

Tort Reforms and Defensive Practices in Obstetrics

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ABSTRACT

Medical malpractice reform remains a highly controversial topic in policy debates. This study examines the impact of state-level tort reforms from 1989-2004 on obstetrics as it is a field particularly affected by the threat of malpractice litigation. There is an abundance of anecdotal evidence that the threat of being sued causes obstetricians-gynecologists to drop obstetrics or perform more C-sections. This study finds that not only do tort reforms have negligible impacts on defensive behaviors, some reforms even have the opposite of their intended effect. Policymakers interested in reducing defensive medicine and their associated costs are advised to focus on other options.

I. INTRODUCTION

Medical malpractice, “frivolous” lawsuits, and defensive medicine have become highly contentious issues in recent health care reform debates. The media and various governmental organizations have also highly publicized these issues with anecdotes of women who have difficulty finding an obstetrician to deliver their babies,¹ physicians who order unnecessary tests to protect themselves from lawsuits², and injured patients compensated with “windfall” jury awards.³ The main public policy response to defensive medicine and “frivolous” lawsuits has been tort reforms directed at reducing claim frequency (number of claims), claim severity (size of awards), and liability insurance premiums.

Proponents of such reforms often exaggerate their potential impact. For example, in 2002, the Bush administration’s Department of Health and Human Services estimated that tort reforms could potentially save as much as \$60 to \$108 billion a year in unnecessary health care costs. These figures, however, were based on just one empirical study (Kessler and McClellan, 1996), which only analyzed the costs and outcomes associated with Medicare beneficiaries diagnosed with acute myocardial infarction or ischemic heart disease. Despite the questionable generalizability of this study,⁴ advocates of tort reform continue to cite these numbers and push for tort reforms as a method of reducing national health care

¹ In July 2002, the House Energy and Commerce Subcommittee on Health held a hearing called “Harming Patient Access to Care: The Impact of Excessive Litigation.” During this hearing, former Representative James Greenwood (R-Penn.), read letters he received from residents in Pennsylvania. One such letter said, “I don’t

² A March 2010 *Newsweek* article, “This Won’t Hurt a Bit,” estimated that at least \$500 billion a year goes toward tests and treatments that do not benefit patients. A follow-up *Newsweek Web Exclusive*, “Block that CT Scan!,” stated that physicians estimate that 35 percent of diagnostic tests they ordered were to avoid lawsuits, as were 19 percent of hospitalizations, 14 percent of prescriptions, and 8 percent of surgeries. The reporter added, “All told, it adds up to \$650 billion in unnecessary care every year.”

³ Senator Jon Kyl (R-Ariz.) released a statement in August 2009 called “Jackpot Justice,” that said, “Trial lawyers’ multi-million dollar ‘jackpot justice’ malpractice lawsuits drive up the cost of health care for everyone. Of course, malpractice lawsuits serve a valuable purpose for those who have truly been wronged, but malpractice law is often abused by some trial lawyers who flood courts with baseless lawsuits.”

⁴ Kessler and McClellan also recognize that their study population—elderly persons—are less likely to file medical malpractice claims than others.

expenditures.^{5,6} This paper analyzes the arguments put forth by supporters of tort reform and focuses on obstetrics as it is a specialty particularly affected by the threat of malpractice litigation.

A 2006 study using data from five insurance companies in four regions of the U.S. indicated that obstetrician-gynecologists (OB-GYNS) were the most frequently sued specialty (Studdert et al., 2006). In 2004, the American College of Obstetricians and Gynecologists (ACOG) identified 23 “red alert” states with a medical liability insurance crisis based on OB-GYNS’ inability to find or afford liability insurance. In the 2009 Medical Liability Survey administered by the ACOG, 91 percent of OB-GYNS reported that they had experienced at least one liability claim filed against them during their professional careers, with an average of 2.69 claims per physician. Approximately one-third reported reducing their number of high-risk patients and increasing the number of C-sections they performed. These obstetric behaviors demonstrate two types of defensive medicine: negative and positive. Negative defensive medicine refers to avoidance behaviors, such as when OB-GYNS drop the obstetric component of their practice, or decrease the number of high-risk patients they treat due to the threat of a lawsuit. Positive defensive medicine refers to assurance behaviors, for example, the use of more diagnostic tests or procedures to reduce malpractice liability.

The assurance behaviors of obstetricians have recently become a national topic of interest amidst growing concerns about the increasing C-sections rate in the U.S.—

⁵ Three members of the American Academy of Orthopaedic Surgeons (AAOS) wrote an article in the Sept. 2009 issue of *AAOS Now* arguing for tort reform, stating that it could save the nation an estimated \$174 billion per year in defensive medicine.

⁶ In a March 2010 *New York Times* interview, Dr. James A. Reiffel, professor of clinical medicine and director, electrocardiography laboratory at Columbia University Medical Center in New York, said costs of defensive medicine could be “fixed if serious efforts at tort reform were undertaken.”

approximately 32 percent in 2007, the country's highest rate ever (Grady, 2010b). Although there is no ideal C-section rate, the World Health Organization recommended that it be no higher than 10 to 15 percent.⁷ Dr. George A. Macones, chairman of obstetrics and gynecology at Washington University in St. Louis, also said the upward trend "is not going to be good for anybody," and added that "one of the major factors is professional liability, ending up in court" (Grady, 2010a). Repeat Caesareans,⁸ which account for about 40 percent of total C-sections, are increasing as well, contributing to the problem (Grady, 2010a). The National Institutes of Health held a conference in March 2010 to examine why the rate of vaginal birth after Caesarean (VBAC⁹) had declined to less than 10 percent from 28.3 percent in 1996. At the end of this conference, the expert panel recommended use of VBAC as a safe alternative for the majority of women who had one prior C-section. The panel of experts recognized doctors' fear of lawsuits and how that may be a driving factor in their avoidance of VBAC (which increases the risk of uterine rupture), but did not offer any solutions.

The issue of defensive medicine in obstetrics is therefore especially prominent today, and although there has been extensive research on the impact of malpractice liability on the rate of C-sections, few studies have specifically analyzed the impact of tort reforms on both negative and positive defensive behaviors of obstetricians. This research analyzes both categories as measured by 1) adequacy of prenatal care utilization, 2) primary C-sections,

⁷ In 1985, the World Health Organization reported that C-section rates above 15 percent do not result in better health outcomes (in terms of neonatal and maternal morbidity and mortality), and recent studies (Villar et al., 2006 and Althabe & Belizan, 2006) have affirmed these findings.

⁸ Repeat Caesareans refer to C-sections in women who have had a prior C-section. Primary C-section refers to C-sections in women who have never had a C-section.

⁹ For women who have had a prior C-section, the risks and benefits of having a repeat C-section (compared to a VBAC) are controversial. Obstetricians often followed the long-held "once a Caesarean, always a Caesarean" dictum, but as C-section rates continuously increased, health care providers and public health professionals became more concerned. In 1980, the National Institutes of Health declared that VBAC was a safe alternative to having a repeat C-section and in the early 1990s, the VBAC rate rose. Beginning in 1996, however, VBAC rates declined sharply due to renewed controversy over its safety, and over 90 percent of women with a prior C-section had a repeat C-section.

and 3) repeat C-sections. Whereas the previous literature often used C-section rates in all pregnant women as their outcome measure, this method is flawed because it does not make much clinical sense to analyze situations in which there are no medical indications for a C-section. This study instead analyzes primary C-section rates in women with cephalopelvic disproportion or dysfunctional labor (CPD/DF¹⁰), two complications of labor and delivery that may require use of a C-section. This outcome measure and subgroup were selected because they represent a circumstance in which there is substantial practice variation in terms of how aggressively physicians try to avoid doing a C-section, likely to be influenced by the threat of litigation. Repeat C-sections are another clinically relevant outcome measure to analyze not only because of issues surrounding VBAC's safety, but because they represent a situation in which physicians have time to think through what procedure would be best, and liability risk may factor into this decision-making process. This study therefore uses more clinically significant and relevant measures and finds that tort reforms are largely ineffective at reducing defensive behaviors (and may even increase them) and have no meaningful impact on infant health.

The structure of this paper is as follows: Section II provides a literature review of relevant studies, Section III describes the theoretical framework, and Section IV details the data sources. Section V specifies the empirical model. Section VI describes the results and discussion. And finally, Section VII presents the conclusion.

¹⁰ CPD is when a baby's head or body is too large to fit through the mother's pelvis. DF refers to a labor that is difficult, painful, or disordered due to abnormal uterine contractions. These two complications are often coded interchangeably on birth certificates and are therefore grouped together.

II. LITERATURE REVIEW

This section reviews the literature on tort reforms and defensive practices in obstetrics. The first part focuses on negative defensive medicine. Although there are several studies that analyze the relationship between malpractice liability and avoidance behaviors in general, virtually no empirical studies have analyzed the impact of tort reforms on obstetric patients' access to care and prenatal care utilization. The second part focuses on positive defensive medicine and reviews the impact of four widely-adopted state-level tort reforms: caps on noneconomic damages, caps on punitive damages, modifications of joint-and-several liability rule (JSL reform), and modifications of the collateral-source rule (CSR reform). Caps on noneconomic damages limit the amount of money that can be awarded to the plaintiff for pain and suffering. Caps on punitive damages limit the amount of money that can be awarded to the plaintiff to punish the defendant. In cases with more than one defendant, JSL reform requires that a defendant be responsible for at least a certain percentage of the harm in order to be fully liable for all of the damages. CSR reform allows a defendant to only have to award the plaintiff whatever is not covered by his or her own private/public sources of compensation (e.g. health insurance and workers' compensation).

Tort Reforms and Obstetric Avoidance Behaviors

There has been extensive study into the impact of medical malpractice pressure on physician supply and patient access to care. Although there is an abundance of anecdotal evidence and survey findings¹¹ that malpractice liability causes physicians to retire early or reduce/eliminate high-risk practices (such as delivering babies or treating high-risk patients), these results may have overestimated the threat of tort as response rates to these surveys were

¹¹ See Brooks et al. (2005), Mello et al. (2005), and Sloan and Chepke (2008).

somewhat low, and those most upset about the problem were more likely to respond. As summarized by Sloan and Chepke (2008), avoidance behaviors limiting patients' access to care "undoubtedly [exist] at some times and in some places," but the problem has mostly been overstated (p. 70-71). In addition, most empirical studies have found that tort reforms have minimal impacts on negative defensive medicine; the few that are statistically significant only apply to certain specialties and geographic areas.¹²

The same general story applies to obstetrics: Negative defensive medicine likely exists, though on a limited scale. Dubay et al. (2001) conducted the first national evaluation of the effect of liability pressure, as measured by malpractice premiums, on prenatal care utilization and two measures of infant health: low birthweight and low 5-minute Apgar score¹³. They found that liability risk results in a reduction in access to and utilization of prenatal care, although the effect sizes were small. The results varied based on demographics of the pregnant women: a decrease in malpractice premiums was associated with a decrease in the incidence of late prenatal care by 3.0 to 5.9 percent for black women and 2.2 to 4.7 percent for white women. They found no association between premiums and infant health.

Dubay et al.'s use of premiums as their measure of malpractice risk has several limitations. First, malpractice premiums are usually not experience-rated, which means that they do not take into account the claims history of individual physicians. Although premiums depend on both the frequency and severity of claims in a geographic area, they also depend on other market factors, such as interest rates and market competitiveness, and may therefore not be the best measure of the malpractice environment (Grant and McInnes, 2004).

¹² See Baicker and Chandra (2004), Kessler et al. (2005), Klick and Stratmann (2005), and Klick and Stratmann (2007).

¹³ Apgar score is a simple method of assessing the health of a newborn child immediately after birth. It is based on five criteria: appearance, pulse, grimace, activity, and respiration. Each aspect is scored on a scale from 0 to 2, adding up to a total score ranging from 0 to 10. Apgar scores less than 7 are generally considered low.

Although premiums are forward-looking, premium levels also depend on previous losses, past and expected investment returns, business strategies, geographic location, and the degree of state regulation of rate changes (Studdert et al., 2004). Additionally, due to the “long tail” of medical malpractice insurance claims (i.e. plaintiffs can wait two or three years after the discovery of an injury to file a claim), insurers are uncertain about what their ultimate liability will be, making it hard for them to set premiums accurately. The enactment of tort reforms may help insurers better predict future losses, but some studies find no association between premium changes and trends in losses.¹⁴ Black et al. (2005) also did not find a strong correlation between paid claims and malpractice insurance premiums. Even though some physicians may alter their practice behaviors in response to changes in premiums, they are not necessarily the best measure of liability risk as they are determined by several factors.

Instead of using premiums, this study uses the presence of tort reforms as a measure of liability risk, which would be of more significance to policymakers. An advantage of using this measure is that it allows for the examination of differences across states and years in tort liability. It also provides a way to control for unobserved variables via state- and time-fixed effects, as well as state-specific time trends. The process in which tort reforms actually get translated into a physician’s perception of liability risk, however, is complex, making them a somewhat difficult measure to use.

Tort Reforms and Obstetric Assurance Behaviors

The most commonly discussed assurance behavior in obstetrics is the use of C-sections. Empirical studies that analyze the impact of liability pressure on C-sections

¹⁴ See Americans for Insurance Reform (2002) and Baicker & Chandra (2004).

(summarized in Table 1) present mixed findings. Several of them are single-state¹⁵ and cross-sectional studies¹⁶ which are all difficult to generalize due to their limited scope. Single-state studies are more likely than national studies to have endogeneity problems because within-state variations in malpractice risk are largely due to geographical differences in unobserved characteristics such as the litigiousness of the population and their health status. Single-year studies also fail to take into account the effect of time trends in malpractice risk, such as the passage (and repeal) of tort reforms.¹⁷

There are four main national studies: Dubay et al. (1999), Kim (2007), Currie and MacLeod (2008), and Yang et al. (2009). Dubay et al.'s study only analyzed data from 1990-1992 and therefore likely did not have sufficient within-panel variation in premiums to fully support their model. They also used premiums as their measure of liability risk (the limitations of which were detailed above). Kim used frequency and severity of claims as his malpractice risk measure, but his data set—the National Practitioner Data Bank (NPDB)—has several caveats. Although it is an extensive database of closed malpractice claims, it only records closed cases with a positive payout. Not counting cases with zero payout may understate the malpractice risk faced by physicians. He may therefore have found no significant associations between malpractice risk and C-sections because his measure understated liability pressure. The NPDB also does not report multiple defendants nor does it include hospitals as providers. Although Kim analyzed Texas closed claims which does provide information about multiple defendants and payments by hospitals, the issue of using a single-state model remains. Additionally, from a public policy perspective, if our goal is to

¹⁵ See Murthy et al. (2007), Sloan et al. (1997), Baldwin et al. (1995), Localio et al. (1993), Tussing et al. (1992), and Rock (1988).

¹⁶ See Sloan et al. (1997), Localio et al. (1993), and Tussing et al. (1992).

¹⁷ See Sloan et al. (1997), Localio et al. (1993), and Tussing et al. (1992).

examine the effectiveness of specific tort reforms, using the frequency and severity of claims as a measure of the malpractice environment is not ideal. As Currie and MacLeod found, different tort reforms may have effects in opposite directions, and this subtlety would not be captured by simply using the number of claims and size of awards.

Currie and MacLeod and Yang et al. are virtually the only two national studies that analyzed the impact of tort reforms on C-sections. Whereas Currie and MacLeod used a linear probability fixed-effects model, Yang et al. used a mixed-effects empirical model (an extension of a random-effects model). Yang et al. argued that a fixed-effects model is problematic in the context of time-invariant covariates and used a Hausman test to justify the use of their mixed-effects model. Fixed-effects models essentially compare the average change in reform states before and after the reform with the average change in the nonreform states. They therefore assume that any unobserved time-varying effects apply equally to both reform and nonreform states. If only a small number of states implemented (or repealed) a reform during the study period, however, the resulting estimates may not be very precise, and there may be confounding by unobserved time-varying effects. Tort reforms were somewhat time-invariant in many states during 1989-2003 (encompassing Yang et al. and Currie and MacLeod's study period). An advantage of the mixed-effects model is that it allows for the examination of between-state variation and within-state variation.

A limitation of Yang et al.'s study, however, is that they used state-level aggregate data in their analyses. In evaluating the impact of tort reforms on C-section rates, it would be best to use micro-data as C-sections vary with specific maternal and fetal characteristics on an individual level. Using micro-data (as Currie and MacLeod do) avoids risking ecological fallacy.

Although the previous literature remains undecided on the impact of various measures of malpractice risk on C-section rates and birth outcomes, Yang et al. and Currie and MacLeod seem to be the most robust studies. Currie and MacLeod found that caps on noneconomic damages increase C-sections, but they do not fully explain why this would be the case if C-sections are a defensive measure as many other studies and obstetricians themselves claim.¹⁸ In other words, if physicians are largely performing C-sections because of high liability pressure, by reducing this pressure, tort reforms should decrease C-sections. Currie and MacLeod also find that JSL reform reduces the rate of C-sections and “preventable complications” of labor and delivery. Again, if C-sections are a defensive procedure, it is unclear why JSL reform would decrease C-section rates if it increases liability risk (as Currie and MacLeod proposed). Yang et al. found that noneconomic damages caps reduce C-sections, which is a more intuitive finding, but recognize that their effect sizes are modest.

A limitation of almost all of the reviewed literature is the oversimplification of the outcomes used to measure assurance behaviors of obstetricians. Empirical studies often rely on the Natality Files for outcome measures (e.g. method of delivery and complications of labor and delivery). Although primary C-section rates in all births are the most commonly-used outcome measure, these results do not carry much clinical weight as C-sections can be performed for a host of reasons (e.g. patient elects to have one or if they’re easier to schedule for physicians), some of which are difficult to control for due to the lack of data. Analyzing physician behaviors in situations where there is an indication for a C-section is therefore more revealing and relevant in discussions of tort liability. Currie and MacLeod analyzed complications of labor and delivery in addition to C-sections and divided them into

¹⁸ See Kim (2007), Deutchman et al. (2003), and First Professionals Insurance Company (2004).

“preventable” and “non-preventable” ones, but it is unclear what clinical evidence they used to arrive at their designations. They also analyzed induction/stimulation of labor as an outcome (as defensive behaviors), but they did not differentiate between those who may have had both C-sections and induction/stimulation of labor, and the reference group is therefore not ideal. They ran separate analyses on “high-risk” and “low-risk” women based on maternal risk factors, but these classifications are not entirely accurate as the degree of severity of a specific risk factor is not captured by the birth certificate data. Although the Natality Files are very rich data sets, they offer crude measures of maternal and infant health that must be considered carefully when selecting measures to evaluate the impact of public policy.

The contributions of this paper are therefore threefold. First, it analyzes the impact of tort reforms on avoidance behaviors of obstetricians as measured by prenatal care utilization. Second, it analyzes the impact of tort reforms on more clinically relevant obstetric assurance behaviors within more clinically appropriate contexts. And third, it analyzes the impact of tort reforms on infant health.

TABLE 1. SUMMARY OF LITERATURE: IMPACT OF LIABILITY RISK ON C-SECTIONS AND BIRTH OUTCOMES

Pub. Year	1 st Author	Malpractice Risk Measure	Impact Measure	Scope	Period	Result
1988	Rock	-Premiums	-C-section	-New York & Illinois -Analyzed at territory level (NY divided into 4 and IL into 3 territories)	1981-1983	-Pos. on C-section
1992	Tussing	-Premiums -Claims per M.D.	-C-section	-New York -Analyzed at county-level	1986	-Neg. for all on C-section
1993	Localio	-Premiums -Perceived risk -Claims per 100 M.D.s -Claims per 1000 hospital discharges -Indiv. claims history	-C-section	-New York -Analyzed at physician, hospital, and geographic region level	1984	-Pos. for all (except indiv. claims history) on C-section
1995	Baldwin	-Indiv. claims history -County claims rate	-C-section -Prenatal care	-Washington -Analyzed at county-level	1988-1989	-All insig.
1997	Sloan	-Freq. & sev. of claims -Indiv. claims history	-C-section	-Florida -Analyzed at county-level	1987	-All insig. on C-section
1999	Dubay	-Premiums	-C-section -APGAR	-National -Analyzed at county-level	1990-1992	-Pos. on C-section (especially in lower socioeconomic groups) -Insig. for APGAR
2007	Murthy	-Premiums	-C-section	-Illinois -Analyzed at county-level	1998-2003	-Pos. on C-section
2007	Kim	-Freq. & sev. of claims	-C-section -Prenatal care	-National -Analyzed at state-level	1992-1998	-All insig.
2008	Currie	-Tort reforms ¹⁹	-C-section -APGAR	-National -Analyzed at county-level	1989-2001	-Pos. for caps on C-section -Neg. for JSL on C-section -All insig. for APGAR
2009	Yang	-Tort reforms ²⁰ -Premiums	-C-section -VBAC	-National -Analyzed at state-level	1991-2003	-Caps and PSP incr. VBAC and reduces C-section -Higher premiums reduce VBAC and increases C-section

¹⁹ Currie and MacLeod (2008) analyzed the following tort reforms: caps on noneconomic damages, modified JSL, and modified CSR.

²⁰ Yang et al. (2009) analyzed the following tort reforms: attorney fee limits, modified common-source-rule (CSR), expert-witness restrictions, modified joint-and-several liability (JSL), periodic payments, shortening of the statute of limitations, and pretrial screening panels (PSP).

III. THEORETICAL FRAMEWORK

The four tort reforms of interest fall into two general categories: 1) damages reform and 2) modification of liability rules. The first category includes caps on punitive damages, caps on noneconomic damages, and CSR modifications, which are all direct tort reforms intended to address the size of recoveries. Tort reforms targeted at size of recoveries also affect the frequency of claims. That is, in limiting the potential size of awards, they also indirectly reduce the contingency fee trial lawyers receive in practice, reducing the probability that they will file suit as windfall recoveries are less likely. Modification of CSR is also directed at reducing the size of awards as it prevents plaintiffs from being doubly compensated. With mandates of collateral source offsets, defendants do not have to compensate plaintiffs for losses that can be recouped from other sources, such as health insurance or worker's compensation. Damages reform also help insurers predict their exposure to losses, potentially stabilizing or reducing malpractice premiums.

The second category, modification of liability rules, is an indirect method of reducing the frequency and severity of claims. JSL reform limits the amount plaintiffs can recover from multiple defendants to their respective contributions to the cause of injury. Under traditional tort law, a hospital defendant (the "deep pockets") may have had to pay damages that a single physician was required to pay, but did not have the funds to do so.

The relationships between these reforms and malpractice premiums and frequency and severity of claims are complex and the literature offers mixed results (summarized in Appendix A). These studies used regression analyses to control for the presence of multiple tort reforms and other determinants of claim frequency and severity and premiums as explanatory variables. The evidence suggests that damages cap significantly reduced the

number of claims filed, the size of awards, and liability premiums. These studies also showed that collateral-source-rule offset significantly reduced frequency and severity of claims, but not premiums. The overall effect of damages reform on premiums is more ambiguous as insurers set premiums based not only on projected losses, but previous losses, past and expected investment returns, and state rate regulation. The impacts of JSL reform, especially in medical malpractice, are less clear as there are much fewer studies.

The mechanism by which tort law then translates into a liability against a physician is therefore complex as different tort reforms may affect different steps in the litigation process. Theoretically, tort reforms aimed at reducing the frequency and severity of claims should reduce the plaintiff/plaintiff's lawyer's probability of filing a suit, thereby reducing the physicians' perceived liability pressure and probability of being sued. Tort reforms aimed at reducing liability insurance premiums should similarly reduce a physician's perceived liability risk. Reductions in liability pressure should then theoretically lead to decreases in defensive practices, both negative and positive.

Although JSL reform is indirectly aimed at reducing the frequency and severity of claims, in medical malpractice cases, they may actually end up increasing the liability pressure faced by physicians. Modification of the JSL rule intended to be fairer to all defendants by assigning damages based on one's proportion of harm committed. Specific to medical malpractice, these changes may prevent plaintiffs' lawyers from simply going after the hospital—the “deep pockets.” Although the malpractice lawyers and patients may have less of a financial incentive to sue, in cases that they do sue, they will have to go after the most responsible party, which in medical malpractice is usually the physician (Currie and

MacLeod, 2008). The liability risk faced by physicians may therefore be increased by JSL reform.

This study assumes that physicians take liability into consideration and respond to tort reforms in terms of their perceived liability risk. Damages caps should reduce the size of the award, thereby decreasing the expected payout if the plaintiff wins, which in turn should lower the probability that the plaintiff or the plaintiff's lawyer will file suit. If physicians believe that their risk of being sued has diminished, they will likely act less defensively. Based on Currie and MacLeod (2008), the opposite should be true for JSL reform as the new law will likely hold the physician even more responsible. The probability of physicians acting more defensively should therefore increase in the presence of JSL reforms.

Decreases in the probability that OB-GYNS will act defensively should lead to increases in access to care (and increases in the utilization of adequate prenatal care) as OB-GYNS will be less likely to drop their obstetric practice or restrict their patient type. Although decreases in the obstetricians' perceived liability risk may theoretically cause them to reduce the level of adequate prenatal care they provide, the empirical literature does not find this result (Institute of Medicine, 1989 and Dubay et al., 2001). This study therefore hypothesizes that tort reforms that reduce liability risk (damages caps and CSR reform) should increase adequate prenatal care utilization. Reductions in liability risk, however, may reduce the provision of defensive/unnecessary prenatal care, which may be measured by the "more than adequate" (i.e. adequate+) category of the Kotelchuck Index²¹. This category can refer to appropriate care for high-risk patients or inappropriate excessive care for average risk patients as the prenatal care index does not control for medical risk factors. Theoretically,

²¹ The Kotelchuck Index, also called the Adequacy of Prenatal Care Utilization (APNCU) Index, classifies the adequacy of prenatal care into four categories: inadequate, intermediate, adequate, and adequate plus. See Data (Section IV) for details.

reductions in liability may affect adequate prenatal care, although due to the lack of empirical evidence, it remains unclear what sort of effect tort reforms will have on this particular outcome.

In regards to assurance behaviors, reductions in the OB-GYNs' perceived liability risk should reduce their use of primary and repeat C-sections. In women with CPD/DF, both stimulation of labor and primary C-sections are analyzed. In such clinical situations, physicians have more discretion in terms of how "defensive" they want to be. With tort reforms that reduce liability pressure, physicians may raise their threshold for performing a C-section in women with CPD/DF and instead try to stimulate labor to avoid having to do a C-section. Reductions in liability risk were therefore hypothesized to decrease primary C-sections and increase stimulation of labor.

IV. DATA

Obstetric & Birth Data: National Center for Health Statistics Natality Files

The chief sources of data for this study are the 1989 to 2004 National Natality Files. This micro-data set contains obstetric and birth information recorded on individual birth certificates, which is sorted by each state and filed with the Center for Disease Control and Prevention/National Center for Health Statistics. This data set notes the method of delivery (primary C-section, vaginal excluding VBAC, repeat C-section, or VBAC), characteristics of labor and delivery (i.e. stimulation of labor), and complications of labor and delivery. In addition, it also records the infant's sex, 5-minute Apgar score, birthweight, gestational age, parity (number of live births mother had beforehand); and the mother's age, education, race, marital status, state of residence, risk factors,²² and utilization of prenatal care.

Adequacy of prenatal care utilization is measured using the Kotelchuck Index, which is calculated based on information provided by the Natality Files. Also called the Adequacy of Prenatal Care Utilization (APNCU) Index, it combines the total number of prenatal care visits and month in which care was initiated to fit into four categories: inadequate (received less than 50 percent of expected visits), intermediate (received 50 to 79 percent of expected visits), adequate (received 80 to 109 percent of expected visits) and adequate+ (received 110 percent or more of expected visits). Although the Kotelchuck Index does not measure the quality of prenatal care, it is preferable to other indices because it is the most comprehensive measure available and includes the category "adequate plus" for women who received more than the recommended amount of care. This adequate+ category does not measure the

²² Maternal risk factors include anemia, cardiac disease, lung disease, diabetes, herpes, hydramnios, hemoglobinopathy, chronic hypertension, pregnancy-associated hypertension, eclampsia, incompetent cervix, previous large or preterm deliveries, renal failure, rh problems, uterine bleeding, prenatal smoking, prenatal drinking, or other.

appropriateness of the extra care provided though as the index is not adjusted for maternal risk factors.

The Natality Files were linked to the tort data by state and year. Due to the large size of the data set, the analyses used a 10 percent random sample.

Tort Reforms Data: Avraham Database of State Tort Law Reforms (DSTLR, 2nd edition)

Ronen Avraham, a law professor at the University of Texas at Austin, compiled a database of state tort reforms, collapsing them into a dummy variable equal to zero or one. A one indicated that a state had a particular reform in that year. The data does not distinguish between different levels of punitive and noneconomic damages caps. If the effective date of the reform was on or after July 1, it was coded as belonging to the year after (as for most of the year it did not apply). This data set records the enactment/repeal of state tort reforms related to medical malpractice and is widely used in the existing literature. Avraham's database was compared to data from the American Tort Reform Association (ATRA) and Currie and MacLeod to resolve any discrepancies. A summary of the tort reforms enacted by states from 1989 to 2004 is provided in Appendix B.

V. EMPIRICAL METHODOLOGY

A logistic regression is used to analyze the impact of tort reforms on adequacy of prenatal care utilization, repeat C-sections, and infant health. A multinomial logistic regression is used to analyze the odds of having a primary C-section in women who had CPD/DF. The base model is specified as

$$\text{OUTCOME}_{it} = \beta_0 + \beta_1 \text{TORT}_{st} + \beta_2 \text{XVAR}_{it} + \beta_3 \text{YEAR} + \beta_4 \text{STATE} + \beta_5 \text{STIME} + \varepsilon_{it}$$

where OUTCOME represents the log odds of receiving adequate or adequate+ prenatal care (Model 1). In the multinomial logit (Model 2), the outcome is a categorical variable representing 4 cases of procedure use in women with CPD/DF (and no prior C-section). The base case is having no stimulation and no C-section. The second case is having a primary C-section with no stimulation, the third case is having stimulation with no C-section, and the fourth case is having both stimulation of labor and a C-section. The outcome in Model 3, a simple logit, is the log odds of receiving a repeat C-section (compared to the reference group who had a VBAC). In Model 4, the outcome is low birthweight (<2500 grams) or low 5-minute Apgar score (<7).

TORT is a vector of indicators for tort reforms; YEAR is vector of year indicators; STATE is a vector of state indicators; STIME is a vector of state-specific time trends, and ε is a random error term. XVAR controls for the newborn's parity and the mother's race, education, age, and marital status. It is important to control for personal characteristics because there are large differences in procedure use and infant health outcomes across demographic groups. The subscript i defines the variable at the individual level, the subscript t defines the year, and the subscript s defines the state.

For the simple logits (Models 1, 3, and 4), odds ratios (OR)—the ratio of the odds of the outcome occurring for births in a state-year with a reform and the odds of the outcome occurring for births in a state-year without a reform—are presented in the results. An odds ratio greater than 1 indicates that the outcome is more likely to occur in a state-year with a tort reform, an odds ratio less than 1 indicates that the outcome is less likely to occur in a state-year with a reform, and an odds ratio equal to 1 means that the outcome is equally likely to occur in both cases. For the multinomial logit (Model 2), the relative risk ratio (rrr) command in STATA exponentiates the regression coefficients and these results are commonly interpreted as a type of odds ratio (UCLA). A 95 percent confidence interval (CI) is calculated to provide an estimated range where the “true” odds ratio may lie. Intervals that include 1.00 indicate that the null hypothesis (i.e. there is no association between the outcome and independent variable) cannot be rejected.

The rationale behind choosing logistic and multinomial logistic models was to define the most clinically appropriate reference group for each of the analyses. A multinomial logit model allowed for mutually exclusive outcomes to be compared so that use of stimulation of labor and primary C-sections in pregnant women could be compared to a specific reference group of women who had neither procedure. To be consistent, a simple logit model was then used for the other analyses. Logistic regressions also have less restrictive assumptions than OLS regressions as they do not require normally distributed variables, a linear relationship between the independent and dependent variables, and homoscedasticity.

This research presents analyses for pregnant women at least 19 years old giving birth to a single, full-term baby. This subgroup, approximately 75 percent of the entire pregnant women population, was selected because these individuals are likely relatively homogenous

with respect to confounding variables that may be associated with the study's measures of defensive medicine (i.e. adequacy of prenatal care, primary C-sections, and repeat C-sections). The sample is limited to singleton births as multiple births oftentimes require more procedures to ensure labor occurs smoothly and physicians have less discretion in terms of whether or not to use a certain procedure or test. The same logic applies to full-term births—obstetricians have less discretion in cases of premature or post-term births in terms of what is the “appropriate” treatment action to take. As a specification check, the analyses were run on all pregnant women and the results did not differ significantly, which may be a result of the tort reforms having overall small effects.

The general plausibility and validity of all regressions were tested by lagging the tort reforms by 1 year and 3 years. In addition, each regression was re-run excluding large states (one at a time) as they account for the majority of births. California accounted for 14.62 percent all of births from 1989-2004 and other large states included Illinois, Florida, New York, Ohio, and Texas.

VI. RESULTS AND DISCUSSION

Descriptive Statistics

Approximately 80 percent of pregnant women in the sample were 19 to 34 years old and about 12 percent were 35 years old or older (Table 2). Close to one-third completed high school and more than 40 percent had at least some college education. Sixty-eight percent of them were married. Roughly 80 percent of the women were white and 15 percent of the women were black.

Nearly 50 percent of pregnant woman received adequate prenatal care, and more than a quarter received more than adequate (adequate+) prenatal care. Approximately 25 percent received less than adequate prenatal care. Five percent of the sample had a complication of CPD/DF. Of these cases, 55 percent had a primary C-section only, 13 percent had stimulation of labor only, 22 percent had both stimulation of labor and a C-section, and 10 percent had neither procedure. Eleven percent of the women in the sample had a prior C-section. Of this group, 79 percent had a repeat C-section and 21 percent had a VBAC.

Seven percent of newborn babies were low birthweight and approximately 1 percent had a low 5-minute Apgar score.

Impact of Tort Reforms on Obstetric Defensive Behaviors

This study has three key findings: 1) certain tort reforms designed to reduce liability risk are associated with increases in defensive behaviors, 2) JSL reform likely increases liability risk and defensive behaviors, and 3) the effect sizes of all tort reforms are nonetheless relatively small. The results of Model 1 suggest that caps on punitive damages and CSR reform, which should theoretically reduce liability risk and increase access to care, decreased the likelihood of a pregnant woman receiving adequate prenatal care (for both

reforms: OR = 0.96, 95 percent CI 0.94-0.98, Table 3). In Model 2, instead of reducing assurance behaviors, caps on noneconomic damages increased the odds of having a primary C-section (OR = 1.17, 95 percent CI 1.02-1.35, Table 4). In Model 3, which analyzed the impact of tort reforms on repeat C-sections, both caps on noneconomic damages (OR = 1.11, 95 percent CI 1.04-1.18, Table 5) and CSR reform (OR = 1.10, 95 percent CI 1.03-1.17) increased the likelihood of having a repeat C-section, although theoretically, they should reduce liability risk and C-sections.

These counter-intuitive findings may reflect the malpractice “crises” leading to the enactment of tort reforms instead of the tort reforms themselves. Regressions with the lagged reforms indicate that their effects generally do not increase with time, which lends credence to the idea that they may have minimal effects on physicians’ perceived tort liability and their subsequent behaviors. Empirical evidence that tort reforms are effective in reducing claim frequency and severity and insurance premiums is still lacking as well. Model 2, which analyzed the impact of tort reforms on primary C-section rates in a subgroup of women who had CPD/DF, was the only specification in which most of the tort reforms had their hypothesized effects (although the results do not support the hypothesis that physicians use stimulation of labor to avoid performing a C-section). Whereas the previous literature found that tort reforms may only be effective in certain specialties, this study finds that their applicability may actually be further limited to specific clinical situations within these specialties. And even in these clinical situations where there is substantial room for physician discretion in patient management (in response to the threat of tort), the effect sizes of tort reforms are small.

The second main finding of this study is that although JSL reform (the “fair-share” rule) intends to indirectly reduce the frequency and severity of claims, it appears to increase the liability risk of obstetricians, making them act more defensively. In Model 1, JSL reform reduced the likelihood of a pregnant women receiving adequate+ prenatal care (OR = 0.96; 95 percent CI 0.94-0.98, Table 3). In Model 2, JSL reform increased the likelihood that a woman with CPD/DF would have a C-section (OR = 1.39; 95 percent CI 1.20-1.61, Table 4). In Model 3, JSL reform did reduce the likelihood of a repeat C-section, but its effect was statistically insignificant (Table 5). This study therefore finds empirical evidence that suggests JSL reform is associated with increases in defensive behaviors by obstetricians.

Despite the contradictory effects of certain tort reforms on obstetric avoidance and assurance behaviors, the effect sizes of all tort reforms are essentially inconsequential. In terms of pregnant women’s access to obstetric care (as measured by prenatal care utilization), caps on noneconomic damages are the most influential reform, but they only increase the odds of receiving adequate prenatal care by a factor of 1.10 (95 percent CI: 1.07-1.12, Table 3). Their impact on adequate+ prenatal care is even smaller (OR = 1.05; 95 percent CI: 1.04-1.08). In terms of reducing primary C-sections, only CSR reform had significant effects (OR = 0.76; 95 percent CI: 0.64-0.89). Caps on punitive damages had the expected effect on repeat C-sections, but their effect size was small (OR = 0.95; CI: 0.93-0.97). Although the directions of the effects of tort reforms in this study do not necessarily agree with the results of other empirical studies,²³ the modest effect sizes of these reforms are a common finding.

Tort reforms are therefore by no means the be-all end-all solution to defensive medicine and rising health care costs as the threat of tort may not be as big a driver of

²³ Yang et al. (2009) found that caps on noneconomic damages were associated with lower rates of C-section and higher rates of VBAC. Currie and MacLeod (2008) found that JSL reform reduces the probability of having a C-section. Neither of the studies found CSR reform to have significant effects.

defensive behaviors as physicians and medical societies report. It could also be the case that physicians do not perceive the enactment of such laws as significant reductions in their liability risk. This possibility may hold especially true for tort reforms that do not lead to significant reductions in liability insurance premiums, and few empirical studies have shown tort reforms to be successful at reducing premiums. Although damages caps have been found to reduce the frequency and severity of claims, this study finds little change in obstetrician's behaviors due to caps on punitive damages and noneconomic damages. In fact, despite the popularity of these two reforms in the public discourse, they were both insignificant in reducing C-sections compared to CSR reform in women with CPD/DF. An exception is that caps on noneconomic damages seem to increase prenatal care utilization. As detailed above though, in several cases the effects of damages caps are actually in the opposite direction of their intended purpose, increasing avoidance behaviors and procedure use instead of reducing them.

Whereas previous studies often neglected to consider the clinical relevance of their outcome measures, one of this study's strengths is that it presents analyses focused on measures of greatest clinical importance to tort liability and obstetrics. Analyzing the impact of tort reforms on the overall stimulation of labor and C-sections rate in all women is not as telling as analyzing the use of these procedures in specific clinical settings in which physicians are more likely to take liability into consideration when determining the threshold at which to act defensively. The clinical settings and specific reference groups used in this study are more revealing of the true effect of tort reforms. Analyzing vague groupings of complications of labor and delivery is less clinically significant and because the birth certificates do not record the severity of these complications or the maternal risk factors that

could potentially cause them, it is difficult to discern whether or not the subsequent use of a particular procedure was “appropriate” or “defensive.” The full extent of the impact of tort reforms may therefore have not yet been recognized in previous studies if the most appropriate outcome measures were not used. This study finds that even in the most clinically relevant situations, however, tort reforms do not have sweeping effects on obstetric defensive behaviors. In addition, these results support previous findings that tort reforms have essentially no impact on infant health, as measured by low birthweight and low 5-minute Apgar score (Table 6). The sensitivity analyses performed also strengthen the findings. Lags (both 1 year and 3 years) of the tort reforms were generally insignificant and their effects seemed to decline with time. For all of the regressions run, the exclusion of each large state one at a time also did not affect the robustness of the results.

This study has several limitations though. The true lagged effects of tort reforms may have been difficult to determine from this data set as a limited number of states enacted tort reform from 1989 to 2004, and several of them did not do so until after 2000. In addition, some states that enacted tort reforms soon repealed them due to constitutionality concerns. The generalizability of this study is of concern as well as it focuses specifically on obstetrics. As several of the analyses are limited to specific groups, statistical power is lost, especially given the need to adjust for multiple confounding variables. There are also other confounders that were not accounted for due to data unavailability such as reimbursement schedules for procedures, patients’ income and insurance status, and patient preference for procedures. In addition, the analyses rely on birth certificate data, which has been shown to be less than 100 percent accurate (Reichman & Hade, 2001 and Roohan et al., 2003), although it is likely the best national source of data available and frequently used in the previous literature.

Despite these limitations, this study makes several important contributions. Not only does it reinforce previous findings that tort reforms are overall ineffective in reducing defensive medicine (as measured by obstetrician's avoidance and assurance behaviors) and improving infant health, but it also demonstrates the importance of selecting clinically appropriate measures to more accurately evaluate the impact of tort reforms. This study demonstrates that even when analyzing clinical situations in which tort reforms should conceptually matter the most, they do not always have their intended effects.

TABLE 2. DESCRIPTIVE STATISTICS

	% of All Births
<i>Demographic characteristics</i>	
Mother's age	
<19 years old	8%
19-24 years old	30%
25-34 years old	51%
35-44 years old	12%
45+ years old	0.1%
Mother's race	
White	79%
Black	15%
Other	5%
Mother's education	
<12 years	22%
12 years	34%
13-15 years	21%
16+ years	22%
Married	68%
<i>Model 1 Outcome variables</i>	
Inadequate or Intermediate Prenatal Care	26%
Adequate Prenatal Care	45%
Adequate+ Prenatal Care	29%
<i>Model 2 Subgroup and Outcome variables</i>	
Mother with CPD/DF	5%
1: No Stimulation. No C-section	10% ^a
2: No Stimulation; Yes C-section	55% ^a
3: Yes Stimulation; No C-section	13% ^a
4: Yes Stimulation; Yes C-section	22% ^a
<i>Model 3 Subgroup and Outcome variables</i>	
Had Prior C-section	11%
Repeat C-section	79% ^b
Vaginal Birth After C-section	21% ^b
<i>Model 4 Outcome variables</i>	
Low birthweight (<2500 grams)	7%
Low 5-minute Apgar score (<7)	1%
<i>N (all births)</i>	6,420,902

^a Indicates percent of women with CPD/DF.

^b Indicates percent of women who had a prior C-section.

TABLE 3. EFFECTS OF TORT REFORMS ON ADEQUACY OF PRENATAL CARE

	Adequate Prenatal Care			Adequate+ Prenatal Care		
	<i>Hypothesized Odds Ratio</i>	<i>Odds Ratio</i>	<i>95% CI</i>	<i>Hypothesized Odds Ratio</i>	<i>Odds Ratio</i>	<i>95% CI</i>
Any PD cap	>1.00	0.96**	0.94-0.98	< or > 1.00	0.96**	0.95-0.98
Any NE cap	>1.00	1.10**	1.07-1.12	< or > 1.00	1.05**	1.03-1.07
JSL reform	<1.00	0.99	0.97-1.02	< or > 1.00	0.96**	0.94-0.98
CSR reform	>1.00	0.96**	0.94-0.98	< or > 1.00	1.02	1.00-1.04
<i>N (total)</i>	3,032,007					

Logistic regression includes dummy variables for state, year, state-specific time trends, mother's race (Hispanic, black, other), parity (i.e. birth order: 1, 3, 4 and 5+), mother's education (12, 13-15, 16+ years), mother's age (25-34, 35-44, 45+), marital status (married), and medical risk factors (any indication of anemia, cardiac disease, acute or chronic lung disease, diabetes, herpes, hydraminos, hemoglobinopathy, hypertension, eclampsia, incompetent cervix, previous low birthweight infant, previous premature birth, renal disease, Rh sensitization, uterine bleeding, prenatal smoking, prenatal drinking, and other). Sample limited to singleton, full-term births. Pregnant women <19 years old are excluded. Adequacy of prenatal care measured by Kotelchuck index.

*5 % significance.

**1% significance.

TABLE 4. EFFECTS OF TORT REFORMS ON PRIMARY C-SECTIONS

	2: No Stimulation Yes C-section			3: Yes Stimulation No C-section			4: Yes Stimulation Yes C-section		
	<i>Hypothesized Odds Ratio</i>	<i>Odds Ratio</i>	<i>95% CI</i>	<i>Hypothesized Odds Ratio</i>	<i>Odds Ratio</i>	<i>95% CI</i>	<i>Hypothesized Odds Ratio</i>	<i>Odds Ratio</i>	<i>95% CI</i>
Any PD cap	<1.00	0.93	0.81-1.08	>1.00	0.85	0.72-1.01	<1.00	0.92	0.78-1.08
Any NE cap	<1.00	1.17*	1.02-1.35	>1.00	1.04	0.88-1.23	<1.00	0.96	0.83-1.12
JSL reform	>1.00	1.39**	1.20-1.61	<1.00	1.31**	1.10-1.57	>1.00	1.68**	1.42-1.97
CSR reform	<1.00	0.76**	0.64-0.89	>1.00	0.67**	0.56-0.81	<1.00	0.64**	0.54-0.76
<i>N (total)</i>	178,718								

Multinomial logistic regression includes dummy variables for state, year, state-specific time trends, mother's race (Hispanic, black, other), parity (i.e. birth order: 1, 3, 4 and 5+), mother's education (12, 13-15, 16+ years), mother's age (25-34, 35-44, 45+), and marital status (married). Sample limited to women who had cephalopelvic disproportion or dysfunctional labor and no prior C-section, giving birth to a single, full-term baby. Pregnant women <19 years old are excluded. Base case (1) is no stimulation and no C-section.

* 5% significance.

** 1% significance.

TABLE 5. EFFECTS OF TORT REFORMS ON REPEAT C-SECTIONS

	Repeat C-section		
	<i>Hypothesized Odds Ratio</i>	<i>Odds Ratio</i>	<i>95% CI</i>
Any PD cap	<1.00	0.88**	0.83-0.94
Any NE cap	<1.00	1.11**	1.04-1.18
JSL reform	>1.00	0.94	0.87-1.01
CSR reform	<1.00	1.10**	1.03-1.17
<i>N (total)</i>	364,024		

Logistic regression includes dummy variables for state, year, state-specific time trends, mother's race (Hispanic, black, other), parity (i.e. birth order: 1, 3, 4 and 5+), mother's education (12, 13-15, 16+ years), mother's age (25-34, 35-44, 45+), and marital status (married). Sample limited to women who had a prior C-section and singleton, full-term births. Pregnant women <19 years old are excluded.

* 5% significance.

** 1% significance.

TABLE 6. EFFECTS OF TORT REFORMS ON INFANT HEALTH

	Low Birthweight		Low Apgar	
	<i>Odds Ratio</i>	<i>95% CI</i>	<i>Odds Ratio</i>	<i>95% CI</i>
Any PD cap	1.04	0.99-1.09	0.98	0.90-1.08
Any NE cap	1.00	0.95-1.04	0.98	0.89-1.08
JSL reform	0.99	0.94-1.04	1.00	0.89-1.12
CSR reform	0.95*	0.91-1.00	0.98	0.89-1.08
<i>N (total)</i>	4,419,550		3,389,163	

Logistic regression includes dummy variables for state, year, state-specific time trends, mother's race (Hispanic, black, other), parity (i.e. birth order: 1, 3, 4 and 5+), mother's education (12, 13-15, 16+ years), mother's age (25-34, 35-44, 45+), and marital status (married). Sample limited to singleton, full-term births. Pregnant women <19 years old are excluded. Babies born weighing less than 2500 grams or with a 5-minute Apgar score less than 7 are considered low birthweight or low Apgar, respectively.

* 5% significance.

** 1% significance.

VII. CONCLUSION

Contrary to arguments and estimates put forth by proponents of tort reforms, this study finds that not only are some reforms associated with increases in defensive practices, but overall, they have essentially no meaningful impact on obstetricians' behaviors and infant health. Even in cases that reforms are associated with reductions in defensive behaviors, their effect sizes are small. Policymakers and health professionals concerned with defensive medicine, especially the lack of access to obstetric care and rising C-section rates, are therefore advised to look beyond tort reforms. In addition, this study provides further evidence that such policies will likely result in minimal savings. Whereas advocates of tort reforms often argue that their passage will considerably reduce defensive medicine and the costs of such "unnecessary care," this study finds little empirical evidence to corroborate these claims.

Future research on the impact of tort reforms or other medical malpractice reforms should continue to pay careful attention to the clinical applicability of the outcome measures used. Moreover, additional research into the various incentives driving defensive medicine is necessary.

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APPENDIX A. SUMMARY OF LITERATURE: IMPACT OF TORT REFORMS ON FREQ./SEV. OF CLAIMS AND PREMIUMS

Reform	Significant decrease in claim severity?		Significant decrease in claim frequency?		Significant decrease in liability insurance premiums?	
	Yes	No	Yes	No	Yes	No
Damages cap	Danzon 1,2 Sloan 2, Avraham, Durrance	Zuckerman	Avraham	Danzon 1, Zuckerman	Zuckerman, Thorpe	Sloan 1, Zuckerman
CSR reform	Danzon 1,2	Sloan 2, Zuckerman	Danzon 2	Zuckerman		Sloan 1, Zuckerman, Thorpe
JSL reform				Lee		

Key: Avraham = Avraham (2007); Danzon 1 = Danzon (1984); Danzon 2 = Danzon (1986); Durrance = Durrance (2009); Lee = Lee et al. (1994) ; Sloan 1 = Sloan (1985); Sloan 2 = Sloan, Mergenhagen, and Bovbjerg (1989); Thorpe = Thorpe (2004); Zuckerman = Zuckerman, Bovbjerg, and Sloan (1990). This table reproduces a table in Studdert, Mello, and Brennan (2004) and Sloan and Chepke (2008), with Avraham, Durrance, and Lee references added.

APPENDIX B. STATE TORT REFORMS 1989-2004

	“On” for whole period	Law “on” b/t period	Law “off” b/t period	Law both “on” and “off” b/t period	“Off” for whole period
PD cap	16 states: CO, FL, GA, IL, KS, KY, MI, MT, NE, NV, NH, OR, TX,VA, WA, WI	11 states: AK (1998),AR (2003), ID (2004), IN (1995), ME (2000), MS (2003), NJ (1996), NC (1996), ND (1993),OK (1996), PA (1997)		2 states: AL (off 1993, on 2000), OH (on 1997, off 1998)	21 states: AZ, CA, CT, DE, HI, IA, LA, MD, MA, MN, MO, NM, NY, RI, SC, SD, TN, UT, VT, WV, WY
NE cap	16 states: AK, CA, CO, HI, ID, KS, MD, MA, MI, MN, MO, NE, NV, UT, WV, WI	7 states: ME (2000), MS (2003), MT (1996), ND (1996), OK (2004), SD (1996), TX (2004)	4 states: AL (1992), NH (1996), OR (2000), WA (1990)	2 states: IL (on 1995, off 1998), OH (off 1992, on 1997, off 1998)	21 states: AZ, AR, CT, DE, FL, GA, IN, IA, KY, LA, NJ, NM, NY, NC, PA, RI, SC, TN, VT, VA, WY
JSL reform	29 states: AK, AZ, CA, CO, CT, FL, GA, HI, ID, IA, KS, KY, LA, MI, MN, MO, MT, NJ, NM, NY, ND, OK, OR, SD, UT, VT, WA, WV, WY	9 states: AR (2003), MS (1990), NE (1992), NV (2003), NH (1990), PA (2002), TN (1992), TX (1995), WI (1995)		2 states: OH (on 1997,off 1998) IL (on 1995, off 1998)	10 states: AL,DE,IN,ME,MD,MA,NC,R I,SC,VA
CSR reform	26 states: AK, AZ, CA, CO, CT, DE, FL, HI, IL, IN, IA, MA, MI, MN, MT, NE, NV, NJ, NY, ND, OR, RI, SD, TN, UT, WA	6 states: ID (1990), ME (1990), OK (2004), PA (2002), WV (2003),WI (1995)	3 states: GA (1991) KS (1993), KY (1995)	2 states: AL, (off 1996, on 2001) OH (off 1998, on 2003)	13 states : AR, LA, MD, MS, MO, NH, NM, NC, SC, TX, VT, VA, WY