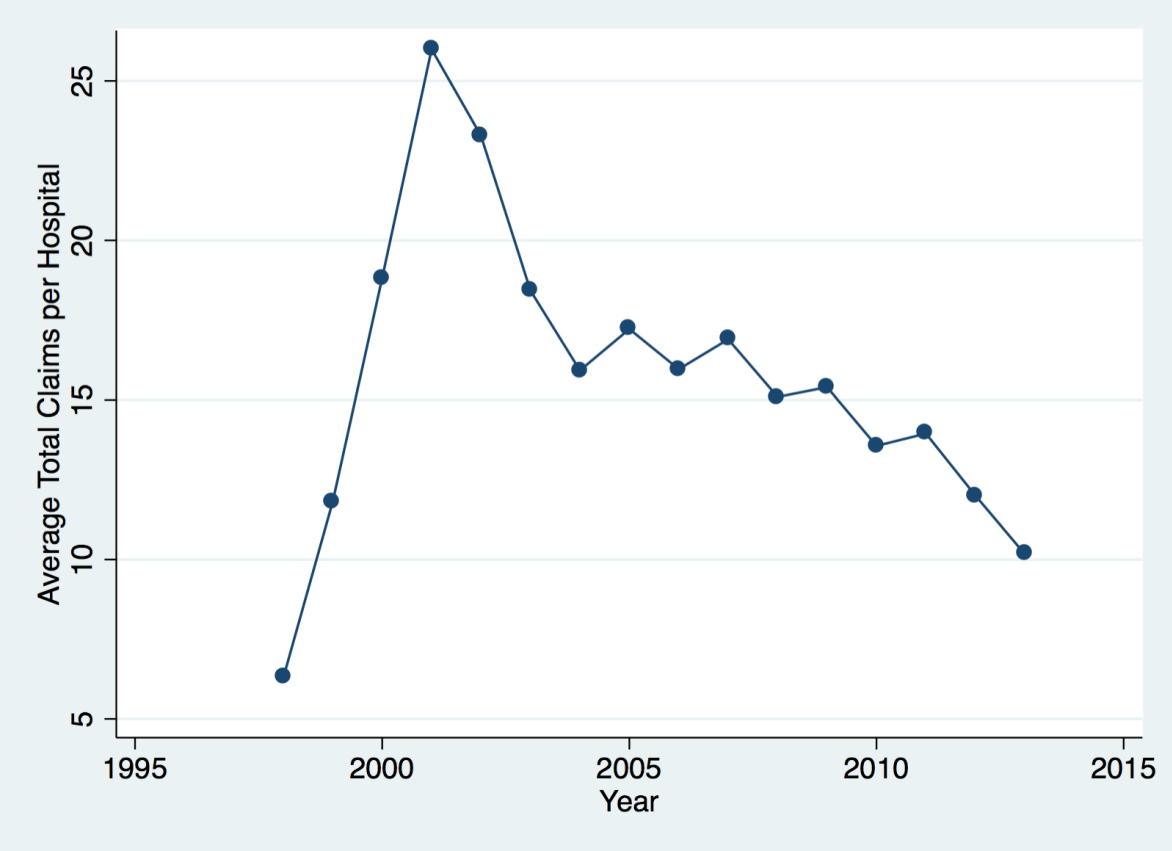
Source: Constructed using FL AHCA Financial Data, AHA Survey Data, FL AHCA Discharge Data, and FL Malpractice Claims from the Office of Insurance Regulation for the years 1998 to 2013.

Figure 3: Heterogeneity in Total Costs of Claims



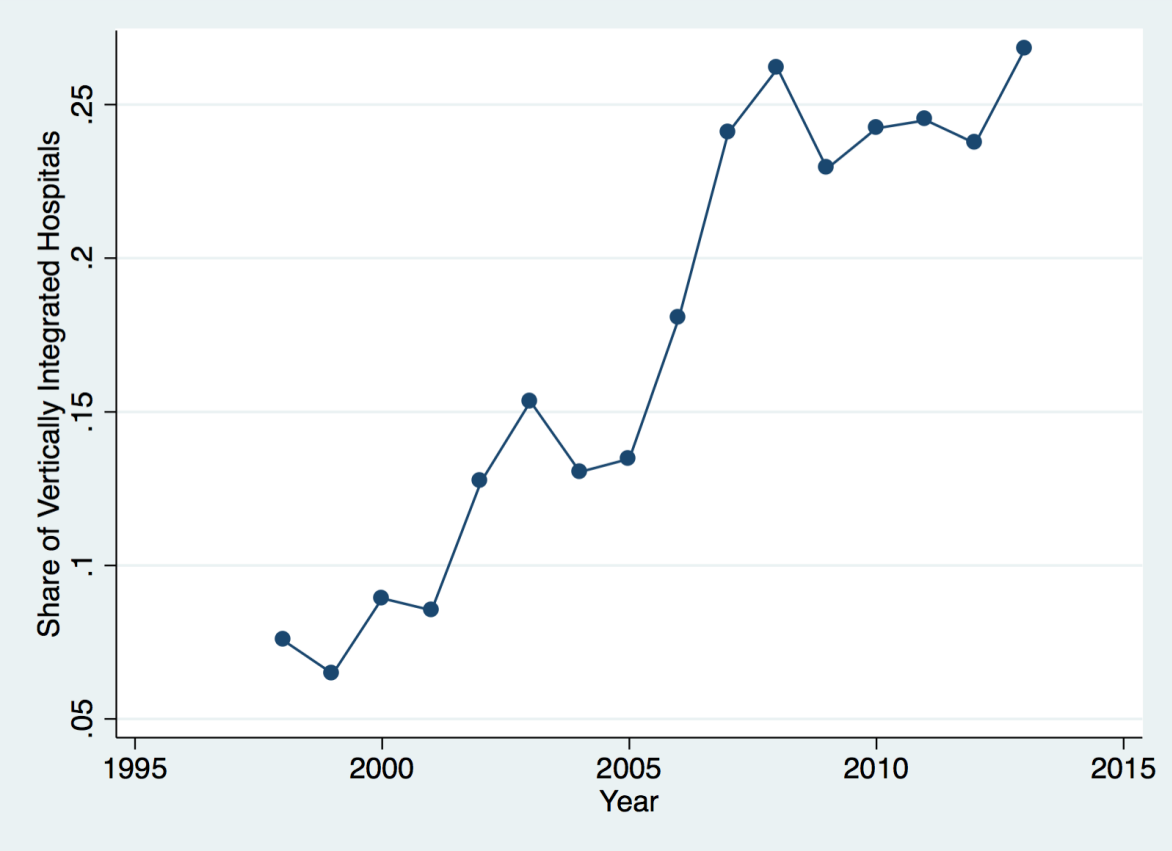
Source: Constructed using FL AHCA Financial Data, AHA Survey Data, FL AHCA Discharge Data, and FL Malpractice Claims from the Office of Insurance Regulation for the years 1998 to 2013.

Figure 4: Average Total Claims per Hospital per Year



Source: Constructed using FL AHCA Financial Data, AHA Survey Data, FL AHCA Discharge Data, and FL Malpractice Claims from the Office of Insurance Regulation for the years 1998 to 2013.

Figure 5: Share of Vertically Integrated Hospitals per Year



Source: Constructed using FL AHCA Financial Data, AHA Survey Data, FL AHCA Discharge Data, and FL Malpractice Claims from the Office of Insurance Regulation for the years 1998 to 2013.

11 Tables

Table 1: Summary Statistics

Outcome Variables	Mean	SD	N
#Physician Claims	13	13	2,929
#Hospital Claims	2	5	2,929
#Total Claims	16	15	2,929
#Claims w/Deaths	6	6	2,929
#Claims w/Major Damage	4	5	2,929
#Claims w/Minor Damage	5	5	2,929
#Claims w/Emotional Damage	1	3	2,929
Total Cost of Claims ($s)	3,289,613	4,888,713	2,929
ln(Total Cost of Claims) (in $s)	13	4	2,929
Total Cost Per Visit ($s)	232	416	2,850
ln(Total Cost Per Visit) (in $s)	5	2	2,850
Control Variables	**Mean**	**SD**	**N**
Vertically Integrated Hospitals	0.18	0.38	2,929
#Hospital Beds	264	269	2,929
%White Patients	0.73	0.22	2,850
%Black Patients	0.13	0.11	2,850
%Hispanic Patients	0.11	0.18	2,850
%Other Race Patients	0.03	0.03	2,850

Table 2: The Effects of Vertical Integration

on the Counts of Malpractice Claims

	(1) Claims Against Physicians	(2) Claims Against Hospitals	(3) Total Claims	(4) Total Claims
VI	-0.57	-0.17	-0.74	-0.07**
	(0.81)	(0.46)	(0.96)	(0.03)
Hospital Beds	-0.23	0.52*	0.29	0.02
	(0.43)	(0.29)	(0.60)	(0.01)
%White Patients	-0.22	-0.20	-0.42	0.002
	(0.34)	(0.21)	(0.36)	(0.02)
%Black Patients	-6.07***	0.86	-5.21***	-0.35***
	(1.36)	(0.56)	(1.52)	(0.05)
%Hispanic Patients	0.27	-0.33	-0.05	0.02
	(0.40)	(0.28)	(0.46)	(0.02)
Year Fixed Effects	Yes	Yes	Yes	Yes
Hospital Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R2	0.33	0.20	0.24	N/A
Observations	2,850	2,850	2,850	2,850

SE in parentheses

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

Source: Estimated using FL AHCA Financial Data, AHA Survey Data, FL AHCA Discharge Data, and FL Malpractice Claims from the Office of Insurance Regulation for the years 1998 to 2013.

Table 3: The Effects of Vertical Integration on the Costs of Malpractice Claims

	(1) Total Cost of Claims	(2) ln(Total Cost of Claims)	(3) Total Cost Per Visit	(4) ln(Total Cost Per Visit)
VI	-527,057**	-0.08	-21.27	-0.10
	(220,517)	(0.08)	(15.03)	(0.08)
Hospital Beds	-337,058**	-0.04	-5.49	-0.06*
	(131,245)	(0.03)	(5.71)	(0.03)
%White Patients	-154,049	0.09	-1.87	0.10*
	(290,968)	(0.07)	(20.57)	(0.05)
%Black Patients	-1,817,662***	-0.39***	-123.09***	-0.40***
	(507,355)	(0.15)	(40.44)	(0.14)
%Hispanic Patients	-482,000	0.04	-26.96	0.03
	(342,084)	(0.06)	(24.02)	(0.05)
Year Fixed Effects	Yes	Yes	Yes	Yes
Hospital Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R2	0.10	0.14	0.05	0.13
Observations	2,850	2,850	2,850	2,850

SE in parentheses

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

Source: Estimated using FL AHCA Financial Data, AHA Survey Data, FL AHCA Discharge Data, and FL Malpractice Claims from the Office of Insurance Regulation for the years 1998 to 2013.

Table 4: The Effects of Vertical Integration on Types of Malpractice Claims

	(1) Claims w/ Deaths	(2) Claims w/ Major Damage	(3) Claims w/ Minor Damage	(4) Claims w/ Emotional Damage
VI	-0.06	-0.07	-0.07	0.01
	(0.04)	(0.04)	(0.04)	(0.12)
Hospital Beds	0.05***	0.01	-0.02	0.04
	(0.02)	(0.02)	(0.02)	(0.04)
%White Patients	-0.05***	0.10	0.02	0.08
	(0.03)	(0.04)	(0.03)	(0.10)
%Black Patients	-0.42***	-0.29***	-0.37***	-0.17
	(0.07)	(0.07)	(0.08)	(0.18)
%Hispanic Patients	0.02	-0.02	0.02	0.10
	(0.03)	(0.04)	(0.02)	(0.09)
Year Fixed Effects	Yes	Yes	Yes	Yes
Hospital Fixed Effects	Yes	Yes	Yes	Yes
Pseudo R2	0.21	0.22	0.23	0.24
Observations	2,850	2,850	2,850	2,850

SE in parentheses

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

Source: Estimated using FL AHCA Financial Data, AHA Survey Data, FL AHCA Discharge Data, and FL Malpractice Claims from the Office of Insurance Regulation for the years 1998 to 2013.

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