Influence and Deterrence:

How Obstetricians Respond to Litigation against Themselves and their Colleagues

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Abstract: The willingness of individuals to engage in a harmful act may be influenced by direct personal experiences and the experiences of others, which can inform individuals about the likely consequences of their actions. In this paper, we examine how obstetricians respond to litigation. It is contended that obstetricians respond to increases in litigiousness by performing more cesarean sections. Using micro data, we examine whether physicians perform more cesareans after they or their colleagues have been contacted about a lawsuit. We observe very small, short-lived increases in cesarean section rates. It does not appear that the recent sharp rise in cesarean section rates is in direct response to litigation.

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I. Introduction

One of the main goals of the legal system is to deter harmful acts, including acts of negligence and criminality. The willingness of individuals to engage in a harmful act may be influenced by many factors, ranging from direct personal experiences (e.g., an individual may have been punished for a harmful act) to experiences of friends, family, colleagues and the larger community. These experiences can inform individuals about the likelihood that they will "get caught" committing a harmful act as well as the subsequent punishment.

The range of factors that might influence the expectation of punishment is reflected in theoretical models of criminal behavior. In seminal work by Becker (1968) and others, the likelihood of punishment does not vary across individuals, but instead varies according the type of crime or the target of crime. For example, in Wilson and Kelling's (1982) broken window theory, individuals infer the probability of arrest in a given neighborhood by examining the level of decay. In Sah (1991), individuals form different assessments of the likelihood of punishment, based on the arrests of others they know. In Lochner (2003), potential criminals are influenced by their own arrest history as well as the experiences of others.

Lochner (2007) reports results of a survey showing that potential criminals' expectations about the probability of arrest are influenced by their own experiences and the experiences of siblings. It is not clear whether potential criminals believe that law

enforcement is tougher or that their own criminal skills are weaker. Lochner also presents data showing that the perceived probability of arrest affects the level of petty larceny and auto thefts. Either the potential criminals fear arrest, or their family members are exerting pressure to remain "clean." In either event, these results indicate that criminal behavior is influenced by individual and family experience with the legal system, and that enhanced law enforcement activity would reduce criminal behavior.

The same issues arise in the liability system, including the realm of medical malpractice which is the focus of this study. When physicians select a test or procedure, they must assess the probability of a malpractice claim and the subsequent punishment. This assessment may be influenced by their own history, the experiences of colleagues, or even national trends. A physician who has been sued may believe that the probability of malpractice litigation is high and exercise greater caution. If the physician's colleagues learn about the suit, they may also believe that the probability of litigation is high. They may pressure the physician who was sued to take greater care and may exercise greater caution themselves. A hospital that is sued might do the same, for example by implementing treatment protocols that influence how physicians practice.

We test these ideas by examining the mode of delivery – cesarean section versus vaginal delivery. Cesarean section is generally regarded as a defensive practice and cesarean section rates in the United States have been increasing for the two decades. We use unique data from Florida that combine individual patient-level hospital discharge data for the period 1994-2000 with physician-level medical malpractice closed claims data from 1979-2003. We find that obstetricians do increase their cesarean section rates subsequent to the first time they are sued, but not thereafter. Obstetricians also increase

their cesarean section rates when other physicians at their hospital are sued. The timing of these effects differs, however, suggesting that the mechanisms that cause the cesarean rates to change also differ. Both effects are both small in magnitude and very short-lived. Changes in countywide litigation rates do not have any impact on cesarean section rates. We conclude that personal and local experiences with malpractice litigation have only a small and short-lived effect on cesarean section rates.

II. Background on Malpractice and Cesarean Sections

Concerns about medical malpractice have intensified in the past few years. According to the *Medical Liability Monitor*, malpractice premiums for most physicians declined in real terms through the 1990s, but increased by 50 percent or more between 2000 and 2004 (see Table 1).[i] According to the American Medical Association, at least 20 states are currently in a "full-blown" malpractice crisis.[ii] The fields of obstetrics, neurosurgery and emergency medicine have been especially hard hit. Malpractice concerns in these three specialties have received the most media attention, and these specialties have experienced the largest malpractice premium increases.

Our focus in this paper in on obstetrics and the choice of delivery mode: cesarean or vaginal delivery. Obstetricians usually initiate a discussion of delivery mode early in the pregnancy. (The vast majority of deliveries are performed by board certified obstetricians and we will refer to all physicians in our data as obstetricians.) Women may have strong personal preferences for one mode or the other, but their obstetricians can articulate in favor of their own preferred option. Even if a woman goes into delivery with strong preferences for one mode of delivery, events at the hospital during the delivery can

overwhelm these preferences. Thus, the actual mode of delivery is the result of obstetrician lobbying, which may have begun six months or more before the delivery, hospital practices, which manifest themselves on the day of the delivery, and nature.

Delivery by cesarean section is thought to be a defensive response by obstetricians who believe that cesarean delivery reduces the risk of a malpractice claim and the potential size of the claim.[iii] Thus, virtually all studies of the deterrence effect of liability in obstetrics focus on the cesarean section rate, which has been steadily increasing since 1994, the first year of our study.[iv] Following the works in criminal justice by Sah (1991) and Lochner (2003), we hypothesize that obstetricians' preferences for cesarean deliveries might be influenced by both personal and external factors that affect perceived malpractice risk. Obstetricians may consider whether they have recently experienced a claim and whether this was the first time or a commonplace occurrence. This might lead to obstetrician to conclude that the environment has become more litigious. An obstetrician who observes claims against colleagues, or broader trends in litigation, might reach the same conclusion. Just as a physician who is sued might take steps to minimize malpractice risk, a hospital that has been sued may do the same.

Cesarean delivery is generally regarded as a "defensive" practice by the medical community. As an editorial in the medical journal *The Lancet* states, "From a defensive medicine perspective, US obstetricians seem to be viewing cesarean section as a safe option (Wagner, 2000)." There are several reasons why the desire to be "safe" can lead to an increased rate of cesarean delivery. During the time of study, many hospitals required obstetricians to use fetal monitoring during a vaginal delivery. An obstetrician who observed an abnormal pattern on the monitor and was fearful of litigation might opt

for an immediate cesarean delivery. Hospitals that desire to be "safe" might require fetal monitoring. (Indeed, this is required by nearly all hospitals today.) Other reasons for choosing cesareans as a defensive practice include modest evidence that vaginal deliveries have poorer outcomes for breech births, a decline in midforceps vaginal deliveries resulting in the need to perform cesarean delivery in the event of dystocia (failure to progress in labor), and the prevailing dictum that "once a cesarean, always a cesarean" that puts an obstetrician who prescribes a vaginal birth after cesarean ("VBAC") at risk for going against community standards (Thacker, 1989).

III. Timing Issues

We are keenly interested in the timing of events associated with malpractice claims and defensive practices; for example, how soon after a claim does the cesarean section rate increase? It is therefore essential to understand the sequence of events associated with a typical malpractice claim.[v] Providers almost always know about an injury when it occurs. Research suggests that there are many more injuries than claims, however, and providers may not view an injury as a cause for concern about legal action (Weiler, et al, 1992). A patient contemplating legal action usually retains an attorney who will ask the hospital for the relevant medical records. All of this occurs within weeks or a few months of the injury. The attorney sends the records to an independent medical expert who gives an opinion as to whether there may have been negligence. At the same time, the hospital may review its defensive practices to ascertain if it is taking due care.

If the expert indicates that negligence may have occurred, the plaintiff's attorney contacts the responsible providers to inform them about the potential for a lawsuit and the likely damages. The obstetrician is usually the first provider to be notified. This contact must occur within a statutory time frame that varies according to the injury. In practice, the contact occurs within a few weeks or months of the receipt of the expert report, and no more than three to six months after the injury. After this contact, the physician will retain an attorney and discover, perhaps for the first time, what is involved in defending against litigation. Over time, the obstetrician might remain free of subsequent lawsuits and some may determine that being sued is "not that bad," leading to a reversion to the pre-injury practice style.

This timing suggests that there are a number of key events that might influence provider decision making: The injury itself, the request for hospital records, and the first contact with the obstetrician at which the potential for a lawsuit is raised. Any resulting change in cesarean section rates may take even longer, because it may take time for physicians to convince patients of the "need" for a cesarean. While our data indicate the date of the first contact with the obstetrician, they do not indicate the date of the injury or request for records. Thus, we focus our empirical analysis on the response to first contact but interpret our findings with these limitations in mind.

We are also interested in what happens when an obstetrician's colleague and/or hospital has been contacted. There are a number of mechanisms by which such contacts could affect an individual obstetrician's practice. The obstetrician might revise expectations about the litigious environment and become more cautious. The entire obstetrics group and the hospital may do the same, leading to across the board increases

in cesarean section rates. While we are unable to fully sort out these competing mechanisms, we will draw inferences based on the timing of the obstetricians' response, as described below.

IV. Related Research

There have been numerous efforts to determine how the legal environment affects the practice of medicine (CBO, 2006). When physicians are surveyed about how they respond to lawsuits, they usually state that they will adopt a more defensive practice style, for example by ordering more diagnostic tests.[vi] However, research examining whether state tort reform legislation affects medical decision making has generated mixed results.[vii]

Despite the conventional wisdom that defensive medicine has contributed towards the use of cesareans, the empirical evidence linking the two is also mixed. Baldwin et al. (1995) find no relationship between an obstetrician's claims history and cesarean section rates. However, Localio et al. (1993) found significant higher cesarean rates among physicians who had been sued. These studies date from a time when there was relative calm in the malpractice environment and the cesarean section rate was relatively flat; the relevance to today's environment is unclear. Moreover, neither of these studies incorporates physician fixed effects, so it is impossible to rule out that physicians who had been sued had some other reason for preferring cesarean delivery.

Using state-level variation of malpractice payments and per-physician number of claims as measures of malpractice risk, Kim (2008) investigates the effect of state level malpractice risk on cesarean rate during 1992-1998.[viii] He finds that the state-level

malpractice risk has no effect on the rate of cesarean. Dubay et al (1999) uses malpractice premium as a measure of liability pressure, and find small effects on the rate of cesarean. Using state level variation in medical malpractice premium and payments as a measure of liability pressure, Baicker and Chandra (2005) also find a small effect of malpractice pressure on cesarean.

The results of these studies suggest that the conventional wisdom in the medical community is overstated. However, this conclusion may be premature. These studies uses malpractice premiums and state tort reform as measures of malpractice risk. It is perhaps not surprising that physicians are relatively unresponsive to changes in these measures. Because malpractice insurance is predominantly community rated, physicians may fail to see a connection between malpractice premiums/state tort reform and the likelihood and consequences of being sued. We believe it is therefore essential to examine physician responses at the micro-level—what happens to the individual physicians who are sued? (In an analogous way, the subjects of Lochner's (2007) study might well be unmoved by changes in sentencing laws, even though they may change their behavior in response to being arrested.)

Grant and McInnes (2004; henceforth GM) move in this direction by studying changes in physician cesarean section rates from 1992 through 1995 based on the occurrence of claims (i.e., contacts) against physicians during 1993-1994 and the dollar amount for which these claims were resolved. They find that claims resulting in nominal awards are associated with reductions in cesarean section rates, while claims resulting in large awards are associated with increases.

GM's before/after framework eliminates some of the potential bias associated with cross-section studies. Even so, their study has several limitations.[ix] Perhaps the most notable is that they implicitly assume that physicians can anticipate the size of an award at the time a claim is filed. In fact, most claims were not resolved until well after the time period they studied, making it difficult to interpret their findings.[x] What makes these results even more puzzling is that physicians are not experience rated, so that the amount of the claims resolution should not matter. Moreover, GM find that other loss-adjustment expenses, such as time spent in litigation, have no effect on physician decision making. Yet it is precisely these expenses, which are directly borne by the physician, that ought to matter.

Gimm (2005) also examines how obstetricians respond to lawsuits. His study covers the period 1992-2000, uses data that is very similar to ours, and incorporates physician fixed effects. He aggregates data to the physician level and finds that cesarean section rates do not vary after a lawsuit. He does not consider multiple sources of information or examine the timing of responses, both of which are central issues in our research. Thus, we are able to obtain many nuanced results that are absent in Gimm's study.

IV. Data

We use patient-level hospital discharge data collected by Florida's Agency for Health Care Administration (AHCA) during 1994-2000 related to deliveries of a newborn, which records all of the deliveries occurred in hospitals in Florida. AHCA data includes information about the treatment (diagnosis related group codes), patient characteristics

(age, race, zip code, type of insurance, risk factors such as multiple gestation and previous Cesarean), physician's license numbers, hospital number identifying a hospital that care is provided, and year and quarter in which patients received care. We can also count number of deliveries each physician performs in each quarter using physician's license numbers. The summary statistics of AHCH data is provided in Table 2.

A total of 4,599 unique physicians presided over at least one delivery during our sample period. We want to restrict our attention to those physicians who routinely perform deliveries, as those who perform just a handful of deliveries may well be facing unique circumstances (e.g. an emergency delivery when no obstetrician is available.) Thus, we limit our sample to those physician/years in which the physician has performed at least 25 deliveries. We have a total of 1,539 unique physicians in the sample, accounting for well over 98 percent of all deliveries. We will refer to these physicians as obstetricians, although we do not know their specialty certification.

We match the physician license numbers to data of closed medical malpractice claims collected by Florida's Department of Financial Services for the period of 1979-July 2003. This data covers every malpractice claim made in Florida that is resolved as of July 2003. The data contains information on medical malpractice claims such as date of occurrence, date of claim, date of filing of lawsuits, and date of resolution, with corresponding physician's license number for. We rearrange this data to construct individual history of claims for each physician dating back to 1979 that covers much longer period than the AHCA data. The rearranged history includes all dates of occurrence (date of the occurrence of an alleged medical malpractice incident), claim (date the side of the physicians are contacted by the side of the patients), and filing of

lawsuit (date a lawsuit is filed if it is filed at all). We also construct county-level variables such number of claims and lawsuit filings for non-OB/GY physicians that can be used as proxies for county-wide litigiousness.

Our data neither contain direct hospital contact information nor do they permit us to identify a physician's colleagues. Thus, we rely on the fact that most obstetricians practice in groups and that groups typically practice within a single hospital. We assume that obstetricians learn about all instances when another obstetrician at their hospital is contacted about an injury.[xi]

Tables 3 to 5 show the number of quarters in which a physician received a new malpractice claim. Table 4 reports the distribution of numbers of claims physicians and hospitals received in a year. Because of the way the original data have been recorded for a part of the data, some claims are likely to be counted multiple times if a claim is against multiple physicians. We can identify such observations and adjusted them so that these observations would be comparable to the other part of the data.[xii] Table 5 aggregates the data in Table 4 at hospital level after assigning physicians to the hospital they perform. In case if a physician performs delivery at more than one hospital, we assign the physician to the hospital which he or she performs majority of deliveries at.

V. Model

To motivate the empirical analysis, we present a simple model of the choice between cesarean and vaginal delivery. For simplicity, we assume that the choice is made by an obstetrician, although a similar analysis would apply to hospitals and we

interpret our empirical results as reflecting decisions made by the obstetrician and the hospital.

When choosing between cesarean (*C*) and vaginal (*V*) delivery, the obstetrician considers three factors; profit, medical and other benefits (such as preference of patient), and the expected liability costs. Thus, the physician solves the following:

$$\max_{i\in\{C,V\}} \pi_i(X_j) + b_i(X_j) - p_i(X_j)\cdot q \cdot L,$$

where subscript $i \in \{C,V\}$ denotes delivery mode, X_j is patient characteristics, π_i is profit of performing procedure *i*, b_i is the medical benefit, p_i is perceived subjective probability of occurrence of an undesirable outcome[xiii], q is the perceived subjective probability of a medical malpractice claim resulting from an undesirable outcome *conditional on the fact that the undesirable outcome has occurred*, and L expected cost to the obstetrician in the event of a medical malpractice claim. We assume that the cost of experiencing a medical malpractice claim does not depend on the choice of procedure nor the characteristics of the patient. Because physicians are community rated for malpractice, the costs of a claim are largely the opportunity cost of dealing with a case and the potential cost to reputation, both of which may be independent of the choice of procedure as well as the patient characteristics.[xiv]

It follows that an obstetrician will perform a cesarean iff

$$(\pi_C - \pi_V) + (b_C - b_V) - (p_C - p_V)\cdot q \cdot L > 0,$$

which is rewritten as

$$\Delta\pi(X_j) + \Delta b(X_j) - \Delta p(X_j)\cdot q \cdot L > 0, \qquad (1)$$

where Δ denotes the difference of a variable between cesarean and vaginal delivery. Inequality (1) includes latent variables indicating whether the patient received a cesarean section, and can be estimated using logit regression.

Now we consider empirical implementation of the model. The key theoretical predictor is q, which measures the perceived probability of a lawsuit subsequent to an undesirable outcome. In practice, this may be influenced by any number of factors: the physician's personal experience, the experiences of the physician's immediate colleagues, and the experience of all the physicians practicing in the same region. In some regressions, we allow q to vary with patient characteristics. We recognize that q may be correlated with unobserved physician preferences. We assume that these unobserved factors are time invariant and estimate (1) using physician fixed effects. Because we also incorporate time fixed effects, the key identifying assumption in our paper is that changes in individual physician preferences for performing cesarean sections that depart from general time trends are not correlated with being contacted, aside from the direct effect of being contacted.

We measure the information variables as follows:

Physician History: Obstetricians may learn from their own experiences. We define physician history to be the cumulative number of times an obstetrician has been contacted about potential litigation. We do not know the date of the associated injury, due to data limitations, so we compute *Physician History* based on the quarter of the contact.[xv]

Hospital History: Obstetricians may be influenced by their colleagues or by rules established by the hospital where they practice.[xvi] We compute *Hospital History* by aggregating *Physician History* for all physicians who practice at the same hospital.

County History: Obstetricians may interact more broadly with their colleagues, for example at medical society meetings. They may also read about the legal environment in local newspapers. We base *County History* on the number of lawsuits filed against non-obstetricians in the county in which the obstetrician practices. We use lawsuits instead of contacts because the latter are private information known to the physicians who have been contacted. We use county as a convenient measure of the "regional" environment And we examine lawsuits against non-obstetricians to capture the broader legal environment.[xvii]

Per inequality (1), we must also control for factors that affect the relative profitability of each delivery mode, the medical benefits, and patient preferences. Different insurers may set different relative payment levels for each delivery mode, and it is generally regarded that Medicaid is the least generous payer. At the same time, HMOs often limit enrollee access to providers who are perceived to have high medical costs. We include indicator variables for *HMO*, *PPO*, *Other Commercial Insurance*, *Medicare* (for disabled patients only), and *Medicaid* (the omitted category.) We use patient demographics as indicators of both profit and patient preferences. We know each patient's *age* and race (*black*, *Hispanic*, *other race*, and the omitted category *white*). We also know each patient's residence zip code, from which we infer the *income* using the zip code's median per capita income from the 2000 U.S. Census. We include a long list of diagnostic characteristics to indicate the medical benefits of cesarean delivery.[xviii] For the sake of clarity, we do not report the coefficients on these control variables in our regressions. Complete results are available upon request.

Timing Issues

As discussed earlier, the defensive response to an injury may unfold over time. We will address this in two ways.

First, we measure "discounted histories" using a range of discount rates. We compute discounted *Physician History* as:

$$H_{khct}^{Indiv} = \delta \cdot H_{khct-1}^{Indiv} + I_{khct}^{Indiv}, \text{ and } H_{khc0}^{Indiv} = 0$$

for obstetrician *k* at hospital *h* in county *c* at time *t*, where *t=0* is the first quarter of 1979,[xix] I_{khct}^{Indiv} is 1 if obstetrician *k* receive any new claims in period *t*, and δ discount factor.[xx] Discounted *Hospital History* and discounted *County History* are calculated in analogous fashion.

Using these variables, our base empirical specification is:

$$Y_{jkhct} = \beta_{Ins} X_j^{Ins} + \beta_{Other} X_j^{Other} + \gamma_{Indiv} H_{khct}^{Indiv} + \gamma_{Hosp} H_{hct}^{Hosp} + \gamma_{Cty} H_{ct}^{Cty} + \eta_k + \varphi_t + \varepsilon_{jkhct},$$

where Y_{jkhct} is 1 for cesarean and 0 for vaginal delivery for patient *j*, X_j^{Ins} is patient *j*'s insurance type, X_j^{Other} represents a vector of other characteristics such as medical risk factors, age, race, and income, η_k are the physician fixed effects, φ_t are year-quarter fixed effects, and ε_{jkhct} is an idiosyncratic shock.

We also estimate a detailed pattern of lagged responses in order to study the timing lags in responding to the event of contact.

$$Y_{jkhct} = \beta_{Ins} X_j^{Ins} + \beta_{Other} X_j^{Other} + \sum_{m=0}^{4} \gamma_{Indiv,m} I_{khc,t-m}^{Indiv} + \sum_{m=0}^{4} \gamma_{Hosp,m} I_{hc,t-m}^{Hosp} + \sum_{m=0}^{4} \gamma_{Cty,m} I_{c,t-m}^{Cty} + \eta_k + \varphi_t + \varepsilon_{jkhct}$$

Another timing issue arises when physicians are contacted more than once over the course of our data. Obstetricians may respond differently to each successive contact.

We address this by allowing for different responses to the first, second, and subsequent claims. We denote each successive contact by adding a superscript to the left of the previous notation. The discounted histories of the first claims are computed as

$$ {}^{1st}H^{Indiv}_{khct} = \delta \cdot {}^{1st}H^{Indiv}_{khct-1} + {}^{1st}I^{Indiv}_{khct}, \text{ and } {}^{1st}H^{Indiv}_{khc0} = 0, $$

We do the same for the second and subsequent claims for individual physicians. We will use this structure to modify the discount and lagged specifications discussed above.

VI. Results

Table 8 presents the results of our regression of delivery mode on discounted cumulative *County History*, *Hospital History*, and *Physician History*. *Hospital History* is associated with a positive and significant increase in the choice of cesarean section. Thus, when a physician at a hospital is contacted about a potential lawsuit, there is an associated hospital-wide increase in cesareans.

To get a sense of the magnitude of the hospital-wide response, consider the results in column (2) using the annual discount rate of 0.6.[xxi] Suppose that a physician in an average hospital is contacted by attorneys about a potential lawsuit. Noting that the annual number of deliveries at the average hospital is 1971, the coefficient of 1.1619 implies an immediate hospital-wide increase in the cesarean section rate of 0.06%. Given an average baseline cesarean rate of 26.7%, this increase is relatively unimportant. Note that the coefficient on *Hospital History* changes dramatically as the discount rate falls, suggesting the need to explore the time structure in more detail. We do so in later regressions.

The point estimate for the coefficient on *Physician History* suggests an immediate response that is a bit larger in magnitude (0.13% increase in cesareans immediately after contact) but this estimate is not statistically significant. These regressions do not distinguish among first, second, and subsequent physician contacts, however. The full story regarding *Physician History* is more complex, as we show below.

County History is not associated with delivery mode in these or any subsequent regressions. The county-wide number of lawsuits filed against non-obstetricians does not affect the rate of cesarean.

All regressions, including those reported in Table 8, include patient characteristics, physician fixed effects, and year-quarter fixed effects, all of which are statistically significant at $p<.001$. Figure 1 plots the year-quarter fixed effect coefficients using the model with a discount rate of 0.6. This discount rate implies that 60 percent of the impact of being sued on physician behavior is still retained one year after being contacted. We choose the discount rate of 0.6 because it provides the best fit to the data when compared with 0.3 and 0.9. Even so, the results are virtually identical using the other discount rates. The figure shows that the year-quarter fixed effects closely follow the time trend in the raw data. In other words, the *History* variables do not, by themselves, explain the increasing trend in cesarean section rates. All subsequent regressions reveal the same pattern. Whatever has caused the pronounced upswing in Cesareans, it is not due to the influence of individual, hospital-wide, or regional contacts with the legal system.[xxii]

Table 9 decomposes *Physician History* into first, second, and subsequent contacts. At a discount rate of 0.9 and 0.6, the first contact is associated with a statistically

significant increase in cesarean rates of 0.5%-0.7% in the quarter immediately after contact. However, the first contact has no effect using a discount rate of 0.3 and second and subsequent contacts never have a significant effect. Results for *Hospital History, County History*, and the year-quarter trends are virtually identical to those reported in Table 8.

Because the results differ as we vary the discount rate, it is important to more precisely estimate the lag structure of information. Table 10 reports the results of regressions that allow for lags of up to four quarters. (Longer lags proved to be insignificant in all specifications.) We restrict attention to the first physician contact, as subsequent contacts have an insignificant effect. We also explore leads, which capture the possibility that information is available and acted upon prior to the quarter in which the physician is contacted.

As in all previous models, *County History* remains insignificant. *Hospital History* is significant but only for lag 0. Based on the coefficient of approximately 1.06, there is a hospital-wide increase in cesarean rates of about .05% during the quarter in which a physician at that hospital is contacted. However, the cesarean rate immediately reverts back to the baseline level in subsequent quarters (apart from the general year-quarter trend that affects all hospitals.) The timing of the physician's response to his or her own contact is much different. In addition to the immediate hospital-wide effect, an additional response by the contacted physician appears three quarters later. During this quarter, the cesarean rate increases by a significant 1.31%. The increase in the subsequent quarter of 0.63% is borderline insignificant. Finally, note that leads are never significant.

These results are consistent with the pattern of information disclosure and provider response described earlier. Hospitals are notified about the potential for a lawsuit shortly after an injury occurs, when the patient's attorney asks for medical records. At this time, the hospital may institute systematic defensive practices, though our results suggest the impact is modest. The affected physician responds more strongly, but this does not manifest itself until 9-12 months later, suggesting that the main response by the affected physician is to influence the delivery mode of new patients. Alternatively, both the hospital and physician may be acutely aware of the potential litigation immediately after contact but physicians put off dealing with the issue until months later. Both the hospital-wide and physician-specific responses are extremely short-lived.

Table 11 allows for the hospital-wide response to vary for physicians who have had previous contacts and according to the physician's overall volume of deliveries. We find that the lag 0 hospital-wide response is equally big for physicians with and without prior contacts. There is an additional lag 2 response for physicians with at least one prior contact. Turning to overall volume, the lag 0 hospital-wide response appears to exclusively affect low volume physicians. Likewise, there is a lag 3 increase in cesareans that is also concentrated in low volume physicians at the affected hospital. Finally, the hospital-wide response is larger for smaller hospitals.

Specification checks

We have used year quarter and physician fixed effects throughout our analysis. Thus, we implicitly assume that that there is no variation over time in physician skills apart from what we pick up with the time dummies. As an additional check, we restricted

our analysis to physicians with at least five years experience, so as to eliminate those who may be moving down the learning curve. Our results are virtually identical.

We also assume that unobservable characteristics of a physician's patients, particularly those characteristics that predict the need for cesareans, do not change if that physician is contacted. To assess the latter, we looked for changes in observable characteristics. Specifically, we ran a linear probability model predicting the need for cesareans on a subsample of physicians who were never contacted. We used the results to predict the need for cesareans among those physicians who had been contacted. Using the sample of physicians who were contacted, we then regressed the predicted probability of a cesarean on the *Physician History* and *Hospital History* variables as well as a vector of physician and year/quarter fixed effects. We found that the predicted probability of a cesarean decreases significantly by about -.005 to -.01 in the 2^{nd} and 3^{th} quarters after contact. If the same pattern held true for unobservable patient characteristics that were uncorrelated with our observables, then our results for these quarters would be biased against finding an increase in cesarean rates. In any event, the magnitudes involved remain small and the effects disappear by the fourth quarter after contact.

VII. Discussion

Despite the conventional wisdom that obstetricians perform cesarean sections as a defensive practice, prior research showed only a slight connection between macro measures of the malpractice environment and cesarean section rates. This study contributes to the literature by taking a micro look at the data, examining on a quarterly

basis how physicians respond to claims lodged against themselves and their immediate colleagues.

We observed two distinct and interesting examples of defensive medicine in obstetrics. At roughly the time when a hospital would receive a request for medical records subsequent to an injury, there is a very small and short-lived hospital-wide increase in the cesarean section rate. This may reflect temporary defensive measures taken by the hospital as it reviews its care processes. This increase appears to be concentrated among low volume providers, who may receive the most scrutiny or may be most susceptible to direction by the hospital. Approximately nine months later, there is a larger increase in the cesarean section rate for the responsible physician. This may reflect efforts by that obstetrician to "lobby" new patients in favor of cesareans. The fact that this effect is short-lived and limited to obstetricians with no previous contacts may indicate that obstetricians overreact to their first contact. It is possible, for example, that they rapidly discover that the litigation process is neither costly nor particularly painful. For example, physicians rarely make a financial payment to the plaintiff and do not appear to lose any income as a result of being sued (Danzon et al., 1990, Zeiler et al., 2008).

Table 1: Trends in Malpractice Premiums

	Median Increase Nationwide		Median Increase Florida	
Year	ObGyn	General Surgery	ObGyn	General Surgery
1997	0	0	0	0
1998	0	0	0	0
1999	0	0	0	0
2000	7%	10%	5%	10%
2001	9%	15%	15%	18%
2002	20%	29%	21%	45%
2003	12%	15%	12%	17%
2004	15%	15%	13%	22%

*Source: *Medical Liability Monitor*, various years. National data are approximated from *MLM* reports. Medical Liability Monitor annually surveys several liability insurance carriers in each "market" (usually several counties) and reports self-reported premium increases for each carrier.

Table 2: Summary Statistics – Patient Level

	# of observations	mean	s.d	min	max
treatment					
cesarean	957,722	0.267	0.442	0	1
patient characteristics					
age	957,722	26.947	6.265	11	58
black	957,722	0.209	0.406	0	1
hispanic	957,722	0.158	0.364	0	1
white	957,722	0.563	0.496	0	1
other race	957,722	0.062	0.241	0	1
income per capita for zipcode (in $1,000)	957,722	20.304	7.530	2.14	236.24
hemorrhage	957,722	0.016	0.124	0	1
diabetes	957,722	0.006	0.075	0	1
feto	957,722	0.026	0.160	0	1
distress	957,722	0.055	0.229	0	1
trauma	957,722	0.257	0.436	0	1
previous history of cesarean	957,722	0.126	0.332	0	1
malposition	957,722	0.014	0.116	0	1
hypertention	957,722	0.013	0.114	0	1
multiple gestation	957,722	0.010	0.101	0	1
herpes	957,722	0.006	0.076	0	1
polyhydramnios	957,722	0.005	0.068	0	1
oligohydramnios	957,722	0.020	0.140	0	1
patient's insurance					
Medicaid	957,722	0.322	0.467	0	1
HMO	957,722	0.306	0.461	0	1
commercial insurance	957,722	0.087	0.282	0	1
PPO	957,722	0.190	0.392	0	1
Medicare	957,722	0.002	0.045	0	1
other insurance	957,722	0.093	0.291	0	1

Table 3: Aggregate Number of Claims against Obstetricians in State of Florida by Year

	Number of claims
1994	359
1995	213
1996	245
1997	407
1998	357
1999	472
2000	410

Table 4: Distribution of Claims per Physician

	0 Claim	1 claim	2 claims	3 claims	Total
1994	1,391	80	7	1	1,479
1995	1,520	64	7	0	1,591
1996	1,486	61	2	0	1,549
1997	1,645	69	6	0	1,720
1998	1,822	73	7	0	1,902
1999	1,842	82	4	0	1,928
2000	1,723	73	6	1	1,803

Numbers in the Table are number of physicians in each year. It does not add up to total because there are physician with more than 4 claims.

Table 5: Distribution of Claims per Hospital

	0 Claim	1 claim	2 claims	3 claims	4 claims	>5 claims	Total
1994	51	22	13	9	6	6	107
1995	50	30	16	7	0	7	110
1996	61	27	19	5	1	3	116
1997	60	31	16	13	8	4	132
1998	75	31	11	11	6	7	141
1999	70	26	13	15	5	8	137
2000	70	22	13	7	5	8	125

Numbers in the Tables are numbers of hospitals. Total is the total number of hospital for the corresponding year.

Table 6: Cumulative Distribution of Claims per Physician as of Q4 2000.

Cumulative Number of Claims	Number	%	Cum %
0	873	62.90	62.90
1	210	15.13	78.03
2	155	11.17	89.19
3	87	6.27	95.46
4	32	2.31	97.77
5	12	0.86	98.63
6	11	0.79	99.42
7	5	0.36	99.78
8+	3	0.22	100.00
Total	1,388	100.00	

Number of physicians counts physician who had more than 25 deliveries per year and performed delivery in the 4th quarter of 2000. The cumulative number of claims is the sum of all claims for each physicians.

Table 7: Cumulative Distribution of Claims per Hospital as of Q4 2004

	# of observation	Mean	s.d	min	Max
Number of claims per Hospital received in 2000 Q4	115	9.51	10.71	0	64

Table 8: OLS regression of caesarean rates on discounted county, hospital, and physician histories.

	(1)		(2)		(3)	
Discount Rate	0.9		0.6		0.3	
County History	-0.0014		-0.0018		-0.0025	
	(0.0014)		(0.0023)		(0.0040)	
Hospital History	0.3852	***	1.1619	***	2.4319	***
	(0.0954)		(0.3177)		(0.5580)	
Physician History	0.0006		0.0013		0.0005	
	(0.0013)		(0.0017)		(0.0021)	
Patient Characteritcs	Included	***	Included	***	Included	***
Year-quarter fixed effects	Included	***	Included	***	Included	***
Physician fixed effects	Included	***	Included	***	Included	***
# of observation	957,722		957,722		957,722	
Adj R-Squared	0.3616		0.3616		0.3616	

Dependent variable is the rate of caesareans. Numbers in parenthesis are standard errors. Statistical significance of coefficients are denoted by *** for 1%, ** 5%, and * 10%. First column employs discount factor of 0.9, second 0.6, and third 0.3. Coefficients for patient characteristics are all significant.

Table 9: OLS regression of caesarean rates on discounted county, hospital, and decomposed physician histories

	(1)		(2)		(3)	
Discount Rate	0.9		0.6		0.3	
County History	-0.0013		-0.0018		-0.0025	
	(0.0014)		(0.0023)		(0.0040)	
Hospital History	0.3809	***	1.1417	***	2.4079	***
	(0.0954)		(0.3179)		(0.5586)	
Physician History						
1st contact	0.0073	***	0.0051	*	0.0021	
	(0.0026)		(0.0030)		(0.0036)	
2nd contact	-0.0030		0.0025		0.0046	
	(0.0027)		(0.0031)		(0.0038)	
3rd contact	-0.0020		-0.0030		-0.0041	
	(0.0022)		(0.0027)		(0.0033)	
Patient Characteristics	Included	***	Included	***	Included	***
Year-quarter fixed effects	Included	***	Included	***	Included	***
Physician fixed effects	Included	***	Included	***	Included	***
# of observations	957,722		957,722		957,722	
Adjusted R-squared	0.3616		0.3616		0.3616	

Dependent variable is the rate of caesareans. Numbers in parenthesis are standard errors. Statistical significance of coefficients are denoted by *** for 1%, ** 5%, and * 10%. First column employs discount factor of 0.9, second 0.6, and third 0.3. Coefficients for patient characteristics are all significant.

Table 10: OLS regression of caesarean rates on lags and leads

	(1)		(2)		(3)	
Hospital Contact						
Lag 0	1.0583	***	1.0595	***	1.0576	***
	(0.3387)		(0.3388)		(0.3388)	
Lag 1	-0.1903		-0.1885		-0.1895	
	(0.3347)		(0.3347)		(0.3348)	
Lag 2	0.3033		0.3040		0.2992	
	(0.3475)		(0.3475)		(0.3476)	
Lag 3	-0.0912		-0.0901		-0.0912	
	(0.2761)		(0.2761)		(0.2761)	
Lag 4	0.0001		0.0001		0.0001	
	(0.0163)		(0.0163)		(0.0163)	
Physician 1st Contact						
Lag 0	0.0004		0.0004		0.0003	
	(0.0046)		(0.0047)		(0.0047)	
Lag 1	0.0009		0.0009		0.0009	
	(0.0048)		(0.0048)		(0.0048)	
Lag 2	0.0030		0.0029		0.0029	
	(0.0047)		(0.0048)		(0.0048)	
Lag 3	0.0131	***	0.0131	***	0.0131	***
	(0.0047)		(0.0047)		(0.0047)	
Lag 4	0.0063		0.0063		0.0063	
	(0.0047)		(0.0047)		(0.0047)	
Physician 1st Contact Leads			Included		Included	
Hospital Contact Leads					Included	
# of observations	957,722		957,722		957,722	
Adjusted R-squared	0.3616		0.3616		0.3616	

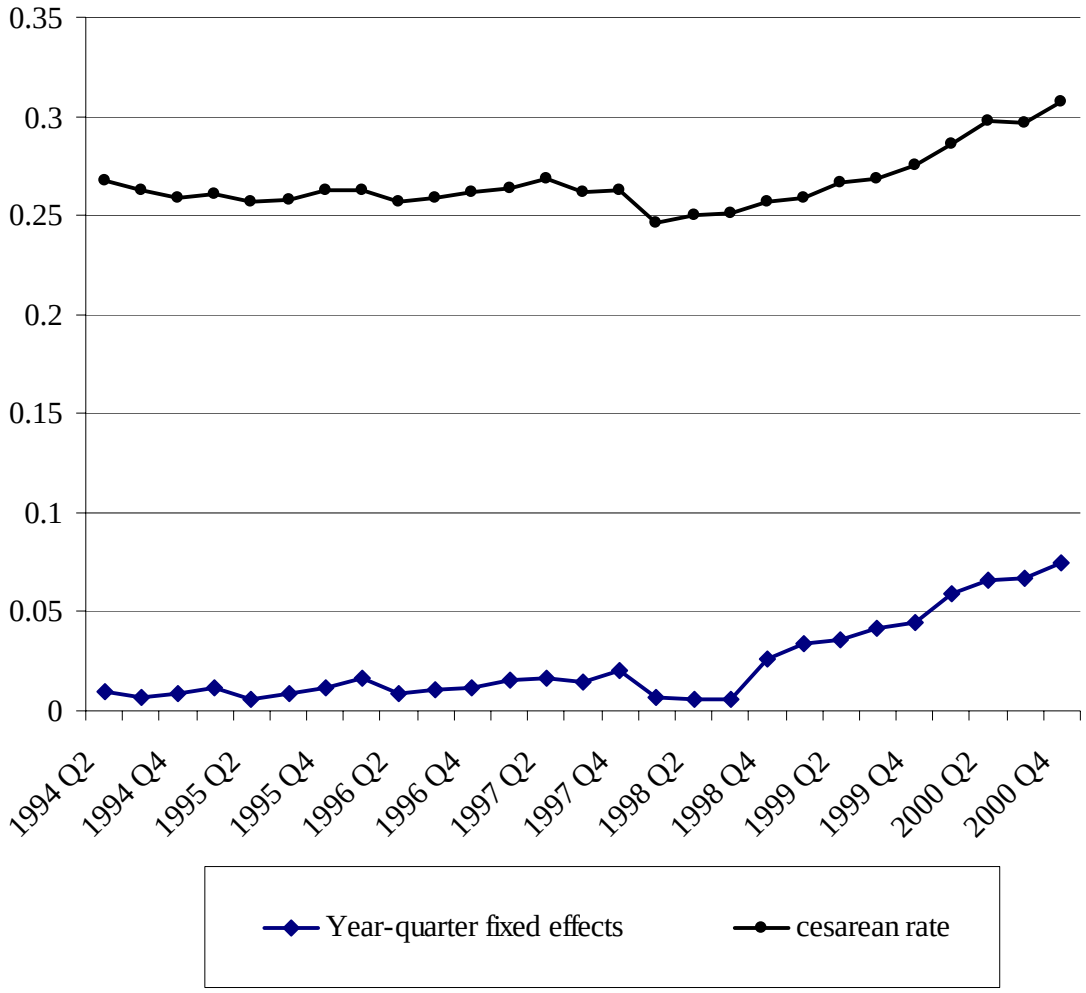
Numbers in parenthesis are standard errors. Significance of coefficients are denoted by *** for 1%, ** 5%, and * 10%. County Litigation Lags, Patient Characteristics, Year-quarter fixed effects, and Physician fixed effects are included. County Litigation Lags, Physician Contact Leads, and Hospital Contact Leads are not statistically significant.

Table 11: OLS regression of caesarean rates on interactions on hospital contacts

	(1)		(2)			(3)	
Hospital Contact							
Lag 0	1.0583	***	1.0562	**		2.7636	***
	(0.3387)		(0.4837)			(0.6205)	
Lag 1	-0.1903		0.0865			0.2696	
	(0.3347)		(0.5312)			(0.6389)	
Lag 2	0.3033		-1.1782	**		0.3526	
	(0.3475)		(0.5210)			(0.6375)	
Lag 3	-0.0912		-0.3290			1.2566	**
	(0.2761)		(0.4709)			(0.6236)	
Hospital Contact x Prior Contact History					Hospital Contact x High Volume		
Lag 0			0.0460		Lag 0	-3.0604	***
			(0.6692)			(0.9083)	
Lag 1			-0.4963		Lag 1	0.0711	
			(0.6768)			(0.9291)	
Lag 2			2.6433	***	Lag 2	0.0632	
			(0.6911)			(0.9342)	
Lag 3			0.3390		Lag 3	-1.8470	*
			(0.5769)			(0.9677)	
					Hospital Contact x Medium Volume		
					Lag 0	-2.0456	***
						(0.7731)	
					Lag 1	-0.8941	
						(0.7756)	
					Lag 2	-0.2111	
						(0.7955)	
					Lag 3	-1.6127	**
						(0.6988)	

Numbers in parenthesis are standard errors. Significance of coefficients are denoted by *** for 1%, ** 5%, and * 10%. County Litigation Lags, Patient Characteristics, Year-quarter fixed effects, Physician fixed effects, and Lag 4 of all variables are included but not reported. County Litigation Lags, Physician Contact Leads, Hospital Contact Leads, and Lag 4s are not statistically significant.

Figure 1: Year-quarter fixed effects and cesarean rates



Cesarean rates are mean of dependent variable *Cesarean* for each quarter computed from the raw data. Year-quarter fixed effects are estimates from the third column in Table 8. Year-quarter fixed effects are virtually identical for all other specifications in Tables 8 to 11.

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[i] Medical Liability Monitor annually surveys several liability insurance carriers in each "market" (usually several counties) and reports self-reported premium increases for each carrier.

[ii] See AMA(2005). This was up from 12 states reported by the AMA in mid 2002. The 19 states determined to be in crisis in October 2003 include: Arkansas, Connecticut, Florida, Georgia, Illinois, Kentucky, Mississippi, Missouri, New Jersey, Nevada, New York, North Carolina, Ohio, Oregon, Pennsylvania, Texas, Washington, West Virginia and Wyoming. In June 2004 the AMA added Massachusetts to the list of states in crisis.

[iii] There are numerous references in both the research and mass media making this connection. For example, the President of the Massachusetts Medical Society stated in 2004: "…doctors are under pressure to exhaust every delivery option available, often including C-sections, because of malpractice worries (Fargen, 2007)." To take another example: "Childbirth activists believe that … doctors fear malpractice claims… so they encourage women to have cesareans that are not necessary (Cassidy, 2007)." Fear of malpractice has even been linked to rising cesarean rates in other nations. For example, see Curtis (2006).

[iv] Source: U.S. National Center for Health Statistics, numerous reports.

[v] We thank Joan Lebow of Lebow, Malecki & Tasch for providing us with information about the pre-litigation process.

[vi] For example, see Charles et al. (1985), Elmore et al., (2005), ACOG (various years) and Kessler and McClellan (1998).

[vii] According to CBO (2006), some studies find a negative relationship with tort limits and health spending, some studies find a positive relationship, and still others find no relationship. See also Currie and Macleod (2006).

[viii] Dubay et al (2001) also uses malpractice premiums and state tort reform as a measure of malpractice liability pressure, and study the effect of malpractice pressure in the context of prenatal care utilization.

[ix] For example, GM do not account for claims occurring in 1992 or 1995, although these would conceivably affect some of the observed change in cesarean section rates between 1992 and 1995. Nor do they consider the time of the claim – a claim in early 1993 is posited to have the same impact as one in late 1994. Finally, like other studies from this time, their data precede the run-up in malpractice premiums.

[x] One set of findings is particularly difficult to interpret. They find that if a physician is sued and the claim is resolved for a nominal amount, the cesarean section rate decreases from the moment of the claim. They infer that physicians in such a circumstance take a more optimistic view of the liability system. But the physician could not know the dispensation of the claim at the moment it is filed. A claim should always be bad news when compared with the alternative.

[xi] To the extent that there are instances where obstetricians remain uninformed when their colleagues are contacted, our findings will represent a lower bound on the actual effects when obstetricians are informed.

[xii] In a part of the original data, a case involving N physician are recorded N^2 times due to a very particular way of recording. We adjust them such that these N claims are counted as a claim against each of N physicians

[xiii] Here, we define an undesirable outcome as an outcome that has a potential to result in a medical malpractice claim. Recall that the subjective probability of an undesirable outcome may be based on the obstetrician's perceived skill level as well as the perceived legal environment.

[xiv] Zeiler et al.(2008) find that personal contributions by physicians to closed claims are rare. Physicians who are sued may worry about losing coverage altogether. These physicians will be concerned about the probability of a lawsuit and might therefore take defensive action. We are unable to distinguish this effect from the main effect described in the paper.

[xv] We do not use the number of claims per quarter because there is a possibility of double counting due to the way the data is recorded.

[xvi] Most obstetricians practice at just a single hospital in the data. For those who divide their time across multiple hospitals, we assign them to the hospital at which they perform the majority of their deliveries.

[xvii] There are several counties in Florida in which only one hospital performs deliveries.

[xviii] We thank Dr. Joel Shalowitz for helping us develop this list. The list contains only those indicators that would be included on an inpatient record, and thus misses potentially key controls such as the extent of prenatal care and prior history of complications during delivery. The specific variables that we include are listed in Table 2.

[xix] Closed claims data starts from 1979 though we only use ACHC for 1994-2000.

[xx] We fix discount factor at annual rate of 0.9 and 0.6 for estimation. In principle, this discount factor can be estimated with maximum likelihood. However, large number of observation and fixed effects makes it computationally very costly.

[xxi] We do not attempt to determine which exact discount rate bets fits the data. We prefer to rely on the regressions using lagged contacts to identify the time dimension of the response.

[xxii] Although it is difficult to pinpoint the reason for the upward trend in cesareans, one factor may be a pronounced decline in the rate of vaginal births after cesareans (VBACs) following a 1996 publication in the New England Journal of Medicine that identified a small risk to the mother's health. See Goer and Henci (2002) for further discussion.