The Impact of Malpractice Risk on the Use of Obstetrics Procedures

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ABSTRACT

Recent malpractice premium hikes and federal tort reform proposals have focused attention on medical liability costs. One frequent justification for tort reform proposals is the potential impact of liability on defensive medicine. There is, however, scant and conflicting evidence on whether malpractice risk alters physician practices. In this paper, I examine whether malpractice risk alters the procedure choices of obstetricians, who face one of the highest rates of malpractice lawsuits among medical specialties. By focusing on obstetricians, I can observe the impact of malpractice risk on the use of procedures such as cesarean sections, prenatal care visits, diagnostic tests, and so on. Because the measured malpractice risk may signal something unobserved about physician quality or practice style, I use malpractice claims against doctors with specialties other than obstetrics and gynecology (ob-gyn) as an instrument for ob-gyn claims. I find that cesarean section rates and most other measures of physician behavior are not sensitive to medical malpractice risk.

1. INTRODUCTION

When a patient is injured owing to the medical malpractice of a physician, the injured party can sue the physician for monetary compen-

BEOMSOO KIM is Assistant Professor of Economics at the Bryan School of Business and Economics, University of North Carolina at Greensboro. I am extremely grateful to William Evans for encouragement and many valuable comments. I also wish to thank Jeffrey Smith and Mark Duggan for many helpful comments. Seth Sanders, Jonah Gelbach, Alexander Whalley, Emily Owens, Julian Cristia, Sarah Bohn, Marilyn John, and participants of a brown bag seminar at University of Maryland also offered helpful comments on this paper. David Dranove and participants of the conference Current Research in Medical Malpractice Liability at University of Chicago Law School also gave me helpful comments.

[*Journal of Legal Studies*, vol. 36 (June 2007)]
 0047-2530/2007/360S2-0004$10.00

sation under negligent tort.[1] Compensation is typically paid for any loss of earnings capacity, pain and suffering, and reasonable medical expenses. Most physicians buy malpractice insurance to insure themselves against the payout of malpractice cases.

In the United States, malpractice insurance premiums increased rapidly in the 1970s and 1980s and again in the early part of this decade. These recent hikes have led the American Medical Association (2005) to declare a malpractice premium crisis in 20 states, including Florida, Pennsylvania, and New York. Nationwide, malpractice insurance premiums increased 15 percent between 2000 and 2002.[2] During the same time period, specialists in some areas experienced premium increases of more than 100 percent.[3]

Concerns about rising malpractice premiums have caught the attention of lawmakers at the federal and state levels. Beginning in 2003, Congress considered federal tort law reform proposals four times, but each time the bills failed.[4] A fifth tort reform bill (H.R. 5, 109th Cong., 1st Sess. [2005]) has passed through the House of Representatives and is currently awaiting discussion in the Senate.[5] Most tort reform proposals include such restrictions as limits on noneconomic jury damage awards, limits on attorney fees, and statutes of limitations in all medical malpractice lawsuits. Similar reforms have been passed in a number of states (Dewey 2005).

One premise behind these reform bills is that the current tort system encourages an excessive amount of litigation, placing doctors at an increased risk of being sued for malpractice. Reform sponsors also argue that greater malpractice risk adversely affects the delivery of health care in two ways. First, an increase in risk may discourage doctors from treating people with certain conditions or conducting risky (but potentially beneficial) procedures. The 2003 American College of Obstetricians and Gynecologists (ACOG) survey (Strunk and Esser 2004) re-

1. Torts are civil wrongs recognized by law as grounds for a lawsuit. Among three general categories (intentional torts, strict liability torts, negligent torts), medical malpractice falls into the negligent category.

2. This statistic is based on my calculation using *Medical Liability Monitor* (1991–2003). No weights were used.

3. Malpractice premiums increased 115 percent for obstetrics and gynecology (ob-gyn) doctors in Oregon and 110 percent for general surgeons in Mississippi.

4. Tort law is state law (Cornell Law School, Legal Information Institute, Wex, s.v. "tort" [http://www.law.cornell.edu/topics/torts.html]).

5. H.R. 5 passed the House in July 2005. The bill includes a $250,000 cap on noneconomic damages.

ported that 14 percent of respondents stopped practicing obstetrics as a result of the risk of litigation. This type of response to malpractice risk may be leading to some serious restrictions in access to necessary health care. Second, health care utilization may increase as doctors alter their practice patterns. To avoid a lawsuit or increase the chance of winning a malpractice suit, a doctor may perform procedures that have little or no medical benefit to patients but that protect him or her from possible future litigation. This type of behavior is typically referred to as defensive medicine (Kessler and McClellan 1996).

Opponents of reform bills believe that limiting compensation for the injured can be unfair to the people who have already suffered significantly from medical malpractice. Reform critics are also often concerned that the deterrent effects of tort law would be weakened as a result.[6] It is thus ultimately an empirical question whether doctors respond to changes in malpractice risk by altering their practice patterns.

Given the potential importance of tort reform and the malpractice crisis, there is surprisingly little empirical evidence regarding the impact of malpractice risk on health care delivery. Kessler and McClellan (1996) found some evidence of defensive medicine in their analysis of heart attack patients covered by Medicare, but they focus primarily on health care expenditures and thus do not shed light on the mechanisms through which this effect operates. While informative, most other studies have important limitations, including insufficient variation due to a short time span, possible omitted variable bias, or an inappropriate measure of malpractice risk.

First of all, we need to know whether doctors have an incentive to change their behavior as a result of malpractice risk. Most physicians are fully insured against the financial costs of malpractice, such as damages and legal defense expenses.[7] In addition, medical malpractice insurance typically does not have mechanisms such as deductibles or experience rating, either of which would give the physician a direct financial incentive to respond to increase in risk.[8] Litigation may, how-

6. The two purposes of tort law are monetary compensation for the injured and the deterrence of the same negligence by physicians in the future.

7. Of all ob-gyn doctors surveyed, 94.4 percent reported being covered by medical malpractice liability insurance (Strunk and Esser 2004). The most common insurance policies limit coverage to $1 million per case or $3 million per year. Only 1.6 percent of claims in my data paid more than $1 million.

8. Most insurance premiums are experience rated. For example, someone with a history of auto accidents will pay a higher auto insurance premium compared with a similar person without any accidents.

ever, reduce current earnings as a result of the loss of practice time or future earnings as a result of the loss of reputation. In addition, there may be substantial legal expenses and emotional stress associated with a lawsuit.[9] Therefore, doctors have two strong incentives: not to be involved in malpractice litigation even with malpractice insurance because of the hassle of involvement and not to make a large payout in a lawsuit since his or her reputation might be affected by the size of the payout.[10]

One practice area that is thought to be particularly affected by high malpractice risk is obstetrics and gynecology (ob-gyn).[11] Between 1994 and 2003, 24 percent of ob-gyn doctors in the state of Massachusetts either made settlement payments themselves or had payments made by their insurance carriers. This is substantially higher than most other specialties. For example, 15 percent of general surgeons and only 4 percent of internal medicine specialists made such payments (Commonwealth of Massachusetts 2004). The ACOG's 2003 survey found that 76.3 percent of ob-gyn doctors experienced at least one lawsuit during their career (Strunk and Esser 2004).

Obstetrics is often cited as a specialty that is particularly impacted by defensive medicine. In particular, it is often suggested that malpractice concerns encourage doctors to perform more cesarean sections (c-sections) than are medically needed. In deliveries involving a birth injury, doctors are more likely to be suspected of negligence when the baby is delivered vaginally because of the limited control of progress compared with c-section (Sachs 1989). Basset, Iyer, and Kazanjian (2000) assert that understanding current defensive medicine during hospital birth requires, first and foremost, understanding the process whereby physicians have come to act as "fetal champions." Therefore, defensive medicine is centered on concerns regarding the condition of the fetus. In case of vaginal delivery, the doctor should prove that c-section would not have made any difference and should convince people that everything necessary has been done (Mavroforou, Koumantakis, and Michalodimitrakis 2005). Cyr (2006) notes that many ob-gyn doctors follow a "when in doubt, cut it out" philosophy, which encourages c-sections whenever

9. Sometimes doctors hire their own attorneys.

10. Grant and McInnes (2004) found that patient volume decreased after large payout claims. I cannot empirically differentiate these two incentives.

11. According to *Medical Liability Monitor* (2003), an ob-gyn doctor practicing in New York City paid 5.3 times more for a malpractice insurance premium than an internist and 1.6 times more than a general surgeon.

the doctor has any concerns that a vaginal delivery may threaten the health of an infant.

The complaint of failure to deliver by c-section is frequently listed as a reason for a malpractice claim. In a retrospective review of physician malpractice claim records for a large New Jersey malpractice insurer, underperformance of c-section was cited 10 times more often as a reason for a malpractice suit than failure to delivery the baby vaginally: 31 versus 3 percent, respectively (Kravitz, Rolph, and McGuigan 1991). In a review of charts from about a quarter million total deliveries from a single insurer over the 1990–2000 period, Greenberg et al. (2006) note that, in many cases, early cesarean delivery would have saved money. Among the 91 lawsuits (4.4 per 10,000), 63 cases could have saved money with planned cesarean, and only five cases could have saved money by delivering vaginally rather than by cesarean. Greenberg et al. (2006) also project that the number of lawsuits would decrease by 53 percent and that legal costs would decrease by 72.7 percent if physicians performed universal c-sections.

The active role of the physician during c-sections may also help reduce the probability of litigation that is conditional on a poor outcome. For example, a doctor does not want to be exposed to a situation in which he or she is absent from the hospital during the patient's labor. Vaginal delivery increases the chance of this occurring because of longer labor times. Compared with a vaginal delivery, doctors play a more active role in deliveries by c-section.

Others have argued that the rapid increase of the U.S. c-section rate in the 1980s relative to England (which had a c-section rate similar to that of the United States in the 1970s) is attributable to the difference in legal environments. Interstate differences in legal environments are also a potential explanation for the more than 10-percentage-point difference in c-section rates between some states in the United States.[12]

In my empirical analysis, I use the National Practitioner Data Bank to better measure the malpractice risk that doctors face. This data set is a national universe of malpractice claims resolved by either settlement or jury verdict for the 15-year period from 1990 to 2005. This long time period allows me to exploit the considerable variation both between states and within a state over time in malpractice risk at the extensive (number of cases) and intensive (awards per case) margins. I calculate

12. In 2003, the c-section rate in Florida was 30.8 percent, compared with 19.2 percent in Utah (Martin et al. 2005).

malpractice risk in two ways: as either the number of ob-gyn claims per 1,000 births in each state over the last 3 years or the amount of ob-gyn claims paid per birth in each state over the last 3 years.[13]

The malpractice risk data are then combined with the Natality Detail data set, which is a census of all live births in the United States. Detailed information in the data is used to construct a series of treatment measures that have been suspected of being influenced by the malpractice risk that ob-gyn doctors face. The large sample size allows me to examine subsamples that may be particularly susceptible to changes in practice style. For example, a doctor's response to higher malpractice risk might vary by patient characteristics such as history of a previous c-section, complications of labor (breech presentation, gestational diabetes, multiple births), or the socioeconomic background of the mother. I therefore examine whether malpractice risk alters procedure choice overall and for these particular at-risk subgroups.

One challenge for reliable identification is that malpractice risk as defined above may be correlated with other factors related to the treatment decision, such as unobserved patient characteristics, physician quality, or practice style. For example, if doctors respond to malpractice risk by performing more c-sections, this may decrease the malpractice risk because a c-section lowers the probability of a lawsuit compared with vaginal delivery (reverse causality). In other words, the probability of a lawsuit is a function not only of the legal environment but also of procedure choices and other factors. To address this issue, I use an instrumental variables (IV) identification strategy that will capture only the malpractice risk generated by a state's legal environment. In particular, I use the malpractice risk for specialties other than ob-gyn as an instrument for the ob-gyn risk measure.

My findings demonstrate that c-section rates are not responsive to medical malpractice risk. In addition, utilization of health care, measured by the number of prenatal visits during pregnancy, is also insignificantly related to malpractice risk. I also find that malpractice risk has no statistical or qualitatively important impact on the use of other procedures such as ultrasound, fetal monitoring, forceps, or vacuum. The one exception is amniocentesis, a diagnostic procedure that is used substantially more as malpractice risk increases. Taken together, the findings suggest

13. I use 3 years for the following reasons: the average litigation process takes 3–4 years, and malpractice risk is a noisy measure because the incidence rate is low.

that malpractice risk does not have a significant effect on the behavior of obstetricians.

The paper is arranged as follows. Section 2 reviews the previous literature on malpractice risk and its impact on physician behavior. Section 3 describes the data used, the empirical analysis, and my identification strategy. Section 4 reports the empirical results, and Section 5 discusses the implications of my findings.

2. LITERATURE REVIEW

Although there has been considerable discussion about the impact of defensive medicine on health care costs, there is relatively little evidence that malpractice risk alters medical decisions. There are two types of studies that have attempted to measure the behavioral changes induced by malpractice risk. The first type uses surveys of providers, while the second type examines the reduced-form relationship between health care expenditures and outcomes and the changes in the malpractice environment.

A number of different surveys have tried to assess how physicians respond to tort litigation. For example, the Office of Technology Assessment conducted a survey (U.S. Congress 1994) of three specialties, including ob-gyn. The survey described a hypothetical scenario and asked doctors which diagnostic procedures they would prescribe. Doctors were also asked to choose the major reason for the procedure choices, with one possible response being malpractice risk. They found that, by their definition, 8 percent of diagnostic procedures performed are medically unnecessary.

Kessler and McClellan (1998) combined survey data from the American Medical Association Socioeconomic Monitoring System with tort reform data and found that doctors who faced higher malpractice risk increased both record keeping and the number of diagnostic tests performed. However, it is well known that surveys are potentially subject to response bias (Grant and McInnes 2004). This problem may be particularly acute in direct physician surveys because physicians may be tempted to exaggerate the impact of malpractice pressure in order to buttress the political argument in favor of liability reform (Klingman et al. 1996). Indeed, physicians estimated the probability of defending against a malpractice claim in any one year to be about three times higher than the actual probability of such a claim arising (Lawthers et al. 1992; Weiler et al. 1993).

Using state tort reforms that cap an injured patient's award as an exogenous change in malpractice risk, Kessler and McClellan (1996) showed that total expenditure declined for Medicare patients with acute myocardial infarction and ischemic heart disease in states with tort reform. However, these states did not experience any statistically significant change in outcomes such as mortality. The authors were unable to tell which procedures were defensive in nature (that is, whether fewer diagnostic tests were prescribed or less aggressive treatment lowered costs).

Using data from the 1990–92 period, Dubay, Kaestner, and Waidmann (1999) analyzed a within-group model correlating changes in c-section rates and malpractice premiums. They found that higher ob-gyn malpractice premiums had a statistically insignificant impact on the rate of cesarean delivery among all births. In contrast, they found that among unmarried mothers who had not graduated from high school, a group suspected to have a higher rate of being malpractice plaintiffs, malpractice premiums had a statistically significant positive impact on the c-section rates. While informative, there are two potential limitations of this study. First, given the short sample period, there is some question as to whether there was sufficient within-panel variation in premiums to successfully identify their model. Second, it is not clear whether higher premiums indicate an elevated malpractice risk for the doctor. While premiums do depend on both claim frequency and claim severity, they also depend on other market factors, such as interest rates and market competitiveness, and hence may measure the malpractice environment poorly (Grant and McInnes 2004). Indeed, Black et al. (2005) did not find a strong correlation between paid claims and malpractice insurance premiums. A report by Americans for Insurance Reform (2002) points out that medical insurance premiums are closely related to insurance market competition but not to paid claims.

Baicker and Chandra (2004) utilized state-level data on premiums and closed claims to examine the impact of malpractice risk on health care delivery. They examined the average malpractice risk from 1992 to 1994 and compared it with the average malpractice risk from 1999 to 2002. They found no statistically significant positive relationship between c-section rates and ob-gyn claims. This could be due to the small number of observations, inappropriate risk measure, or possible omitted-variable bias. They used aggregated state-level data instead of individual-level data, which I use here. They measure risk per doctor; however, each doctor can treat a very different number of patients. Therefore, it is better to measure risk per case. Their estimates may be subject to the omitted-variable bias problem mentioned earlier.

Using hospital discharge data and closed-claims data from Florida over the 1992–95 period, Grant and McInnes (2004) estimated the changes in doctor-specific c-section rates after physicians experienced malpractice litigation. They found that, after litigation, physicians had a 1-percentage-point higher risk-adjusted c-section rate. They assumed that a doctor would change behaviors only if sued. However, a doctor's malpractice risk is a reflection of the expected probability of being sued as a result of delivering medical services. Litigation against peers increases a doctor's perceived risk. If true malpractice risk is decided by specialty, as we see in the malpractice insurance market, Grant and McInnes cannot find unbiased results using their identification strategy. In addition, society is more concerned with whether doctors who do not experience litigation also perceive an increased malpractice risk and accordingly practice defensively.

Tussing and Wojtowycz (1997) defined malpractice risk as the cumulative number of obstetrics malpractice suits in a county from 1975 to 1986. This malpractice risk measure is constructed to be increasing over time, which can generate a spurious relationship if the dependent variable has an increasing trend. Taken together, the previous literature provides conflicting evidence regarding the impact of increased malpractice risk on physician behavior.

3. EMPIRICAL METHODOLOGY

3.1. Data

There are two major sources of data for this study: the National Practitioner Data Bank (NPDB) Public Use Data File and the Natality Detail File (U.S. Department of Health and Human Services 2006, 1992–98). The NPDB is an extensive collection of data on malpractice payouts, including pretrial settlements throughout the nation. If a malpractice insurance carrier pays on behalf of a practitioner, the carrier is required by the Health Care Quality Improvement Act of 1986 (Pub. L. No. 99-660, 100 Stat. 3743 [1986]) to report data about the claim to the NPDB within 30 days of the payout. This Public Use Data File is updated at the end of each quarter. For this project, I use the NPDB Public Use

Data File containing reports received from September 1, 1990, through March 31, 2005. I measure malpractice risk from 1992 to 1998 but drop cases that took more than 6 years from injury occurrence to resolve (for consistency throughout the data period, because some claims take several years to resolve).

The NPDB Public Use Data File records the year of injury and the year of report and has information on the size of the payment, related services (obstetrics, medication, and the like), the state in which the practitioner works, and practitioner's field of license (physician, pharmacist, dentist, and so on) for each case.[14] To maintain the confidentiality of the data, payment amounts are recorded in ranges only.[15] Payments are also top coded at $105 million, but no payments exceeded this amount during my data period.

Even though the NPDB is the most extensive data set of closed malpractice cases, it has several limitations. First, it lists only closed cases with a positive payout. In Section 1, I argued that there may be both psychic and economic costs to defending against a malpractice claim. As a result, not counting cases with zero payout may understate the malpractice risk faced by physicians. Second, tort cases are decided locally (for example, juries are selected at the county level), so there may be variation in malpractice risk within a state. However, the NPDB does not identify substate geographic information, so I cannot measure any within-state variation in malpractice risk. Third, the NPDB cannot link multiple defendants for a single case when they are reported separately. Fourth, hospitals are not included as providers. Therefore, hospitals that are the sole defendants in a case are not included in the data set. Likewise, closed cases in the NPDB that included both hospitals and physicians as defendants list only the physician defendants. Despite these limitations, it is the most accurate source of information for the entire United States over a long period regarding physician malpractice risk.

The Natality Detail File is a census of all live births in the United States and includes almost 24 million births for the 7 years (1992–98)

14. For each claim, there are six potential dates of interest: date of injury, date of opening a legal case, date of reporting to insurance company by doctors, date of a case closing (by jury verdict or settlement), payment date, and date of report (when the NPDB received the record). Only year of injury and year of report are available in the data.

15. For example, $10,000 increments are used for actual payments between $100,001 and $1 million. Payments between $1 million and $10 million are coded as the midpoint of $100,000 increments. Between $10 million and $20 million, a $1 million increment is used.

in which I have measures of malpractice risk. These data have demographic information about the mother (age, education, marital status, race, and ethnicity), the father (age, race, and ethnicity), characteristics of the pregnancy (parity, plurality, gestation, maternal weight gain, smoking and drinking during pregnancy, prenatal visits, breech presentation, high blood pressure, and gestational diabetes), and method of delivery. The data also include information about who attended the delivery, such as a midwife or a medical doctor.[16]

3.2. Measuring Malpractice Risk

I measure malpractice risk using closed-claims information in the NPDB Public Use Data File. Theoretical models of the tort liability system typically assume that agents respond to both the probability and the size of liability awards. Subsequently, I construct two measures of malpractice risk: one that measures the number of cases (frequency) and another that measures the size of liability payments (severity) per birth.

As I mentioned above, there is tremendous heterogeneity across medical specialties in the lifetime risk of being sued for malpractice. This is not surprising. Obstetricians care for different types of patients and perform a very different service than, for example, dermatologists or psychiatrists. As a result, each specialty should have different underlying levels of malpractice risk. For this reason, I measure malpractice risk within each specialty.

The malpractice risk faced by doctors is also assumed to vary by state and year on the basis of several factors. Each state has a different tort environment (tort law, precedent by jury, and so on). Practice patterns also vary substantially for different regions (Nicholson and Epstein 2003). For the most part, insurance companies set malpractice premiums according to a physician's specialty, type of practice, and geographical location (Quinn 1998).[17] For example, ob-gyn doctors practicing in New

16. In this analysis, I use only births delivered by medical doctors since midwives do not have the same procedure choices, such as c-section delivery, nor do they face the same malpractice risk. Less than 8 percent of births were delivered by midwives in the 7 years' worth of data I use.

17. Type of practice means a hospital- or office-based practice. Insurance companies define their own geographical categories. Only nine large states, such as New York and California, have geographic variation in prices within a state. For example, depending on the insurance carrier, there are three to six geographical regions within California in 2002. The rest of the states tend to have one premium for each specialty. I use state as the geographical level since only state is observed in the National Practitioner Data Bank (NPDB).

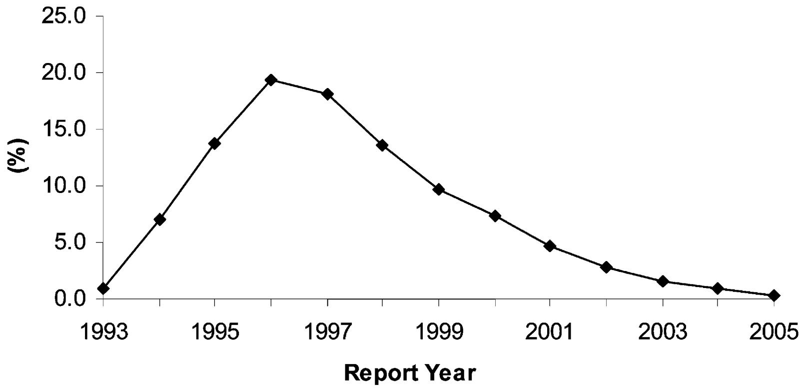

Figure 1. Number of malpractice claims for injuries occurring in 1993

York have very different malpractice risk than those practicing in Wyoming because of different legal environments and different practice patterns.

The NPDB identifies both the year of injury and the year of report, so malpractice risk can be measured using one of these years as the frame of reference. The key question to address is this: if doctors are altering their practice style on the basis of malpractice risk, are they altering their behavior after alleged malpractice occurs (date of injury) or when a malpractice suit is paid out and then reported to the NPDB (date of report)? Research on this question by Grant and McInnes (2004) suggests that behavior changes are associated with the incident that led to the malpractice claim, not with the closure of the claim. Subsequently, I look for evidence that ob-gyn doctors practice defensive medicine after an injury occurs.[18] Unfortunately, injury claims make it into the NPDB only once a case has been closed, which many times can be years after the injury. Therefore, I must define a consistent window after which an injury occurs when cases will be reported in the NPDB.

Figure 1 reports the distribution of years in which the case is reported to the NPDB for injuries that occurred in 1993 for all medical mal-

18. Grant and McInnes (2004) have information on zero-payout claims if insurance companies spent money for legal defense using Florida closed-claims data. I do not have information on zero-payout cases in the NPDB. However, the coefficients for the zero payouts in Grant and McInnes's study were of very small magnitude and not statistically significant. As a result, I feel comfortable with my results, even though I do not have zero-payout cases.

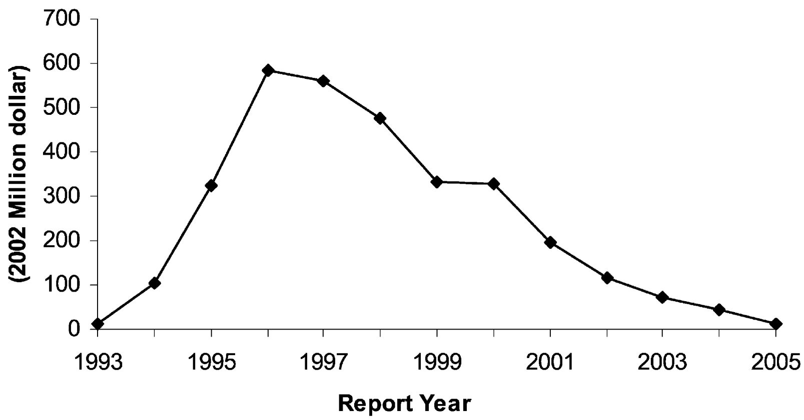

Figure 2. Amount of malpractice claims paid for injuries occurring in 1993

practice cases.[19] The mean year of the report is 1997.3, the median is 1997 (the fourth year after the injury), and the mode is 1996 (the third year after the injury). Note, however, that a small fraction of cases are reported 10–12 years after a patient is injured. Figure 2, in which I graph the distribution of total dollars paid (in real 2002 dollars) for reported cases resulting from injuries in 1993, shows similar results. Most cases are settled within a few years of the actual injury. In Figure 3, I report the cumulative distribution of closed claims for injuries occurring in 1993. Roughly 80 percent of cases are reported within 6 years of injury.[20]

Although I have Natality Detail File data through the early 2000s and the NPDB data are reported through March 2005, the long lag between injury and the claim report means that I cannot use the latest years of data. If the distribution of paid claims in 2002 is similar to the distribution in 1993, then only about 15 percent of 2002 claims have been reported by March 2005.[21] In order to have a consistent measure of malpractice risk across all years in the sample, I use the same window of years after injury for cases to be reported. This understates the total

19. The ob-gyn cases have the same shape of distribution with a larger mean year of 1998, the fifth year after the injury.

20. Overall, 18.6 percent of cases by number and 24.7 percent of cases by amount have not been resolved within 6 years of injury.

21. The distribution of lags between injury year and report year is indeed very stable throughout my data period.

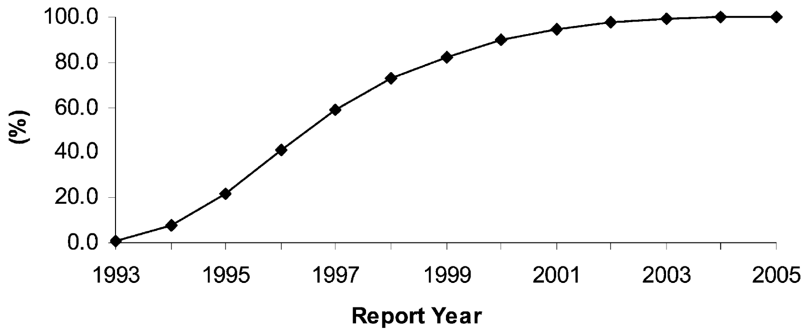

Figure 3. Cumulative density function of the number of malpractice claims for injuries occurring in 1993.

closed claims from earlier years in the sample, but all years are treated equally.

The choice of the length of the window that I use requires trade-offs. Using a longer window generates more accurate measurement of risk but reduces the available years of data that I can use from the Natality Detail data. For example, a 2-year window would allow me to use data through 2002, and a 4-year window would allow me to use data through 2000.[22] Unfortunately, as the numbers in Figure 3 illustrate, the shorter the window, the fewer actual reported claims are included in the malpractice risk index.

I use a window of 6 years after the injury to construct the malpractice risk measure (see Figure 4).[23] Cases reported within the same year that an injury happens are rare.[24] Therefore, I decided to drop the cases that were reported in the same year in which the injury occurred, basing this decision on the same logic I used to drop cases reported 6 or more years after the injury.[25]

With the text above as a backdrop, I define malpractice risk in the

22. Although I have data reported by March 2005, I assume that I have data until 2004 as a complete year.

23. I cover 81 percent of injuries in terms of frequency based on Figure 3 with this window. Figure 4 shows slightly lower coverage, which is 76 percent in terms of severity by using a 6-year window.

24. Only around 1 percent of cases (on the basis of on the number of claims) or .3 percent of cases (on the basis of the amount of payout) are closed in the same year that the injury occurred.

25. Results are robust if I use a 5-year window instead of a 6-year window.

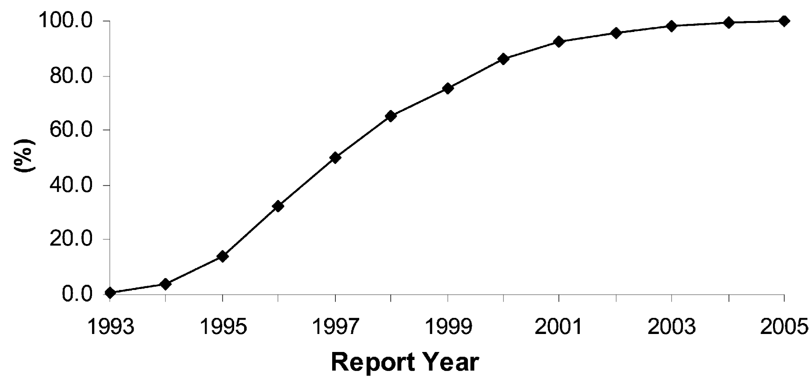

Figure 4. Cumulative density function of the amount of claims paid for injuries occurring in 1993.

following manner. The variable C_{sjt} denotes the number of reported cases in which the injury occurred in state s in year t, with the gap between injury and reporting measured in years by j. The numbers of births in thousands in state s and year t are written as B_{st}. These variables can be used to construct the malpractice risk for ob-gyn doctors in state s in year t:

$$R_{st}^{\mathrm{OB}} = \left(\sum_{j=1}^{6} C_{sjt}\right)/B_{st}. \tag{1}$$

The number of malpractice injuries in a given year should be proportional to the size of the exposure, so I divide the number of ob-gyn malpractice cases by the number of births in thousands. For another measure of malpractice risk, I use the amounts of ob-gyn claims paid after adjusting for inflation using the urban consumer price index for the year of the report in thousands of dollars and then dividing it by the number of births.[26]

It is likely that doctors will consider not only this year's risk but also risk in recent years. To account for this, I use a 3-year moving average to measure the level of risk that doctors face. The choice of a 3-year

26. The paid year, not reported year, should be used. But the paid year is not recorded in the data. Considering the rule that all paid claims should be reported within 30 days after payout, reported year is a good proxy.

moving average is subject to discussion.[27] Considering that the average litigation process takes 3–4 years, it is reasonable to assume that there is persistence in the malpractice risk from year to year. An additional benefit is that it will give a less noisy measure because the incidence rate is quite low. I denote the moving average of risk in ob-gyn as $\mathrm{MAR}_{st}^{\mathrm{OB}}$:

$$\mathrm{MAR}_{st}^{\mathrm{OB}} = \left(\sum_{k=0}^{2} R_{st-k}^{\mathrm{OB}}\right)/3. \tag{2}$$

To construct the malpractice risk for ob-gyn doctors in 1993, I use obstetrics-related cases in which an injury occurred in 1993 and the case was reported by 1999. Then the frequency of these included cases is divided by the number of births (in thousands) in 1993. The severity of these cases is measured in thousands of dollars divided by the number of births in 1993. The measured risk for ob-gyn doctors as in equation (1) in 1993, 1992, and 1991 was averaged to get the final measure of risk in equation (2) that ob-gyn doctors face in 1993.[28] I have constructed malpractice risk in this way from 1992 to 1998. I cannot include data for 1999 because the 6-year window for injuries occurring in this year is past the date of my last observation. The incorporation of the 3-year moving average also forces me to drop the first 2 years of observations for which I have outcome data (injuries that occurred in 1990 or 1991).

Table 1 presents descriptive statistics for the malpractice risk faced by ob-gyn doctors: an average probability of a successful malpractice suit of .19 percent for every 1,000 deliveries. On the basis of the severity measure presented in Table 1, ob-gyn doctors face an average risk of a payout of $73 for each delivery. Doctors in specialties other than ob-gyn face a lower level of malpractice risk, with a .04 percent probability of a malpractice suit with a positive payout by frequency risk measure for every 1,000 procedures and an $8 (in 2002 dollars) payout for each procedure.

3.3. Definition of Outcomes

The extensive data available in the Natality Detail File provide me with a number of outcomes that measure the practice patterns of physicians. The most frequent outcome analyzed is the method of delivery: vaginal

27. Results are robust to not using moving average for the risk measure.

28. I used 1992, 1991, and 1990 to construct malpractice risk in 1993 with the concern that it might take some time to share the information. My results are robust to these different measures.

Table 1. Descriptive Statistics of Measured Risks in Obstetrics and Gynecology (Ob-Gyn) and Other Specialties

	Ob-Gyn Claims per 1,000 Births	Other Specialties' Claims per 1,000 Population	Ob-Gyn Claims Paid per Birth ($1000s)	Other Specialties' Claims Paid per Population ($1000s)
1%	.0620	.0105	.0151	.0030
5%	.0936	.0181	.0272	.0039
25%	.1357	.0291	.0408	.0049
50%	.1762	.0394	.0635	.0072
75%	.2292	.0439	.0943	.0104
95%	.3136	.0586	.1591	.0152
99%	.4318	.0645	.2120	.0186
Mean	.1874	.0382	.0733	.0082

Note. Dollar values are thousands of 2002 dollars.

or cesarean. There are different costs and benefits of each procedure. Women who deliver a baby by c-section have a higher risk of hemorrhage, blood clots, and bowel obstruction as well as infection because it is a major abdominal surgery. They also have to be hospitalized longer and are more likely to be rehospitalized subsequently. Women with a vaginal delivery are more likely to experience minor issues like urinary incontinence. However, a baby who is born vaginally is more likely to have nerve injury (Childbirth Connection 2006).

The following arguments suggest that c-sections are employed as defensive medicine. Most obstetrical malpractice litigation is triggered by injuries to babies such as brain damage.[29] In both animal experimentation and epidemiological studies, it has been shown that total asphyxia in full-term infants leads to brain damage and in many cases to perinatal death (Sachs 1989).[30] There is a greater chance of asphyxia when the baby is delivered vaginally. When an injury occurs to a vaginally delivered baby, the plaintiff has a greater ability to allege a failure to perform a timely c-section or misinterpretation of the fetal heart rate tracing or both (Sachs 1989).

There is also some suggestive evidence that c-section rates in the

29. The primary allegations of obstetric claims are a neurologically impaired infant (34.3 percent) and stillbirth or neonatal death (15.3 percent) (Strunk and Esser 2004).

30. Asphyxia is a condition in which an extreme decrease in the concentration of oxygen in the body accompanied by an increase in the concentration of carbon dioxide leads to loss of consciousness or death (*American Heritage Dictionary of the English Language*, 4th ed.). Perinatal refers to the 5 months before and 1 month after birth.

United States are responsive to malpractice risk. Rates in the United States (6 percent) were similar to those of Europe (England, 5 percent; Hungary, 6 percent) in the early 1970s. The U.S. rate increased to 20 percent between 1981 and 1983, while rates in England increased to only 10 percent (Notzon, Placek, and Taffel 1987). It has been suggested that one possible explanation for the divergence in c-section rates between the two countries is the difference in legal environments. The U.S. legal system, often described as litigious, could be driving the difference in c-section growth rates compared with other countries (Tharoor 2001).

The Natality Detail File includes information on prenatal care, including the number of doctor's office visits during the pregnancy and the use of diagnostic procedures such as ultrasound and amniocentesis. The data also indicate whether equipment or technology such as fetal monitoring, forceps, or vacuum extraction were used during labor.[31]

Prenatal care visits are recorded as integer counts, and values range from zero to 49. All other outcomes in this paper are recorded as dummy variables for which usage of the procedure, test, or device is given a value of one.

3.4. Subsamples

I use a census of births in the United States from 1992–98. (This is referred to as the All Births sample.) Some patients are more likely to be more affected by a physician's change in practice style stemming from an increase in malpractice risk. I divide the data into six different subsamples that might be susceptible to changes in practice pattern based on the mother's history of previous delivery, complications during birth, or socioeconomic status.

The Centers for Disease Control and Prevention (CDC) and King and Lahiri (1994) claim that a c-section may represent defensive medicine for some patients and that this would be especially true for patients with

31. Ultrasound is a commonly used diagnostic procedure that allows the provider to observe the development of a fetus. Amniocentesis is a procedure performed during the early stages of pregnancy to detect genetic or chromosomal disorders using sample fluid from the mother's womb. Fetal monitoring is typically performed during delivery to check the baby's heart rate. Steel forceps or soft-cup vacuum extractors can be used to assist vaginal delivery when it does not progress spontaneously or when the baby must be delivered immediately because of fetal distress or maternal fatigue.

a previous c-section.[32] Within the medical profession, there is substantial disagreement on the costs and benefits of vaginal births after c-sections (VBACs), and as a result, a consensus guideline for treatment has not yet been reached. The old concept could be summarized by the phrase, "once cesarean, forever cesarean." The supporting idea was that a woman who has a scar in her uterus as a result of a previous c-section might have a higher probability of experiencing a rupture in a future labor. Repeated cesarean would then reduce the chance of separation of the uterus. However, c-section carries its own risks, as described above.

Owing to the lack of consensus in the medical profession about the desirability of VBACs, and partly owing to movements by such groups as the CDC and ACOG to lower the repeated c-section rate, VBAC rates have fluctuated significantly over time. Almost 19 percent of patients who had a previous c-section delivered their baby vaginally in 1989, but this rate increased sharply to 28.3 percent by 1996 and then declined rapidly to 20.6 percent by 2000. The high risk of trying vaginal labor for patients with a previous c-section and a lack of consensus in the medical profession may lead obstetricians to respond to the malpractice risk that they face when they practice for this subgroup of patients.[33]

There are specific high-risk medical conditions for pregnancy, such as such as breech presentation, in which the baby is in a buttocks- or feet-first position. For some breech presentations, vaginal delivery can pose serious health risks for both the mother and the baby (Sachs 1989). Other conditions that produce more frequent use of c-sections include gestational diabetes, multiple births, and high blood pressure. These potentially high-risk patients could lead doctors to choose more defensive procedures. People also have expressed concern that care for these high-risk pregnancies could be impacted by heightened professional liability risk.

Women of low socioeconomic status are another subgroup that researchers believe is differentially affected by physicians' practice changes (Dubay, Kaestner, and Waidmann 1999). Some state governments have

32. The Centers for Disease Control and Prevention have targeted that by the year 2010 the U.S. cesarean delivery rate for women giving birth for the first time should decrease to 15 percent from the 1998 baseline rate of 18 percent (U.S. Department of Health and Human Services 2000). They specifically wanted to increase rates of vaginal birth after cesarean to 37 percent from 28 percent (the 1998 rate) by the year 2010.

33. Several studies found that patients who tried vaginal birth after delivery but failed in the end have higher risks of uterine rupture and infectious morbidity compared with repeat cesarean delivery (Hibbard et al. 2001; Landon et al. 2004; Scott, Flora, and Deveny 1998; Mozurkewich and Hutton 2000).

experienced reduced obstetrician participation in Medicaid.[34] One possible reason is the common notion that low-income patients are more litigious with regard to physicians, even though the data do not confirm this (General Accounting Office 1987). These patients of low socioeconomic status also have lower incomes and higher probabilities of adverse outcomes that might lead to litigation. They have limited access to health care, including prenatal care, because of medical insurance status or time constraints. Therefore, obstetricians might choose more defensive procedures or perform more diagnostic tests when they care for this subgroup. In this paper, I classify the low-socioeconomic-status group as those with a high school degree or less.[35]

In Table 2, I present descriptive statistics for a variety of outcomes. Given the large sample size, standard deviations for these discrete outcomes are approximately equal to $[\bar{X}(1-\bar{X})]^{.5}$, where $\bar{X}$ is the sample mean. The primary outcome in the analysis is the choice between c-section and vaginal delivery. Cesarean section rates vary considerably across subsamples, as expected. Only 16 percent of pregnancies result in c-section among the patients who had not had a previous c-section. On the other hand, 86 percent of pregnancies with breech presentation result in c-section. The number of prenatal visits could measure the mother's access to health care. Interestingly, the number of prenatal visits does not vary much across subsamples. Rates of use of ultrasound and amniocentesis are significantly higher for women with complications. Patients with a high school degree or less have the lowest rates of use of diagnostic tests among all subsamples.

3.5. Econometric Model

The basic question I examine is whether the higher malpractice risk faced by ob-gyn doctors alters procedure choices. As discussed above, I measure risk (MAR) in two ways: (1) the number of ob-gyn claims per 1,000 births over the last 3 years in a state and (2) the amount of ob-gyn claims paid per birth over the last 3 years in a state. The basic econometric model is a within-group specification in which I examine within-

34. For example, the number of providers in Washington State participating in Medicaid maternity care declined by 4.3 percent in 1986, compared with the year before.

35. I also tried the socioeconomic classification that was used by Dubay, Kaestner, and Waidmann (1999): unmarried with less than a high school degree or unmarried with a high school degree. Results are robust to different classifications of socioeconomic status.

Table 2. Descriptive Statistics of Outcome Variables for Various Samples

		History		Complications			
	All Births	Previous Cesarean Section	No Previous Cesarean Section	Breech	Gestational Diabetes	Multiple Birth	**≤High School Degree**
Cesarean section	22.78	75.59	16.09	85.87	37.27	56.44	21.80
Prenatal visits	11.45	11.59	11.43	11.55	13.05	12.95	10.87
	(1.28)	(1.35)	(1.29)	(1.76)	(1.77)	(2.54)	(1.22)
At least one ultrasound	62.43	67.38	61.80	72.80	70.97	70.63	60.47
Amniocentesis	3.22	5.36	2.94	5.38	9.18	6.26	1.90
Fetal monitoring	81.64	78.00	82.10	81.50	87.08	81.65	80.71
Forceps[a]	4.87	5.78	4.83	11.16	5.98	5.86	4.21
Vacuum[a]	7.75	9.36	7.69	9.02	8.57	9.26	6.93
N	23,639,438	2,657,393	20,982,045	940,378	622,569	644,402	13,108,946

Note. Standard deviations for continuous variables are in parentheses. All values except prenatal visits are percentages. Prenatal visits are the number of visits to a doctor's office from zero to 49. Given my large sample sizes, standard deviations for discrete outcomes are approximately equal to $[x(1-x)]^{.5}$, where x is the sample mean.

[a] The cesarean section population is dropped since this procedure is used only for vaginal delivery.

state changes in the use of procedures over time as malpractice risk changes. This model can be described by the following specification:

$$Y_{ist} = X_{ist}\beta + \lambda \mathrm{MAR}^{\mathrm{OB}}_{st} + \theta_t + \alpha_s + \nu_{ist}, \tag{3}$$

where Y_{ist} measures the procedure choice (for example, the binary variable equals one if the baby was delivered by c-section and equals zero for vaginal deliveries) for patient i in state s in year t; X_{ist} denotes the mother's observable characteristics, which include age, race, and education; θ_t is a year fixed effect; α_s is a state fixed effect; and ν is an idiosyncratic error term. In all models, I calculate variances allowing for an arbitrary form of heteroskedasticity and arbitrary correlation in errors within a state.

The use of a within-group specification is critical for a variety of reasons. Much of the variation in malpractice risk is due to permanent differences across states. If I regress the state-level malpractice risk on state and year fixed effects, I obtain R^2-values of .73 and .68 for the frequency risk measure and the severity risk measure, respectively. This is not surprising. Each state has a different tort law system, which leads some states to have a more favorable legal climate for plaintiffs.

I could capture some of these permanent differences by including a series of descriptive variables that characterize a state's tort law system. However, these variables would imperfectly measure these differences, especially in the case of medical malpractice, since tort law is based on both common and statutory law.

More important, I am concerned that the same factors that lead to a different legal environment may also reveal something about the medical environment. For example, suppose a state has lower quality medical services with a higher than average frequency of true medical malpractice. In this case, the medical tort system within a state may evolve to reflect the higher rate of malpractice. The state legal environment may alter the burden of proof for plaintiffs, and payments conditional on judgment may differ as well. To address these unobservable differences between states, I use a within-state model with variation over time in malpractice risk and procedure choices to identify the model. Therefore, any difference in practice style or malpractice risk that is permanent across states will be purged from the analysis by adding state fixed effects.

Even if I use a within-group model, malpractice risk may signal something unobserved about physician quality. Suppose that low-ability doctors are more prone to use c-sections to minimize the possibility of an emergency situation such as fetal distress or dystocia, which are common complications of vaginal deliveries. At the same time, low-ability doctors are also more likely to be sued, since the quality of the service they provide is substandard. If this is the case, then there is a positive correlation between the malpractice risk and error term in equation (3), biasing upward the coefficient λ.

Omitted-variables bias might also be generated by reverse causality. As mentioned above, deliveries by c-sections are less likely to result in a lawsuit than are vaginal deliveries. If doctors shed risk by performing more c-sections, this may decrease the malpractice risk as I have constructed it. If this is the case, then there is a negative correlation between the malpractice risk and error term in equation (3), which biases downward the coefficient λ.

To reduce the possibility of omitted-variable bias, I use an IV procedure. A two-stage least squares (2SLS) model will produce a consistent estimate of λ if I can identify an instrumental variable that alters the ob-gyn malpractice risk but does not directly impact c-section rates. I will use a measure of malpractice risk for all medical specialties except ob-gyn as an instrument.

As I demonstrate below, it is easy to establish the first criterion, namely, that within-state malpractice risk is correlated across specialties. This instrument captures medical malpractice risk specific to each state and year observation that is not based on practice style. Potential plaintiffs consider a number of factors when deciding whether they should seek a legal remedy for their injuries. One factor they consider is the legal climate within the state. State tort laws or recent jury verdicts may encourage or discourage patients from seeking remedies regardless of medical specialty. Subsequently, in any given year, the malpractice risk for ob-gyn doctors and doctors with other specialties in a state may be correlated since both risks are governed by the same legal climate.

The other criterion to be a valid instrument is that the instrument must not directly impact the outcome of interest. In other words, ob-gyn doctors should depend only on their own specialty's risk, not on other specialties' risks, for their procedure choices. For example, when the number of malpractice claims in cardiology increases because of the medical services provided to patients, ob-gyn doctors will not change their procedure choice (for example, c-section or vaginal delivery) on the basis of an increased malpractice risk in cardiology. Each specialty has its own underlying malpractice risk that does not depend on other specialties partly because each specialty, especially ob-gyn, provides unique medical services. Separate malpractice insurance premia by specialty reflects these factors. Therefore, changes in malpractice risk for doctors with other specialties will not change the procedure choice of ob-gyn doctors unless it is subsumed in the legal environment.[36]

In summary, the legal environment may be reflected in malpractice risk for both ob-gyn doctors and doctors with other specialties. However, it is unlikely that ob-gyn doctors are responding to the higher risk levels in other specialties. The higher risk that doctors face in all other specialties except ob-gyn should be subsumed into the ob-gyn risk through the legal environment. Therefore, my assumption that malpractice risk in other specialties affects ob-gyn procedure choices only through the legal climate seems reasonable.

I measure risk for other specialties exactly the same way as ob-gyn risk, with only one exception. I use the number of births as a denominator to calculate risk per case for ob-gyn doctors, but for other specialties, I use the resident population of the state in the relevant year as the denominator.

4. RESULTS

4.1. The Impact of Malpractice Risk on the Use of Cesarean Section

In Table 3, I report ordinary least squares (OLS) and 2SLS estimates of equation (3) for one outcome variable, c-section, for all births. I report only the estimated coefficient on the malpractice variable, as that is the coefficient of primary interest. My OLS estimates are potentially biased for the reasons mentioned above. I use two measures of risk: the number of ob-gyn claims per 1,000 births and the amount of ob-gyn claims paid per birth. The negative signs of the coefficients for malpractice risk suggest that fewer c-sections are performed when risk increases, which is contrary to the conventional wisdom. However, none of the coefficients are estimated precisely. In addition, the elasticity for the number of ob-

36. The worst possible scenario for my instrument is that doctors' abilities in ob-gyn and other specialties in a state move together over time. However, my instrument will be valid unless doctors in all specialties have the same preference in geography (for example, one region has doctors of lower ability throughout all specialties), and it looks like doctors are more likely to change preference of specialty on the basis of future income over time, since the opening for each specialty is very limited (Bhattacharya 2005; Hurley 1991). The other possible threat to my instrument, for example, is when doctors perceive their risk as a weighted probability of being sued across specialties as well as their own.

Table 3. Impact of Malpractice Risk on Cesarean Section: All Births Sample

Risk Measure	All Births
Ordinary least squares estimates:[a]	
Ob-gyn claims per 1,000 births	−.0076
	(.0181)
	[−.0062]
Ob-gyn claims paid per birth ($1,000s)	−.0101
	(.0221)
	[−.0032]
First-stage estimates:	
Other specialties' claims per 1,000 population	3.97
	(.92)
Other specialties' claims paid per population ($1,000s)	5.96
	(1.76)
Two-stage least squares estimates:[a]	
Ob-gyn claims per 1,000 births	−.0412
	(.0727)
	[−.0338]
Ob-gyn claims paid per birth ($1,000s)	.0262
	(.1108)
	[.0084]
Exogeneity test (p-value):	
Ob-gyn claims per 1,000 births	.609
Ob-gyn claims paid per birth ($1,000s)	.724

Note. Standard errors in parentheses are clustered by state. Elasticities are in brackets. State and year fixed effects are included. The independent variables for regression are age, race (white, black, Hispanic, and other), marital status (1 if married), and education (less than high school, high school graduate, some university, and university graduate). Ob-gyn = obstetrics and gynecology. N = 23,639,438 births.

[a] The dependent variable is cesarean section.

gyn claims is −.0062, which is very small. The elasticity for the amount of ob-gyn claims paid per birth is even smaller.

Table 3 also presents the first-stage results for the 2SLS estimates. The coefficient estimates for both risk measures for other specialties are positive and statistically significant at the 1 percent level, which means that the instrument and ob-gyn malpractice risk are correlated. I also report the 2SLS estimates for the malpractice risk measures.[37] The co-

37. Owing to the large number of observations, I cannot run the regression using each birth as the unit of observation. I collapsed the data into cells based on the covariates that are all discrete (such as age, race, marital status, education, state, and year) and use the cell size as a frequency. The STATA procedure allows the calculation of clustered standard errors in a two-stage least squares (2SLS) model with fixed effects. Unfortunately, there is no STATA procedure that allows the use of frequency weights in addition. Therefore, I run 2SLS manually, which means that I run the first stage, get the predicted value, and use this

efficient of risk measured as the number of ob-gyn claims decreases greatly compared with the OLS estimate. However, not surprisingly, the standard errors increase substantially. As a result, the 2SLS estimates are statistically insignificant. For risk measured as the amount of ob-gyn claims paid per birth, the 2SLS estimate is much larger than the OLS estimate. It is positive, which supports the hypothesis that the number of c-sections increases with higher malpractice risk. However, this estimate is also imprecise. On the basis of the *p*-value of the Hausman test for exogeneity in Table 3, I cannot reject the null hypothesis that the OLS estimates are statistically equal to the 2SLS estimates. While the magnitude of the estimates changed substantially, the increased standard error makes it difficult to reject the null hypothesis.

The elasticity calculated from the 2SLS results using the number of ob-gyn claims per 1,000 births or the amount of ob-gyn claims paid per birth are both still very small. If the amount of ob-gyn claims paid increased from the 25th percentile to the 75th percentile (which is a $54 increase in risk per delivery), the rate of c-sections would increase by just .1 percent, which is .6 percent of the mean. In other words, it is the case that for every 10,000 babies delivered, 2,278 babies are delivered by c-section. A 129 percent increase in risk would increase the number of babies delivered by c-sections by 14. Even if the true impact of the malpractice risk were at the top end of the 95 percent estimated confidence interval, an increase from the 25th percentile to the 75th percentile in the amount of ob-gyn claims paid would increase the c-section rate by only 1 percentage point. Therefore, although the estimates are statistically insignificant, I can reject the hypothesis that the impact of malpractice risk on c-section choice is substantial.

In Table 4, I expand my analysis of c-sections into the six different subsamples discussed earlier. The coefficients of interest in the OLS estimates are all negative except for the group with no previous c-section for both frequency (number of ob-gyn claims per 1,000 births) and severity (ob-gyn claims paid per birth) but are statistically insignificant. The first-stage estimates for 2SLS are statistically significant at the 1

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predicted value in the second regression. In this case, I will not get the correct standard error because the actual malpractice risk is required to calculate the correct 2SLS standard errors. To compare the difference between the correct and incorrect standard errors, I test a subsample small enough for STATA to handle without collapsing the data: breech presentation (940,378 observations). The standard errors differ from each other in the fifth digit after the decimal point, so I am comfortable presenting standard error estimates based on this alternative procedure.

Table 4. Impact of Malpractice Risk on Cesarean Section: Various Samples

		History		Complications			
	All Births	Previous Cesarean Section	No Previous Cesarean Section	Breech	Gestational Diabetes	Multiple Birth	**≤High School Degree**
Ordinary least squares estimates:[a]							
Ob-gyn claims per 1,000 births	−.0076	−.0391	.0022	−.0694	−.0554	−.0197	−.0033
	(.0181)	(.0640)	(.0146)	(.1096)	(.0306)	(.0420)	(.0173)
	[−.0062]	[−.0098]	[.0025]	[−.1528]	[−.0285]	[−.0666]	[−.0027]
Ob-gyn claims paid per birth ($1,000s)	−.0101	−.0750	.0127	−.1121	−.0749	−.0393	−.0031
	(.0221)	(.0784)	(.0182)	(.1873)	(.0504)	(.0655)	(.0232)
	[−.0032]	[−.0073]	[.0057]	[−.0976]	[−.0155]	[−.0532]	[−.0010]
First-stage estimates:							
Other specialties' claims per 1,000 population	3.97	3.98	3.97	4.00	3.99	4.02	3.81
	(.92)	(.89)	(.92)	(.99)	(.93)	(.91)	(.86)
Other specialties' claims paid per population ($1,000s)	5.96	5.82	5.97	5.98	5.81	6.01	5.63
	(1.76)	(1.69)	(1.77)	(1.98)	(1.64)	(1.69)	(1.73)
Two-stage least squares estimates:[a]							
Ob-gyn claims per 1,000 births	−.0412	−.0895	−.0218	−.0398	−.0170	−.1924	−.0338
	(.0727)	(.2092)	(.0598)	(.1808)	(.0915)	(.1285)	(.0737)
	[−.0338]	[−.0225]	[−.0253]	[−.0876]	[−.0087]	[−.6511]	[−.0286]
Ob-gyn claims paid per birth ($1,000s)	.0262	−.3606	.0575	−.1971	−.0718	−.0887	.0319
	(.1108)	(.4168)	(.0935)	(.4329)	(.1601)	(.1837)	(.1240)
	[.0084]	[−.0355]	[.0261]	[−.1716]	[−.0149]	[−.1202]	[.0103]
Exogeneity test (*p*-value):							
Ob-gyn claims per 1,000 births	.609	.765	.659	.847	.640	.143	.648
Ob-gyn claims paid per birth ($1,000s)	.724	.441	.612	.812	.983	.775	.763
N	23,639,438	2,657,393	20,982,045	940,378	622,569	644,402	13,108,946

Note. Standard errors that allow for heteroskedasticity and arbitrary covariance in errors within a state are in parentheses, and elasticities are in square brackets. State and year fixed effects are included. The independent variables for regression are age, race (white, black, Hispanic, and other), marital status (1 if married), and education (less than high school, high school graduate, some university, and university graduate). Ob-gyn = obstetrics and gynecology.

[a] The dependent variable is cesarean section.

percent level throughout all of the subsamples. The 2SLS estimates differ substantially from the OLS estimates. Some of the 2SLS estimates, such as that for all births using the amount of ob-gyn claims paid per birth, even changed sign from the corresponding OLS estimates, but the direction of movement from OLS estimates is not consistent throughout the subsamples. However, all of the coefficients are estimated imprecisely, and I cannot reject the null hypothesis on the basis of the p-values of the Hausman test for exogeneity.

Consider the magnitude of the estimate using the amount of ob-gyn claims paid per birth for mothers with a high school degree or less. If the malpractice risk were to increase from the 25th percentile to the 75th percentile, the c-section rate would increase by just .2 percent, which is .8 percent of the mean. In other words, the number of babies delivered by c-section would increase by only 16 from 2,180 for every 10,000 babies born to mothers with a high school degree or less as a result of a 129 percent increase in risk.

4.2. The Impact of Malpractice Risk on Other Outcomes

In Table 5, I report OLS estimates for various outcomes using the number of ob-gyn claims per 1,000 births as the risk measure. Higher malpractice risk could limit patients' access to health care if some doctors decide to stop practicing ob-gyn as malpractice risks increase. On the other hand, doctors might want to see patients more often to decrease the possibility of litigation. The estimated effect for number of prenatal visits is positive, which suggests that pregnant women see doctors more often when doctors face higher malpractice risk. For pregnant women who have gestational diabetes, higher malpractice risk produces a statistically significant increase in prenatal visits. I also report results for the use of ultrasound and amniocentesis. Some doctors have been sued for failure to detect in advance certain genetic problems that can give parents broader choices (Blume et al. 2003). Therefore, with increased malpractice risk, doctors might want to perform diagnostic tests to detect any genetic problems more aggressively. Indeed, these estimates suggest that doctors are more likely to use these diagnostic tests when they face a higher malpractice risk. For mothers who had a c-section previously and for mothers having multiple births, the coefficient on malpractice risk in the amniocentesis equation is estimated with statistical precision. The coefficients on malpractice risk for both subsamples are .05 and .08, respectively. I find a positive sign in all subgroups for use of vacuum

Table 5. Ordinary Least Squares Estimates of the Impact of Malpractice Risk, with Number of Obstetrics and Gynecology Claims per 1,000 Births as a Measure of Risk

Outcome	All Births	History: Previous Cesarean Section	History: No Previous Cesarean Section	Complications: Breech	Complications: Gestational Diabetes	Complications: Multiple Birth	⩽High School Degree
Cesarean section	−.0076	−.0391	.0022	−.0694	−.0554	−.0197	−.0033
	(.0181)	(.0640)	(.0146)	(.1096)	(.0306)	(.0420)	(.0173)
	[−.0062]	[−.0098]	[.0025]	[−.1528]	[−.0285]	[−.0666]	[−.0027]
Prenatal visits	.2561	.0714	.2834	.8846	1.2485	.8578	.4176
	(.5023)	(.4850)	(.5070)	(.5198)	(.6100)	(.8005)	(.5517)
	[.0041]	[.0011]	[.0046]	[.0144]	[.0183]	[.0126]	[.0070]
At least one ultrasound	.0106	.0570	.0053	.0533	.0600	.0738	.0132
	(.1026)	(.1174)	(.1017)	(.1099)	(.1066)	(.1363)	(.0880)
	[.0031]	[.0160]	[.0016]	[.0138]	[.0162]	[.0199]	[.0040]
Amniocentesis	.0228	.0484	.0198	.0358	.0357	.0779	.0145
	(.0133)	(.0206)	(.0124)	(.0218)	(.0274)	(.0304)	(.0083)
	[.1326]	[.1717]	[.1259]	[.1258]	[.0746]	[.2376]	[.1408]
Fetal monitoring	.0232	.0025	.0239	.0261	.0112	.0055	.0310
	(.0552)	(.0644)	(.0554)	(.0533)	(.0501)	(.0683)	(.0603)
	[.0053]	[.0006]	[.0054]	[.0060]	[.0024]	[.0012]	[.0070]
Forceps[a]	.0190	.0340	.0182	.0710	.0013	.0454	.0188
	(.0164)	(.0249)	(.0162)	(.0573)	(.0272)	(.0244)	(.0165)
	[.0731]	[.1118]	[.0704]	[.1203]	[.0041]	[.1479]	[.0823]
Vacuum[a]	.0078	.0520	.0060	.0063	.0364	−.0261	.0070
	(.0176)	(.0276)	(.0174)	(.0718)	(.0243)	(.0256)	(.0185)
	[.0188]	[.1056]	[.0145]	[.0132]	[.0815]	[−.0538]	[.0186]
N	23,639,438	2,657,393	20,982,045	940,378	622,569	664,402	13,108,946

Note. Standard errors in parentheses are clustered by state. Elasticities are in brackets. State and year fixed effects are included. The independent variables for regression are age, race (white, black, Hispanic, and other), marital status (1 if married), and education (less than high school, high school graduate, some university, and university graduate).

[a] The cesarean section population is dropped since this procedure is used only for vaginal delivery.

except for the multiple births subgroup. No statistically significant change, however, is detected.

I report 2SLS estimates in Table 6. For the use of amniocentesis, the 2SLS estimates are six times larger than the corresponding OLS estimates, and these estimates indicate that amniocentesis rates increase as doctors face higher malpractice risk. I reject the null hypothesis of exogeneity, which means that the 2SLS estimates are significantly different from their OLS counterparts. The elasticity of amniocentesis for the group with multiple births is 1.3, which is very large. Increasing the malpractice risk from the 25th percentile to the 75th percentile would increase the rate of amniocentesis by 4.1 percentage points, which is 64.7 percent of the mean. For every 10,000 multiple-birth babies, 626 undergo an amniocentesis test; 405 more babies would undergo amniocentesis when the risk increases 85 percent. For the rest of the subgroups, the impact of malpractice risk on the use of amniocentesis is somewhat smaller. There is one more statistically significant estimate for the sample with gestational diabetes. Use of vacuum extraction increases by 1.3 percentage points when malpractice risk increases from the 25th percentile to the 75th percentile.

Table 7 presents OLS results for risk measured as the amount of ob-gyn claims paid per birth. The use of amniocentesis is positive throughout all subgroups and statistically significant for the groups with previous c-section, gestational diabetes, multiple births, and low socioeconomic status. For the group with previous c-sections, malpractice risk has a statistically significant positive impact on the use of amniocentesis, forceps, and vacuum extraction.

In Table 8, I report 2SLS results. When the number of prenatal visits is the dependent variable, the coefficient is negative, which suggests there might be some problem with access to health care that changes the sign from OLS estimates. However, all of the estimates are statistically insignificant with relatively small elasticities.

Malpractice risk increases the use of amniocentesis by a statistically significantly amount in all subsamples except breech presentation. For the group with previous c-sections, if the malpractice risk increases from the 25th percentile to the 75th percentile, the rates of amniocentesis increase by 3 percentage points, which is 54 percent of the mean. For every 10,000 multiple-birth babies, 536 babies undergo amniocentesis as a baseline. If malpractice risk were to increase by 77 percent, 290 more babies would undergo amniocentesis. For the same subsample, forceps and vacuum extraction usage also would increase by a statisti-

Table 6. Two-Stage Least Squares Estimates of the Impact of Malpractice Risk, with Number of Obstetrics and Gynecology Claims per 1,000 Births as a Measure of Risk

		History		Complications			
Outcome	**All Births**	Previous Cesarean Section	No Previous Cesarean Section	Breech	Gestational Diabetes	Multiple Birth	**≤High School Degree**
Cesarean section	−.0412	−.0895	−.0218	−.0398	−.0170	−.1924	−.0338
	(.0727)	(.2092)	(.0598)	(.1808)	(.0915)	(.1285)	(.0737)
	[−.0338]	[−.0225]	[−.0253]	[−.0876]	[−.0087]	[−.6511]	[−.0286]
	{.609}	{.765}	{.659}	{.847}	{.640}	{.143}	{.648}
Prenatal visits	.4450	.2512	.4928	.8028	−1.0668	−1.1059	1.1778
	(2.2200)	(2.1869)	(2.2272)	(2.4892)	(2.6407)	(3.5442)	(2.5133)
	[.0072]	[.0041]	[.0080]	[.0131]	[−.0156]	[−.0163]	[.0199]
	{.922}	{.926}	{.914}	{.970}	{.314}	{.540}	{.729}
At least one ultrasound	−.1625	.1951	−.2059	.3034	.3900	.1524	−.1427
	(.2495)	(.2954)	(.2480)	(.3022)	(.2823)	(.2828)	(.2483)
	[−.0487]	[.0550]	[−.0623]	[.0788]	[.1054]	[.0412]	[−.0435]
	{.408}	{.558}	{.313}	{.324}	{.172}	{.734}	{.468}
Amniocentesis	.1300	.2837	.1103	.2095	.3021	.4134	.1020
	(.0500)	(.0849)	(.0460)	(.0575)	(.0747)	(.0927)	(.0328)
	[.7565]	[1.0067]	[.7015]	[.7363]	[.6315]	[1.2613]	[.9904]
	{.020}	{.003}	{.032}	{.002}	{.000}	{.000}	{.004}
Fetal monitoring	.1757	.1487	.1749	.3284	.2023	.0218	.2130
	(.2697)	(.2885)	(.2699)	(.2655)	(.2962)	(.3009)	(.2912)
	[.0403]	[.0362]	[.0398]	[.0761]	[.0445]	[.0051]	[.0486]
	{.525}	{.568}	{.530}	{.207}	{.473}	{.951}	{.484}
Forceps[a]	.0578	.1561	.0532	.4373	.1424	.0451	.0561
	(.0862)	(.1231)	(.0855)	(.2822)	(.1135)	(.0957)	(.0891)
	[.2224]	[.5136]	[.2059]	[.7409]	[.4569]	[.1469]	[.2458]
	{.639}	{.286}	{.670}	{.152}	{.185}	{.997}	{.665}
Vacuum[a]	.0378	.1959	.0301	−.1947	.1214	.0029	.0173
	(.0619)	(.1172)	(.0602)	(.1918)	(.0535)	(.0905)	(.0618)
	[.0914]	[.3980]	[.0731]	[−.4081]	[.2718]	[.0059]	[.0460]
	{.589}	{.185}	{.656}	{.248}	{.076}	{.740}	{.849}
N	23,639,438	2,657,393	20,982,045	940,378	622,569	664,402	13,108,946

Note. Standard errors in parentheses are clustered by state. Elasticities are in brackets. State and year fixed effects are included. The independent variables for regression are age, race (white, black, Hispanic, and other), marital status (1 if married), and education (less than high school, high school graduate, some university, and university graduate). Data in braces are *p*-values from the exogeneity test.

[a] The cesarean section population is dropped since this procedure is used only for vaginal delivery.

Table 7. Ordinary Least Squares Estimates of the Impact of Malpractice Risk, with Amount of Obstetrics and Gynecology Claims Paid per Birth as a Measure of Risk

		History		Complications			
Outcome	**All Births**	Previous Cesarean Section	No Previous Cesarean Section	Breech	Gestational Diabetes	Multiple Birth	**≤High School Degree**
Cesarean section	−.0101	−.0750	.0127	−.1121	−.0749	−.0393	−.0031
	(.0221)	(.0784)	(.0182)	(.1873)	(.0504)	(.0655)	(.0232)
	[−.0032]	[−.0073]	[.0057]	[−.0976]	[−.0155]	[−.0532]	[−.0010]
Prenatal visits	.0780	.0562	.0857	1.1031	.6517	.9994	.5128
	(.5577)	(.5478)	(.5626)	(.6797)	(1.0046)	(.8757)	(.6557)
	[.0004]	[.0003]	[.0005]	[.0071]	[.0038]	[.0059]	[.0033]
At least one ultrasound	.5577	.6749	.5443	.5595	.4475	.6123	.4802
	(.3518)	(.3489)	(.3529)	(.3261)	(.2521)	(.3603)	(.3038)
	[.0655]	[.0746]	[.0644]	[.0574]	[.0488]	[.0663]	[.0562]
Amniocentesis	.0750	.1206	.0697	.0960	.0973	.1354	.0405
	(.0418)	(.0558)	(.0401)	(.0617)	(.0452)	(.0517)	(.0204)
	[.1707]	[.1676]	[.1735]	[.1334]	[.0820]	[.1654]	[.1509]
Fetal monitoring	−.0215	−.0606	−.0194	−.0588	−.0233	−.0420	−.0283
	(.0905)	(.1016)	(.0908)	(.0873)	(.0828)	(.1099)	(.0833)
	[−.0019]	[−.0057]	[−.0017]	[−.0053]	[−.0020]	[−.0039]	[−.0024]
Forceps[a]	.0440	.1117	.0413	.1569	.0220	.0553	.0397
	(.0216)	(.0407)	(.0213)	(.0624)	(.0504)	(.0319)	(.0212)
	[.0662]	[.1439]	[.0625]	[.1051]	[.0284]	[.0721]	[.0667]
Vacuum[a]	.0097	.1251	.0052	−.0045	.0321	−.0183	.0130
	(.0215)	(.0472)	(.0216)	(.1257)	(.0294)	(.0341)	(.0214)
	[.0091]	[.0995]	[.0049]	[−.0037]	[.0289]	[−.0151]	[.0132]
N	23,639,438	2,657,393	20,982,045	940,378	622,569	664,402	13,108,946

Note. Standard errors in parentheses are clustered by state. Elasticities are in brackets. State and year fixed effects are included. The independent variables for regression are age, race (white, black, Hispanic, and other), marital status (1 if married), and education (less than high school, high school graduate, some university, and university graduate).

[a] The cesarean section population is dropped since this procedure is used only for vaginal delivery.

Table 8. Two-Stage Least Squares Estimates of the Impact of Malpractice Risk, with Amount of Obstetrics and Gynecology Claims Paid per Birth as a Measure of Risk

		History		Complications			
Outcome	**All Births**	Previous Cesarean Section	No Previous Cesarean Section	Breech	Gestational Diabetes	Multiple Birth	**≤High School Degree**
Cesarean section	.0262	−.3606	.0575	−.1971	−.0718	−.0887	.0319
	(.1108)	(.4168)	(.0935)	(.4329)	(.1601)	(.1837)	(.1240)
	[.0084]	[−.0355]	[.0261]	[−.1716]	[−.0149]	[−.1202]	[.0103]
	{.724}	{.441}	{.612}	{.812}	{.983}	{.775}	{.763}
Prenatal visits	−4.0906	−4.1888	−4.0494	−4.3970	−8.2019	−7.5293	−1.7111
	(2.6960)	(2.7560)	(2.6969)	(2.9430)	(3.6181)	(5.7066)	(3.0602)
	[−.0261]	[−.0269]	[−.0259]	[−.0284]	[−.0486]	[−.0444]	[−.0111]
	{.095}	{.100}	{.098}	{.041}	{.008}	{.104}	{.430}
At least one ultrasound	.4794	1.2750	.3792	1.1461	1.0582	1.2509	.6041
	(.4856)	(.6359)	(.4796)	(.6779)	(.6253)	(.6590)	(.5284)
	[.0563]	[.1409]	[.0449]	[.1177]	[.1154]	[.1354]	[.0707]
	{.870}	{.323}	{.731}	{.367}	{.292}	{.333}	{.812}
Amniocentesis	.2786	.5392	.2448	.3271	.5398	.6053	.2161
	(.1317)	(.2003)	(.1217)	(.1774)	(.2125)	(.2511)	(.0875)
	[.6342]	[.7494]	[.6095]	[.4547]	[.4551]	[.7397]	[.8052]
	{.104}	{.031}	{.130}	{.182}	{.030}	{.051}	{.036}
Fetal monitoring	.3096	.1802	.3219	.2819	.1415	−.0100	.4394
	(.5231)	(.6453)	(.5124)	(.4985)	(.4671)	(.5065)	(.5122)
	[.0277]	[.0172]	[.0287]	[.0258]	[.0125]	[−.0009]	[.0385]
	{.498}	{.691}	{.475}	{.471}	{.707}	{.945}	{.334}
Forceps[a]	.2093	.4907	.1960	.4023	.2731	.0949	.2146
	(.1450)	(.1895)	(.1426)	(.2514)	(.2061)	(.1739)	(.1488)
	[.3150]	[.6324]	[.2970]	[.2696]	[.3534]	[.1238]	[.3608]
	{.237}	{.042}	{.260}	{.305}	{.202}	{.816}	{.221}
Vacuum[a]	.0588	.4424	.0403	−.1679	.1118	.0114	.0187
	(.0752)	(.1675)	(.0714)	(.2851)	(.1043)	(.1168)	(.0722)
	[.0556]	[.3521]	[.0383]	[−.1392]	[.1009]	[.0094]	[.0191]
	{.472}	{.050}	{.589}	{.522}	{.410}	{.769}	{.936}
N	23,639,438	2,657,393	20,982,045	940,378	622,569	664,402	13,108,946

Note. Standard errors in parentheses are clustered by state. Elasticities are in brackets. State and year fixed effects are included. The independent variables for regression are age, race (white, black, Hispanic, and other), marital status (1 if married), and education (less than high school, high school graduate, some university, and university graduate). Data in braces are *p*-values from the exogeneity test.

[a] The cesarean section population is dropped since this procedure is used only for vaginal delivery.

cally significant amount, but the value is smaller in magnitude, with elasticities of .6 and .4, respectively.

4.3. Other Measures of Malpractice Risk

There are some other ways to measure malpractice risk. One is to use a different source of closed-claims data that has some advantages over the NPDB. The state of Texas collects data on closed malpractice cases within its jurisdictions, and these data are publicly available to researchers. Texas is the second largest state measured by population and the third largest in total health care spending (Black et al. 2005). The advantages of the Texas data are as follows. The Texas data have county-level information as well as the month and year of injury, filing of the suit, and payment. The Texas data also have a unique identifier that allows me to combine multiple-defendant cases into a single case. It also includes the payment of cases on behalf of hospitals.

I analyzed the Texas closed-claims data collected from 1988 to the present using a within-county model. In this analysis, I found that malpractice risk has no statistically significant impact on choice of procedure. I also found that the instrumental variable constructed in the same way as in the present paper was not statistically significant at the 5 percent level. It might be because the judicial area does not completely match with the county or, as in the malpractice insurance market, because it has a different market area from the county border. In any case, the model does not have a sufficiently large sample size to be successfully identified.

The other possible source of a malpractice risk measure is to use malpractice premiums, which have been used in several previous studies. *Medical Liability Monitor* surveys malpractice insurance premiums annually at the state level or, in some cases, at the substate level.[38] With these data, I used the log of the average annual premium for ob-gyn doctors from 1994 to 2002 as a measure of the malpractice risk that they face. I then used the log of premiums for general surgeons as an instrumental variable. The estimates from the first stage of the 2SLS estimates were significant at the 1 percent level, but the 2SLS estimates were insignificant for most outcomes, including c-section rates. As other research has found, my results show very little correlation between pre-

38. Respondents report the base premium for coverage providing $1 million per claim and $3 million in aggregate for a year, which is considered standard coverage. Survey respondents report premiums for three specialties (internal medicine, general surgery, and ob-gyn), and company-specific premiums vary by state-specific submarkets.

miums and either frequency or severity of malpractice claims. Because of space limitations, I do not report results using the Texas closed-claims data or the malpractice premiums, but they are available upon request.

4.4. Marginal-Patient Sample

When ob-gyn doctors choose between a c-section and a vaginal delivery, they consider various medical and physical conditions. Therefore, not all women are equally likely to have a c-section. Some conditions, such as breech presentation, increase the chance of a c-section greatly. When the patient's medical condition makes the choice obvious, malpractice risk is less likely to affect a doctor's behavior. However, for some patients for whom the method of delivery is not as certain from observed characteristics, malpractice risk could be a larger factor in the doctor's decision. For example, a patient with certain conditions might be treated using a c-section by some doctors and vaginal delivery by others.

In this section, I develop a model that attempts to telescope in on those patients who are most likely to be affected by malpractice risk. I will call this sample the marginal-patient sample because it excludes patients with the lowest and highest probabilities of having a c-section. To find the marginal-patient sample, I regressed medical and physical information on a dummy variable that equals one if a c-section was performed and included state and year fixed effects. The model fits quite well—the R^2-value for this regression is .17. Next I rank patients in descending order by their predicted probability of having a c-section. Patients who fall between the 12.5th percentile and the 37.5th percentile of the descending order of predicted c-section probability are the marginal-patient sample, considering the roughly 23 percent c-section delivery rate for all births in my data. The marginal-patient sample has 5.8 million observations.

Table 9 displays descriptive statistics on the two measures of risk for this marginal-patient sample. It is very similar to that of previous subgroups reported in Table 1. In Table 10, the impact of malpractice risk on c-section for the marginal-patient sample is reported. In the OLS specifications, I find negative and insignificant estimates with very small elasticities for both measures of risk. The first stage of the 2SLS regression is significant, but the 2SLS estimates are still negative and insignificant. Even if the true impact of the malpractice risk were at the top end of the 95 percent estimated confidence interval, an increase in the number of ob-gyn claims per 1,000 births from the 25th percentile to the 75th percentile would increase c-section rates by only .6 percentage

Table 9. Descriptive Statistics of Measured Risks in Obstetrics and Gynecology (Ob-Gyn): Marginal-Patient Sample

Percentage	Ob-Gyn Claims per 1,000 Births	Ob-Gyn Claims Paid per Birth ($1,000s)
1	.0669	.0155
5	.0990	.0272
25	.1402	.0390
50	.1687	.0607
75	.2175	.0906
95	.3081	.1591
99	.4318	.2120
Mean	.1860	.0712

points. When I use the amount of ob-gyn claims paid per birth, the malpractice risk at the top end of the 95 percent estimated confidence interval would increase c-section rates by 1.6 percentage points, which is small. I report the *p*-value from an exogeneity test, and I cannot reject the null hypothesis that OLS estimates are equal to the 2SLS estimates.

5. CONCLUSION

President George W. Bush has argued for commonsense medical liability reform to protect patients, stop sky-rocketing costs associated with frivolous lawsuits, make health care more affordable and accessible for all Americans, and keep necessary services in communities that need them most.[39] A frequent justification for tort reform is the concern that malpractice risk may encourage doctors to alter their practice styles. To date, there is little evidence supporting this point. In this paper, I examine whether a higher risk of malpractice awards alters procedure choice in obstetrics. I focus on obstetrics because it has one of the highest malpractice risks in medicine and is often considered to be a specialty in which defensive medicine is particularly prevalent.

In a sample spanning 7 years and containing more than 24 million observations, I find that doctors' procedure choice is insensitive to malpractice risk. I find that increased malpractice risk has little if any impact on health care access, as measured by the number of prenatal doctor's office visits. I also find no statistically significant change in other mea-

39. Legal Reform: The High Costs of Lawsuit Abuse. White House press release, January 5, 2005 (http://www.whitehouse.gov/news/releases/2005/01/20050105-2.html).

Table 10. Impact of Malpractice Risk on Cesarean Section: Marginal-Patient Sample

Risk Measure	Cesarean Section
Ordinary least squares estimates:	
Ob-gyn claims per 1,000 births	−.0127
	(.0420)
	[−.0094]
Ob-gyn claims paid per birth ($1,000s)	−.0023
	(.0651)
	[−.0006]
First-stage estimates:	
Other specialties' claims per 1,000 population	3.75
	(.77)
Other specialties' claims paid per population ($1,000s)	4.87
	(1.26)
Two-stage least squares estimates:	
Ob-gyn claims per 1,000 births	−.1649
	(.1234)
	[−.1225]
Ob-gyn claims paid per birth ($1,000s)	−.2395
	(.2777)
	[−.0681]
Exogeneity test (*p*-value):	
Ob-gyn claims per 1,000 births	.149
Ob-gyn claims paid per birth ($1,000s)	.355

Note. The predicted cesarean section rate is calculated for each individual using 32 pregnancy-related conditions such as blood pressure. I rank each individual on the basis of predicted cesarean section rate by descending order. I use a subsample of the 12.5th percentile to the 37.5th percentile, taking into account that the cesarean section rate of around 23 percent for all births is for marginal patients whose procedure choices are more responsive when malpractice risks for doctors are changed. Standard errors are clustered by state. Ob-gyn = obstetrics and gynecology. N = 5,834,291 births.

sures of treatment such as the use of ultrasound, forceps, and vacuum as malpractice risk changes. Even though I find some significant increase in the use of amniocentesis when malpractice risk increases, overall I do not find substantial changes in behavior by obstetricians as risk increases.

There are some limitations of this paper in terms of data. One is that the NPDB data are not complete because they do not cover payouts on behalf of hospitals (Smarr 1997) and do not include cases that ended without any positive payment. However, the NPDB data are the most extensive existing data set, and the results are not different even if I use a Texas data set that has some advantages such as including claims against hospitals.[40]

Another limitation is that there is more than one possible explanation for my findings. For example, there may be no significant principal-agent concerns that lead to defensive medicine because doctors care only about patients' outcomes. The other possibility is that malpractice risk is still too small for doctors to change their choice of procedures. In addition, the measure of risk that I construct is still only a proxy for malpractice risk, even though it is the best one given the available data. Therefore, it might not perfectly capture the risk as it is perceived by physicians. Unfortunately, this paper cannot distinguish between these explanations, and thus further research is needed.

In the 1970s and 1980s, many states enacted tort reform in order to control malpractice insurance premiums. However, the issue of malpractice premiums has recently returned as an object of public concern. One of the most important reasons for further reform at the federal level is the potential adverse effect of increasing malpractice premiums on health care delivery through changes in doctors' behavior. On the basis of my findings, it appears that federal-level tort reform will have at most a minimal impact on the way doctors practice medicine.

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40. I do not observe the case in which it is resolved with zero payout, as mentioned in footnote 18.

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