

ABSTRACT

Title of Document: THE IMPACT OF MEDICAL MALPRACTICE REFORMS ON ACCESS TO HOSPITAL-BASED OBSTETRIC SERVICES

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Policy-makers and public health researchers are concerned that rapidly rising medical malpractice insurance premiums and reduced supply of malpractice insurance coverage have discouraged health-care providers from providing some key but high-risk services in certain geographic regions. Obstetricians/gynecologists and family practitioners who also provide obstetric services appear to be particularly vulnerable to pressure from malpractice litigations. They are frequently sued and face large damages when they lose. To mitigate perceived adverse effects of malpractice litigation on physician behaviors, states have introduced a variety of tort reforms such as caps on malpractice damage awards since the mid-1970s. This thesis examines the effect of direct tort reforms – those reforms that are expected to have a direct and significant impact on the size of malpractice damages -- on access to hospital-based obstetric services.

Using data from the American Hospital Association's annual survey of hospitals, we document a significant decline in the availability of hospital-based obstetric services in a county, particularly in rural communities, from the mid-1980s to the early 2000s. By

combining hospital data with novel data on the introduction and repeal of tort reforms at the state level, we are able to measure the effects of different types of reforms on the likelihood that a county has hospital-based obstetric services available. Applying a difference-in-difference approach to data from 1985, 1990, 1995, and 2000, we find some evidence that caps on total damages and the mandatory offset of compensation from collateral sources in total damages improve the availability of hospital-based obstetric services at the county level. Caps on non-economic damages have smaller effects while caps on punitive damages or allowing periodic payment of damages do not appear to have an impact on the likelihood that a county has hospital-based obstetric services available. The mandatory offset of collateral source rule is found to have a larger impact in rural counties. However, our estimates were not statistically significant at conventional levels and thus no firm conclusions concerning the impact of direct tort reforms on the provision of hospital-based obstetric services can be drawn.

THE IMPACT OF MEDICAL MALPRACTICE REFORMS ON
ACCESS TO HOSPITAL-BASED OBSTETRIC SERVICES

by

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Dedication

To my parents, who has instilled in me the value of knowledge and education since I was a young child.

To Gerald D. Tyler, a dear friend and mentor. May he rest in heaven.

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Introduction

Periodically over the past three decades, health care providers in the United States have been faced with rapid increases in medical malpractice insurance premiums. Rapid rate hikes and shortages of malpractice insurance providers occurred first in the mid-1970s, were repeated in the mid-1980s and have again surfaced in the late 1990s and the early 2000s. The average premiums for all physicians nationwide rose by 15 percent between 2000 and 2002, almost twice as fast as total health care spending per person during the same period.¹ Moreover, changes in malpractice insurance premiums differ by specialty and geographic locations, leading to rate increases for some specialties in particular areas that were substantially higher than the national average. From July 1999 to July 2002, internists saw a 62.25 percent increase in their medical malpractice premiums, general surgeons saw a 58.13 percent increase and obstetricians/gynecologists (OB/GYNs) saw a 46.5 percent increase.² Institutional health care providers have also experienced marked malpractice insurance premium increases. Almost half of the hospitals responding to a survey in early 2003 reported that their medical malpractice premiums had doubled or more than doubled over the previous two years and another 21.4 percent claimed a rate increase of between 50 and 99 percent during the same period

¹ The Congressional Budget Office, *Limiting Tort Liability for Medical Malpractice*, [2004], <http://www.cbo.gov/showdoc.cfm?index=4968&sequence=0>.

² Percentage changes calculated from data published by Medical Liability Monitor cited in the ASPE 2003 study. ASPE, *Addressing the Health Care Crisis: Reforming the Medical Litigation System to Improve the Quality of Health Care* (Washington, DC: Department of Health and Human Services, [2003]).

of time.³ The average medical liability insurance premiums paid by nursing homes rose by 131, 143 and 51 percent in 2001, 2002 and 2003, respectively.⁴

Accompanying premium hikes in the medical malpractice insurance market is reduced availability of affordable malpractice insurance, caused by some of the major providers withdrawing from the market. In late 2001, St. Paul Companies, then the second largest medical malpractice carrier in the country insuring about 750 hospitals and 42,000 physicians in 45 states,⁵ announced that it would phase out of the market over a two-year period as its existing insurance contracts expired. Other providers followed suit. As a result, the number of insurance carriers in some states has decreased substantially in recent years. For example, the number of active professional liability providers in Florida declined by more than 80 percent, from 66 to 12, between the late 1990s and 2002. In Missouri, more than 30 insurance companies were licensed to write medical liability insurance in 2001. Today, only 3 are willing or able to write new business. In Arkansas, there were 88 companies underwriting medical liability in 1996, and only 9 of them remained in 2003, of which only 4 were writing new policies.

In response to rate hikes and the difficulty in finding affordable insurance, there are many popular press accounts of providers' behavioral responses including re-location to a different region where malpractice insurance was easier and cheaper to obtain, early retirement, newly-imposed limits on the type or scope of procedures performed, restriction of services to 'low-risk' populations, or closing down of practices. A 2002

³ American Hospital Association, *Professional Liability Insurance: A Growing Crisis: Results of the AHA Survey of Hospitals on Professional Liability Experience*, [2003].

⁴ Theresa W. Bourdon and Sharon C. Dubin, *Long Term Care General Liability and Professional Liability 2004 Actuarial Analysis* (Washington DC: The American Health Care Association, [2004]).

⁵ AHA Trend Watch, *June 2002, Vol. 4, No. 3*.

survey of OB/GYNs by the American College of Obstetricians and Gynecologists (ACOG) reported that 76 percent of respondents in 9 states under heightened liability pressure had been forced to retire, relocate, or modify their practice (e.g. decrease surgical procedures, stop obstetrics, and/or decrease the amount of high-risk obstetric care). These behavioral changes, often referred to as negative defensive medicine, as they are induced by liability pressure, may lead to reduced access to care, particularly for people with high-risk medical conditions and those who are perceived as litigious by the medical professionals.

Health care providers and insurance companies attribute rapid premium increases and the contracting supply of malpractice insurance to the size of jury awards or out-of-court settlements for medical malpractice claims. In response, they have called for tort reforms in hopes that these reforms would reduce the frequency of malpractice claims and curb the increase in malpractice verdicts or settlements in general. They argue that lower malpractice awards resulting from tort reforms would translate into lower insurance premiums and thus ameliorate the liability pressure perceived by health care providers, which would then encourage the provision of health services. However, it is not clear if tort reforms do indeed mitigate the practice of negative defensive medicine and improve access to care.

Tort reforms as a proposed remedy to these recurring malpractice crises are not new to the health care industry. In response to the hikes in malpractice premiums, many states enacted tort reforms exemplified by California's Medical Injury Compensation Reform Act (MICRA) enacted in 1975, which shortened the statute of limitations, restricted attorney fees, mandated offset of compensation from other resources in the

verdict or settlement, and most importantly, imposed a \$250,000 cap on non-economic damages. Different components of MICRA are defined as either direct or indirect reforms, depending on the way they are expected to impact the expected value of total payouts for malpractice claims. Measures that reduce the frequency of malpractice claims being brought to court or the probability that the plaintiff will win the dispute once a claim is successfully brought to court are indirect reforms ; measures that reduce the amount of payout for a medical malpractice claim are direct reforms (McClellan and Kessler, 1996).

Some studies have shown associations between the number and the size of malpractice claims or medical malpractice premiums and physician behaviors, such as Rock (1988), Tussing and Wojtowycya (1992), Localio et al. (1994), Baldwin (1995), Grumbach et al. (1997), and Dubay et al. (1998). However, data on medical malpractice claims and malpractice premiums are fragmented, incomplete and difficult to obtain. Other studies such as Danzon (1985, 1986a, 1986b), Sloan et al. (1989), Yoon (2001), Thorpe (2004) have provided some evidence on the effectiveness of tort reforms on reducing the frequency and/or the severity of malpractice claims and malpractice insurance premiums.

In contrast to these previous studies that examine the direct impact of reforms on tort activity, some researchers have chosen to examine the impact of tort reforms on physician behaviors.⁶ Such an approach utilizes tort reforms as an identifiable source of

⁶ Daniel Kessler and Mark McClellan, "Do Doctors Practice Defensive Medicine?," *QUARTERLY JOURNAL OF ECONOMICS* 111, no. 2 (1996), 353.; Daniel P. Kessler, William M. Sage and David J. Becker, "Impact of Malpractice Reforms on the Supply of Physician Services," *JAMA: The Journal of the American Medical Association* 293, no. 21 (2005), 2618-2625; William E. Encinosa and Fred J. Hellinger, "Have State Caps on Malpractice Awards Increased the Supply of Physicians?" *Health Affairs* (web version, 05/31/, 2005).

variation in the liability pressure perceived by health care providers. Kessler and McClellan (1996) found evidence that physicians practice defensive medicine and reforms that directly reduce liability pressure could reduce medical expenditures by 5 to 9 percent. Kessler et al. (2005) found that three years after adoption, direct reforms increased physician supply by 3.3 percent. Encinosa and Hellinger (2005) caps on non-economic damages led to 2.2 percent increase in the number of physicians per capita.

This thesis investigates the impact of direct tort reforms on access to obstetric care provided by hospitals. There has been a clear downward trend in the provision of hospital-based obstetric services in the US over the past two decades. Since 99 percent of babies are delivered in hospitals and some obstetric procedures treating complicated maternity and newborn cases can only be carried out in a hospital setting, the decline in hospital-based obstetric services has raised alarms among policy-makers concerning access to obstetric care, especially for vulnerable populations such as women who are poor or those who live in rural areas. It is thus useful to expand the current state of knowledge about whether tort reforms have any effect on access to obstetric care and whether they could be used as an effective tool in improving access to obstetric care when needed. In addition, OB/GYNs have been among the hardest hit medical specialties during medical malpractice crises. Therefore if there is an impact of tort reform on physician behavior, we might reasonably expect these responses to be among OB/GYNs. Using data from the annual surveys of hospitals by the American Hospital Association (AHA), we identified whether a county had hospital-based obstetric services in 1985, 1990, 1995, or 2000. We then conducted multivariate analyses to examine the effects of five types of direct tort reforms (caps on total damages, caps on non-economic

damages, caps on punitive damages, periodic payment arrangements, and the mandatory offset of collateral source rule) on the availability of hospital-based obstetric services in the county, after controlling for county socioeconomic characteristics and other demand- and supply-side factors. We argue that it takes time for tort reforms to change the liability pressure perceived by hospitals. Moreover, it takes time for hospitals to open obstetric facilities in response to mitigated liability pressure. Therefore we included each of the five types of direct reforms in the analyses as the number of years a county had had the reform over the five most recent years. Such a specification utilizes variation in liability pressure brought about by the enactment as well as the setback (such as repeals and court rulings) of tort reforms and therefore increases the power of the estimation more than when only changes in liability pressure from the enactment of tort reforms are accounted for.

The least-square estimates suggest that an additional year with the mandatory offset of collateral source rule or a cap on total damages or a cap on non-economic damages in the five most recent years increases the likelihood of a county having hospital-based obstetric services by 0.60, 0.50, and 0.26⁷ percentage points, respectively. The effects of the other two types of reforms are very small and cannot be estimated with reasonable precision. The mandatory offset of collateral source rule appears to have a noticeably larger impact on rural counties, increasing the probability that a rural county has hospital-based obstetric services by 0.76 percentage points when it has been in effect for one year in the five most recent years. Caps on total damages and caps on non-economic damages, on the other hand, have similar effects on rural areas as in non-rural areas.

These results from our multivariate analysis indicate that the effects of caps on total damages and caps on non-economic damages on the provision of hospital-based obstetric services are modest. Compared to a situation where no state imposed a reform in the prior five years, if all states imposed the mandatory offset of collateral source rule for five years, 93 more counties would have at least one hospital that provided obstetric services; if all states had caps on total damages for five years, women in about 78 counties would have access to obstetric services provided by a hospital; if all states had a separate cap on non-economic damages in all counties for five years; about 40 counties would be added onto to the list of counties with hospital-based obstetric services.⁸

Since state policies and regulations other than tort reforms, such as those on licensing and certification, might also have played a role in affecting a hospital's decision concerning the provision of obstetric services, we generalized the model to allow for correlations across errors within a state. With the correction for arbitrary correlations across errors, the estimates of the effects of an additional year with a cap on total damages or a mandatory offset of collateral source rule became statistically insignificant, implying that no firm conclusion could be drawn with reasonable precision of the impact of these reforms on the provision of hospital-based obstetric services at the county level.

This thesis is composed of seven chapters. Chapter 1 provides background information on medical malpractice insurance crises in the United States. Chapter 2 documents the decline in the obstetric services provided by hospitals from the mid-1980s to the early 2000s. Chapter 3 defines different tort reforms and examines the history of the adoption and setbacks of tort reforms. Chapter 4 reviews extant literature on the

⁷ This estimate is not statistically significant at the 5 percent level ($p > 0.05$).

study of the impact of tort reforms on access to care. Chapter 5 explains the data sources, and the construction of variables used in the statistical analyses, and provides bivariate comparisons of county characteristics and other demand- and supply-side factors between counties with and without hospital-based obstetric services. Chapter 6 details the methodology of the multivariate analyses and the corresponding results. Chapter 7 draws some conclusions and provides a discussion of policy implications and potential areas for further research.

⁸ Calculations in this paragraph are based on a total of 3,100 counties. Virginia independent cities are combined with their original counties.

Chapter 1 Background on Medical Malpractice Insurance Crises

A. The Medical Malpractice Insurance Market at a Glance

The medical malpractice insurance market in the United States has seen significant rate increases and withdrawal of underwriters in recent years. Among all medical providers, physicians are thought to feel the impact of rapidly rising medical malpractice costs first. Based on data from the Office of the Actuary at the Centers for Medicare and Medicaid Services, a Congressional Budget Office study reported in January 2004 that average premiums for all physicians nationwide rose by 15 percent between 2000 and 2002, almost twice as fast as total health care spending per person during the same period.⁹ Other medical providers such as hospitals, nursing homes and nurse practitioners have also experienced sharp increases in medical malpractice premiums since the late 1990s. The American Hospital Association (AHA) conducted a survey of hospitals on professional liability experience in March 2003. 48.7 percent of the respondents reported ‘increases of double or more’ in their medical malpractice premiums over the previous two years and another 21.4 percent claimed a rate increase of between 50 percent and 99 percent during the same period of time.¹⁰ A 2004 study released by the American Health Care Association found that nursing homes incurred substantially higher medical liability insurance premiums in 2003 than in 2000 – average medical liability insurance premiums for nursing homes rose by 131, 143 and 51 percent in 2001, 2002 and 2003 respectively. Smaller providers fared worse than their larger

⁹ The Congressional Budget Office, *Limiting Tort Liability for Medical Malpractice*.

¹⁰ American Hospital Association, *Professional Liability Insurance: A Growing Crisis: Results of the AHA Survey of Hospitals on Professional Liability Experience*.

counterparts, with nursing homes with fewer than 250 beds having to cope with a rate hike of greater than 70 percent from 2002 to 2003.¹¹

Meanwhile, a number of major insurance companies started to restrict coverage based on geographic location, specialty and provider's claims history and some discontinued the line of business altogether. In late 2001, St. Paul Companies, then the second largest medical malpractice carrier in the country insuring about 750 hospitals and 42,000 physicians in 45 states¹², announced that it would phase out of the market over a two-year period as its existing insurance contracts expired. Other major carriers such as Medical Inter-Insurance Exchange (MIXX), PHICO, Legion, Frontier and Reliance followed suit. Overall, these insurers accounted for nearly 14 percent of the national market before their withdrawals from the malpractice insurance market.

Changes in malpractice premiums and the availability of insurance policies affect some medical specialties and geographic regions more than others. OB/GYNs, surgeons, and internists are reportedly among the worst hit by premium hikes and difficulty in finding malpractice policies. Surveys carried out by Medical Liability Monitor show double- or near double-digit premium increases for obstetrician/gynecologist (OB/GYN), general surgeons and internists every year between 1999 and 2002. As a result of the consecutive rate increases, internists saw a 62.25 percent hike in their medical malpractice premiums from July 1999 to July 2002, general surgeons saw a 58.13 percent increase and OB/GYNs saw a 46.5 percent increase over the same time period.¹³ In

¹¹ Bourdon and Dubin, *Long Term Care General Liability and Professional Liability 2004 Actuarial Analysis*.

¹² AHA Trend Watch, June 2002, Vol. 4, No. 3.

¹³ Percentage changes calculated from data published by Medical Liability Monitor cited in the ASPE 2003 study. ASPE, *Addressing the Health Care Crisis: Reforming the Medical Litigation System to Improve the Quality of Health Care*.

contrast, annual income moved up only by 28.45, 39.75 and 32.64 percent from 1999 to 2002 for office-based internists, surgeons and OB/GYNs respectively.¹⁴

Geographically, some states or regions within states have been disproportionately affected by hikes in malpractice premiums and reductions in insurance providers. For example, the highest premium increases for internal medicine, general surgery or OB/GYN was 38 percent in Wyoming from 2001 to 2002, compared with 113 percent in Virginia over the same period of time.¹⁵ Between 2002 and 2003, internists in rural Pennsylvania saw a 73 percent increase in premiums¹⁶ and premiums tripled for OB/GYNs in Lackawanna County, Pennsylvania¹⁷. Hospitals in Pennsylvania reported an 81 percent increase in malpractice insurance premiums from 2001 to 2002. However, underlying the state average increase was a range of increases from 48 percent in the state's Northeast region to 115 percent in the Southeast region.¹⁸ In 2003, nursing homes in Texas paid \$5,500 per bed for medical malpractice insurance premiums and litigation costs, almost double the national average of \$2,290 per bed.¹⁹ As a result of the withdrawal of major malpractice insurance companies, some states have lost a significant portion of insurers in a short period of time.²⁰ In Florida between the late 1990s and 2002, active professional liability providers dropped by more than 80 percent, from 66 to

¹⁴ Percentage changes calculate from the occupational employment and wage estimates published by the Bureau of Labor Statistics available at http://bls.gov/oes/oes_dl.htm.

¹⁵ *ibid.*

¹⁶ Christopher Guadagnino, "Malpractice Studies show Grim Forecast," *Physician's News Digest*, <http://www.physiciansnews.com/cover/204a.html> (accessed 08/30, 2004).

¹⁷ American Medical Association, *America's Medical Liability Crisis: A National View*, American Medical Association, [2004], <http://www.ama-assn.org/ama/noindex/category/11871.html>.

¹⁸ Randall R. Bovbjerg and Anna Bartow, *Understanding Pennsylvania's Medical Malpractice Crisis: Facts about Liability Insurance, the Legal System and Health Care in Pennsylvania*, [2003], <http://medliabilitypa.org/research/report0603/UnderstandingReport.pdf>.

¹⁹ Medical Liability Monitor, "Nursing Homes Liability Costs Up Dramatically," *Medical Liability Monitor* 29, no. 7 (2004), 5-5.

²⁰ Kenneth E. Thorpe, "The Medical Malpractice 'Crisis': Recent Trends and the Impact of State Tort Reforms," *Health Affairs* (2004).

12. In Missouri, the Missouri State Medical Association reported that more than 30 insurance companies were licensed to write medical liability insurance in 2001, but two years later, only 3 were willing or able to write new business. In Arkansas, there were 88 companies providing medical liability policies in 1996, and only 9 of them remained in 2003, of which only 4 were writing new policies.²¹ As a result of rapid premium increases and reduced presence of insurance providers, health care providers started to ‘go bare’ (carrying no insurance) or self-insure. For example, in 2004, among the 47,700 physicians in active patient care in Florida, more than 5 percent did not have malpractice insurance coverage and the percentage was as high as 20 percent in Miami-Dade County.²²

Lack of affordable malpractice insurance exposes health care providers to considerable financial risks. In 2004, the American Medical Association (AMA) declared 20 states to be ‘crisis states’,²³ where rising malpractice insurance premiums are causing physicians to “limit services, retire early, or move to a state with reforms where premiums are more stable.”²⁴ A 2002 ACOG survey of OB/GYNs reported that 76 percent of respondents in 9 states with a liability insurance crisis have been forced to retire, relocate, or modify their practice (e.g. decrease surgical procedures, stop obstetrics, and/or decrease the amount of high-risk obstetric care).

The future supply of medical providers and their distribution across specialties and geographic regions may also be affected by changes in the medical malpractice

²¹ ASPE, *Addressing the Health Care Crisis: Reforming the Medical Litigation System to Improve the Quality of Health Care*, 2003.

²² Wall Street Journal online, January 28, 2004.

²³ The list of these states is: Arkansas, Connecticut, Florida, Georgia, Illinois, Kentucky, Massachusetts, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, Washington, Nevada, West Virginia, and Wyoming.

²⁴ <http://www.ama-assn.org/ama/pub/category/7861.html>.

market. A 2003 online AMA survey of medical students' opinions of the current medical liability environment found that 50 percent of the respondents would take the medical liability situation into consideration when they choose their specialty and 39 percent would factor in medical malpractice pressures when they decide where to practice after medical school.²⁵ If medical students do respond to these pressures, this could mean a reduced supply of health care providers in some specialties and compromised access to care in some areas.

There is limited evidence that certain geographic areas lack providers in some key but high risk specialties. As of 2003, 158 of Texas' 254 counties lack an OB/GYN and 138 do not have a pediatrician. South Texas does not have a single neurosurgeon and medically underserved region lacks specialists in all fields.²⁶ Access to obstetric services in rural areas is a matter of particular concern to policy-makers and health care researchers. Family practitioners play a critical role in providing obstetric services in rural areas. However, the percentage of family physicians that have hospital privileges for routine deliveries in rural areas dropped from 38.6 percent in 1993 to 25.5 percent in 2000.²⁷

Alarming as they appear, rapidly rising medical malpractice insurance premiums accompanied by a contraction in the supply of malpractice insurance are not new phenomena. There were two earlier periods of significant increases in malpractice premiums and reductions in insurance availability that attracted attention from the public

²⁵ American Medical Association Division of Market and Analysis, *AMA Survey: Medical Students' Opinions of the Current Medical Liability Environment*, [2003].

²⁶ Texas House of Representatives, News Release, March 2003. Available at <http://www.house.state.tx.us/news/release.php?id=203>.

²⁷ T. S. Nesbitt, "Obstetrics in Family Medicine: Can it survive?" *The Journal of the American Board of Family Practice* 15, no. 1 (2002), 77-79.

and policy-makers. The first episode was in the mid-1970s when medical malpractice insurance premiums were increasing in some areas by as much as 500 percent per year. During this period, traditional commercial insurers restricted coverage and in some extreme cases, withdrew completely from the market.

A professional liability insurance crisis also occurred in the mid-1980s, this time striking not only the medical community but other professions as well. The nationwide cost of physicians' medical liability insurance tripled in the 1980's, rising from \$1.7 billion in 1982 to \$5.6 billion in 1989.²⁸ The average annual growth rate in physicians' liability premiums was more than four times the general inflation rate over the same period and also out-paced the medical cost index. OB/GYNs were among the worst hit of all medical specialties. During the period of 1982-1986, mean professional liability premiums of self-employed OB/GYNs soared by 171 percent, well above the 14 percent increase in the Consumer Price Index and the 32 percent increase in the medical care component of the CPI.²⁹ Liability premiums paid by health care institutions also increased faster than the general inflation rate. Between 1988 and 1991, premiums paid by community health centers rose from \$30 million to \$60 million.³⁰

B. Causes of the Crisis

Given the volatility in the medical malpractice insurance market that has been witnessed in the last three decades, one cannot help but ask what the underlying causes of these episodes of rapid increases in malpractice premiums and reductions in the supply of

²⁸ Testimony of Congressman Jon Kyl on THE MEDICAL CARE INJURY COMPENSATION REFORM ACT OF 1991, H.R. 3516. Figures not adjusted for inflation.

²⁹ Rostow VP, Osterweis M and Bulger RJ, "Medical Professional Liability and the Delivery of Obstetrical Care," *New England Journal of Medicine* 321, no. 15 (1989), 1057.

³⁰ AMA report, 1992.

malpractice insurance are and why previous efforts aimed at addressing the problems failed to work.

Interestingly, not much evidence is available on whether negligence on the part of practitioners is to blame for medical malpractice insurance crises. Webster's Dictionary defines 'malpractice' as 'a dereliction of professional duty or a failure to exercise an accepted degree of professional skill or learning by one (as a physician) rendering professional services which results in injury, loss, or damage.'³¹ Malpractice consists of two essential parts – negligence and the resulting injury. If, for one reason or another, negligence by health care providers increased just prior to the current round of malpractice premium hikes, then it would make sense for insurance carriers to respond by raising insurance premiums or by withdrawing from the market.

While studies do show a rate of injury related to medical treatment that is shockingly high, and two large studies inspected the probability of in-hospital injuries attributable to negligence, there is little published research that explores changes in the frequency and level of medical negligence that are correlated with the outbreak of medical malpractice insurance premium hikes and contractions in insurance supply. In November 1999, the Institute of Medicine (IOM) aroused public awareness of the severity of medical errors in the US in their report 'To Err is Human: Building a Safer Health System'. The report suggested that extrapolation based on hospital admissions in 1997 imply that 44,000, and perhaps as many as 98,000, patients die in hospitals due to preventable adverse events every year. Even the lower estimate of 44,000 placed the number of deaths in hospitals attributable to medical errors above those from motor vehicle accidents, breast cancer and AIDS in the same year. The IOM estimates are

based on findings on the proportion of negligence-induced injuries in hospitals from two well-known studies: one that analyzed chart data from a large sample of hospital admissions in New York in 1984 (hereafter referred to as the New York Study)³² and the other that analyzed a smaller yet still sizeable sample of hospital admissions in Colorado and Utah in 1992 (hereafter referred to as the Colorado/Utah Study)³³. The New York and Colorado/Utah studies concluded that 0.9 and 1.1 percent of hospitalizations, respectively, ended with negligent injuries. However, surprisingly little is known about whether increasing premiums during medical malpractice insurance crises are at least partly due to changes in the incidence of negligence.

Medical professionals emphasize that modern medicine is not perfect and that bad outcomes from medical treatment are inevitable. Allied with insurance providers, they argue that the current medical malpractice insurance crisis, as were the previous two major crises, is a LITIGATION crisis. In their opinion, the litigiousness of the American society rewarded by sympathetic juries is the main driver for skyrocketing insurance premiums and the withdrawal of insurance carriers. Some argue that more frequent lawsuits, the increasing probability of favorable outcomes for plaintiffs, ballooning jury awards and a tilting distribution of awards toward the high end are all on the list of factors that helped trigger the current round of malpractice premium hikes and the withdrawal of major insurance providers from the market.

There exists evidence of frivolous lawsuits and large jury awards. Based on expert review of medical claims, the New York study concluded that only 17 percent of

³¹ Merriam-Webster dictionary online version.

³² T. A. Brennan and others, "Incidence of Adverse Event and Negligence in Hospitalized Patients. Results of the Harvard Medical Practice Study I," *New England Journal of Medicine* 324, no. 6 (1991), 370-376.

medical malpractice claims made actually involved negligence while the Colorado/Utah study found negligence to be responsible for 22 percent of the claims. Such low presence of negligence in malpractice claims is mirrored in the low proportion of claims that are closed in favor of plaintiffs. Only 13.8 percent of malpractice claims that were closed in court in 2003 resulted in some payment to the plaintiff. Of all malpractice claims closed in 2003, including both by court verdict and settlement out of court, only 30 percent found the defendant responsible for the plaintiff's injury.³⁴ Even though malpractice claims that bear no merit are most often closed with no financial award to the plaintiffs, they can impose substantial financial costs on medical professionals or their insurance companies since they are expensive to refute. On average, it costs \$87,720 per claim when the defendant prevails in court³⁵ and \$17,408 even if the case is dropped or dismissed³⁶.

For medical malpractice claims that are found to be in favor of the plaintiff, awards amounts have moved up rapidly. Between 1997 and 2002, the median jury award almost doubled, rising from \$157,000 to \$300,000;³⁷ between 1997 and 2003 the median out-of-court settlement amount doubled from \$100,000 to \$200,000.³⁸ Moreover, the percentage of high-end claims, i.e. claims with payout more than 1 million dollars, has increased. The Physician Insurers Association of America (PIAA) reported that almost 8

³³ D. M. Studdert and others, "Negligent Care and Malpractice Claiming Behavior in Utah and Colorado," *Medical Care* 38, no. 3 (2000), 250-260, ISI: 000085644100002.

³⁴ Physician Insurers' Association of America. PIAA Claim Trend Analysis: 2003 ed. (2004).

³⁵ *ibid*, exhibit 6a-4.

³⁶ *ibid*, exhibit 6b-4.

³⁷ *ibid*, exhibit 6a-2.

³⁸ *ibid*, exhibit 6b-2.

percent of all malpractice awards exceeded \$1 million in 2003, doubling the percentage of million-dollar awards in 1998.³⁹

Litigation is more heavily concentrated in some medical specialties than others. OB/GYNs have consistently been one group that has both a high probability of being sued and a high payout amount when they are found negligent in causing the plaintiff's injury. Data collected by the PIAA show that among 28 specialty groups, OB/GYNs had the most number of claims reported against them and paid the highest average defense cost per claim (\$34,308) in 2000. In the 1990s, along with family physicians and general practitioners, OB/GYNs led in the percentage of claims against them that were closed with a positive payout. Meanwhile, their claim payouts averaged at \$235,059, second only to those made by neurologists.⁴⁰

In contrast to the assertions of medical professionals, consumer rights protection groups and trial lawyers argue that the current shortage of affordable malpractice insurance for the medical professionals is an INSURANCE crisis. They argue that the data sources used by insurance companies and medical professionals are limited and the methodologies used are flawed. They support their views with studies that demonstrated that no drastic increases in medical malpractice payouts occurred while malpractice insurance premiums skyrocketed. For example, a recent research paper using the Texas closed claims database found virtually no change in the number of paid claims larger than \$250,000 between 1990 and 2000, after controlling for population growth and inflation.⁴¹ Neither overall jury awards or large claims (>\$250,000) increased significantly in either

³⁹ Thorpe, *The Medical Malpractice 'Crisis': Recent Trends and the Impact of State Tort Reforms*.

⁴⁰ American College of Obstetricians and Gynecologists, *the Nation's Obstetrical Care Endangered by Growing Liability Insurance Crisis*, [2002].

an economic or a statistical sense in Texas between 1988 and 2002. However, during this period, medical malpractice premiums increased by 135 percent. The paper thus concluded that the higher malpractice insurance premiums in Texas in recent years most likely reflected changes in the insurance market rather than an upward trend in claim payouts. In Florida, malpractice premiums increased at a rate from 33 percent to 150 percent for different specialties in 2001 and 2002. However, data from the Department of Insurance indicate that the average medical malpractice claim was \$256,464 in 2002 -- almost no change from 1999's \$256,743 figure --, and the total payout was \$334.4 million in 2002, even lower than the \$379.7 payout in 1999 without adjusting for inflation.⁴²

Consumer rights advocates and trial lawyers argue that the current affordability and availability crisis on the medical liability insurance market is the result of a host of factors unrelated to the litigation system in the country. Such factors include the insurance business cycle, the need to shore up reserves by insurance companies, the decline in their investment income, the need to avoid downgrades and the absence of price pressures resulting from consolidation and the exit of some players from the market.

For the first two episodes of rapid malpractice premium increases, both the frequency and severity of claims were demonstrated to be the contributors to skyrocketing premiums or lack of insurance availability.⁴³ However, the frequency of medical malpractice claims appears to have been stable over the last few years and even

⁴¹ Bernard S. Black and others, *Stability, Not Crisis: Medical Malpractice Claim Outcomes in Texas, 1988-2002*, [2005].

⁴² Mike Salinero, "Rivals Roll Out Statistics in Malpractice Cap Battle," *Tampa Tribune* 11/24/2002, <http://multimedia.tbo.com/multimedia/MGA2S61VS8D.html>.

⁴³ P. M. Danzon, "The Frequency and Severity of Medical Malpractice Claims: New Evidence," *Law and Contemporary Problems* 49, no. 2 (1986), 57-84.

the insurance companies and health professionals do not consider it a serious contributor to the current shortage of affordable liability insurance. A 2003 Department of Justice study of medical malpractice trials and verdicts in large counties in the U.S. showed little difference in the number of claims filed in state courts in 1996 and 2001.⁴⁴ Other research found that while there may be more medical malpractice claims in absolute terms, the number of claims per physician has seen no change or even declined.⁴⁵

The severity of claims, on the other hand, has stimulated heated debates between the insurance company/medical professional camp and the trial lawyer/consumer advocacy camp. The debate mainly concerns the sources of data that are used to calculate changes in medical malpractice awards. The two main data sources most commonly cited for medical malpractice payouts by insurance companies and health care providers and their trade associations are the Jury Verdict Research (JVR) and PIAA. A third data source, the National Practitioner Data Bank (NPDB), is less known but is receiving more attention gradually. The PIAA dataset has its advantages. It contains information on claims that are not ultimately paid, thus making it possible to examine the percentage of claims ruled in favor of the plaintiff; and it contains information on injury severity, specialty of defendant and type of malpractice related to each claim, making it possible to study the relationship between claim frequencies and severity with claim characteristics that are not available in NPDB. However, as a trade association, PIAA only collects information from its member companies, and not all member companies respond to data collection requests. Consequently, the paid medical malpractice claims

⁴⁴ Thomas H. Cohen, *Medical Malpractice Trials and Verdicts in Large Counties, 2001*, Department of Justice, Bureau of Justice Statistics, [2004]).

⁴⁵ Public Citizen, <http://www.citizen.org/congress/civjus/medmal/articles.cfm?ID=9125>.

that are reported to PIAA only account for 12 percent of those reported to NPDB,⁴⁶ leaving NPDB undoubtedly the more reliable source for calculating the distribution of payments to medical malpractice claims. The JVR data only include information on cases closed with jury awards, which, according to PIAA, represent 6.75 percent of all malpractice claims. Therefore the JVR data have the tendency of overestimating the average medical malpractice claim payouts because jury awards are on average higher than out-of-court settlement amounts. In addition, the JVR data seem to overstate the percentage of claims that are ruled in favor of the plaintiff by a jury – while PIAA reports that the national average stood around 14 percent in 2003,⁴⁷ JVR data reveal that 42 percent of claims in their database were won by plaintiffs in 2002.⁴⁸

Compared with the third data source, the NPDB, both JVR and PIAA contain a much smaller proportion of medical malpractice claims with a payout. The NPDB, maintained by the Department of Health and Human Services (DHHS), is considered the most comprehensive source of medical malpractice claim payments. It was the product of the Health Care Quality Improvement Act of 1986, which, among other things, mandated that all payments in settlement of malpractice claims against physicians, dentists and other health care practitioners be reported to the NPDB. Data collection started in 1990 and by the end of 2003 DHHS had received around 245,000 reports on medical malpractice cumulatively.⁴⁹

⁴⁶ Public Citizen, "Medical Malpractice Award Trends: Should You Believe Doctors Or Government Sources," <http://www.citizen.org/congress/civjus/medmal/articles.cfm?ID=8798> (accessed 01/13, 2005).

⁴⁷ Physician Insurers' Association of America. PIAA Claim Trend Analysis: 2003 ed. (2004).

⁴⁸ Jury Verdict Research, "Medical Malpractice Jury-Award Median up Slightly," http://www.juryverdictresearch.com/Press_Room/Press_releases/Verdict_study/verdict_study8.html (accessed January 14, 2005, 2005).

⁴⁹ Calculated as 33,716/0.135. The numbers are taken from P7 of the 2003 NPDB annual report, available at http://www.npdb-hipdb.com/pubs/stats/2003_NPDB_Annual_Report.pdf.

If one turns to data supplied by the NPDB, a different picture of changes in medical liability over the past few years emerges. Between 1997 and 2000 the median medical malpractice payment increased from \$100,000 to \$135,000. This 35 percent increase is not dramatically higher than the 31 percent growth in the national health-care expenditures⁵⁰ and even trails behind the 37 percent increase in premiums for private single-coverage health insurance over the same time period⁵¹.

Alternatively, consumer advocacy groups and trial lawyers look to business cycles and under-performing investment markets as possible sources for the current rapid increases in malpractice premiums and the lack of affordable liability insurance in some areas. They believe that when investment income is strong and underwriting appears profitable, entry into the insurance market is encouraged. With the increase in the number of insurers on the market, competitive pressures build up and insurance companies are forced to engage in aggressive underwriting activities, keeping flat or even lowering insurance premiums to attract customers and win market shares. As profit margins shrink, insurance companies have to tighten their underwriting policy and raise premiums to make up for declining profits. Such premium increases could be exacerbated if investment income drops as a result of macroeconomic conditions. In the end, competitive pressures in insurance market drive out inefficient companies. After consolidation, competitive pressures are alleviated and surviving companies can use their increased market power to charge higher premiums and a new business cycle starts.

⁵⁰ Source: the Centers for Medicare and Medicaid. See <http://www.cms.hhs.gov/statistics/nhe/historical/t1.asp>.

⁵¹ Calculated from the Medical Expenditure Panel Survey, Insurance Component. See http://www.meps.ahrq.gov/Data_Pub/IC_Tables.htm.

Data from the National Association of Insurance Commissioners show a drop in investment yield amounting to more than 30 percent in the late 1990s – from around 5.8 percent in 1998 to 4 percent in 2002.⁵² In a 2002 report, the Americans for Insurance Reform, a nationwide coalition of consumer groups, published two major findings after examining medical malpractice premiums, jury awards, settlement costs and other costs related to medical malpractice lawsuits over the past three decades. The reports concluded that: (1) the medical malpractice insurance payout amount has not seen dramatic increases but in fact has been stable and virtually unchanged after adjusting for inflation in medical costs; and (2) medical malpractice insurance premiums charged by insurance companies have been correlated with the state of the economy, falling when the economy was strong and rising when the economy weakened, thus reflecting insurance companies' realized and expected investment income from premiums.⁵³ A 2003 General Accounting Office study also concluded that falling investment income was among many factors that contributed to the drastic increases in medical liability insurance premiums although it identified rising medical malpractice claims as the primary cause for rate increases, especially over the long run.

C. Proposed Remedies

Based on their contrasting views concerning the causes of the current medical liability crisis, medical professionals and insurance companies have proposed measures to tackle the problems that are vastly different from those promoted by consumer

⁵² Eric Nordman, Davin Cermak and Kenneth McDaniel, *Medical Malpractice Insurance Report: A Study of Market Conditions and Potential Solutions to the Recent Crisis*. The National Association of Insurance Commissioners, [2004], http://www.naic.org/models_papers/papers/MMP-OP-04-EL.pdf.

⁵³ Americans for Insurance Reform, *Medical Malpractice Insurance: Stable Losses/Unstable Rates*, [2002], <http://www.insurance-reform.org/StableLosses.pdf>.

advocacy groups and trial lawyers. Among all alternatives proposed by different interest groups to remedy the medical malpractice crisis, medical malpractice reform has attracted the most attention. It is frequently covered in the news media and is advocated not only by medical providers and insurance companies, but also by the President, the Senate and the Congress who has each put forward a proposal recently. Medical malpractice is a special form of tort, which is ‘a wrongful act or an infringement of a right (other than under contract) leading to legal liability’⁵⁴. The tort system in this country is one of the major channels for compensating victims of accidental injuries caused by another party’s negligence. With financial as well as non-pecuniary costs incurred to tortfeasors, such as time and stress involved in defending a tort lawsuit, the tort system is also designed to serve the role of deterring future negligence. The tort system is used by patients for compensation when they suffer injury that may be attributed to negligence by a health care provider. Tort reform refers to changes in legislations, at the state or the federal level, with regard to tort liability, usually with the purpose of alleviating tort pressure by reducing the frequency and severity of tort claims. The most commonly cited success story of tort reform related to medical malpractice and the model for most medical malpractice liability reform proposals at both the state and the federal level is California’s Medical Injury Compensation Reform Act (MICRA) which went into effect in 1975. MICRA stipulated a sliding scale for attorneys’ contingency fees; shortened the statute of limitations to one year after the discovery of an injury or three years after the injury; allowed offsetting of collateral sources in the final award and periodic payment of future

⁵⁴ Oxford dictionary at <http://www.askoxford.com/>.

economic damages⁵⁵; and most importantly, capped non-economic damages at \$250,000 without adjustment for inflation over time.

As a means of preventing negligence and compensating victims, the tort system should strive to achieve two goals – efficiency and equality. However, proponents of tort reforms argue that the existing medical malpractice liability system in most states is not only costly but also ineffective in carrying out its dual roles of compensation and deterrence, hence unquestionably failing the efficiency goal. According to this critique, under the current medical malpractice liability system, real victims of medical malpractice are seldom compensated for their loss. On one hand, only a small fraction of negligent adverse events in medical treatment result in medical malpractice lawsuits – a mere 3 percent according to the 1992 Colorado/Utah study. On the other hand, the majority of medical malpractice lawsuits, more than 75 percent of those studied in the Colorado/Utah study, does not contain the negligence element of a tort and therefore lack merit. Moreover, a significant proportion of medical malpractice related spending is consumed by administrative and legal costs. In 2003, direct medical malpractice costs, including benefits paid or expected to be paid to the party that suffered injury, defense costs and administrative costs, totaled almost \$27 billion, or \$91 per person living in the United States.⁵⁶ Assuming administrative and legal costs for medical malpractice claims were comparable to those for other tort claims, less than half of the \$27 billion would have been collected by medical malpractice claimants in 2003.

⁵⁵ ‘Damages’ is the monetary compensation the plaintiff seeks from the defendant(s) for the plaintiff’s injuries.

⁵⁶ Towers Perrin Tillinghast, *U.S. Tort Costs: 2004 Update Trends and Findings on the Costs of the U.S. Tort System*, Towers Perrin Tillinghast, [2004].

Aside from direct costs, medical malpractice liability pressure also brings about indirect costs such as the practice of defensive medicine. Defensive medicine has been defined as ‘a deviation from what the physician believes is sound practice, and is generally so regarded, induced by a threat of liability’⁵⁷. In other words, defensive practices are those that would not have occurred in the absence of a malpractice threat. Defensive medicine could potentially have a more profound impact on society than the direct costs associated with settling malpractice claims, for it not only generates unnecessary health care costs but may threaten access to care as well.

In general, two types of defensive medicine have been observed. Positive defensive medicine refers to actions taken because of malpractice pressure, such as ordering more laboratory tests than medically necessary or opting for procedures that otherwise would not have been carried out had there been no liability pressure. Extra costs entailed in these actions have been frequently cited as one of the major factors contributing to this nation’s rapidly escalating health care expenditures. Although the cost of positive defensive medicine is hard to measure, and different studies have reached variant numbers, they all show that the magnitude of the costs is not negligible. A 1994 Lewin-VHI study estimated defensive medicine costs at \$12 billion annually.⁵⁸ Kessler and McClellan (1996) concluded that there could be a \$50 billion savings annually if federal health liability tort reform were enacted.⁵⁹ In addition, some medically unnecessary laboratory tests and surgeries put patients at heightened risk for injury and

⁵⁷ N. Hershey, "The Defensive Practice of Medicine. Myth or Reality." *The Milbank Memorial Fund Quarterly* 50, no. 1 (1972), 69-98.

⁵⁸ Rubin, R.J., Mendelson, D.N., "How Much does Defensive Medicine Cost?" *Journal of American Health Policy* (1994).

⁵⁹ Kessler and McClellan, "Do Doctors Practice Defensive Medicine?" *QUARTERLY JOURNAL OF ECONOMICS* 111 (1996):353.

even death. It is estimated that in 2001, about 7.5 million unnecessary surgeries were performed among the top 50 medical and surgical procedures and these surgeries were responsible for more than 37,000 deaths and cost \$122 billion (in 1974 dollars).⁶⁰

Negative defensive medicine, on the other hand, occurs when physicians reduce their availability to or even completely avoid patients who they believe pose a high risk of bringing a malpractice lawsuit. This can result in decreased or eliminated access to care, especially for vulnerable populations such as people who are poor, have high risk of adverse outcome after treatment or reside in rural areas. Lack of access to care could threaten lives when treatment of acute diseases is delayed and it could also affect the long-term health of communities because of compromised preventive care and compromised management of chronic diseases.

The proponents of medical malpractice reform further argue that, despite its high costs, the current medical malpractice system does not effectively deter future negligence by health care providers. Fearing that any information they reveal would be used against them in court, doctors often choose not to communicate with their patients after an adverse event takes place.⁶¹ Liability pressures also discourage doctors from discussing with their colleagues their experience with adverse events even though such discussion could benefit not only themselves but their colleagues and patients.

⁶⁰ Gary Null and others, "Death by Medicine", Nutrition Institute of America, [2003].

⁶¹ David M. Studdert and Troyen A. Brennan, "No-Fault Compensation for Medical Injuries: The Prospect for Error Prevention," *JAMA* 286, no. 2 (07/11/July, 2001), 217-223; H. D. Scott and others, "Physician Reporting of Adverse Drug Reactions. Results of the Rhode Island Adverse Drug Reaction Reporting Project," *JAMA: The Journal of the American Medical Association* 263, no. 13 (1990), 1785-1788; A. S. Rogers and others, "Physician Knowledge, Attitudes, and Behavior Related to Reporting Adverse Drug Events," *Archives of Internal Medicine* 148, no. 7 (1988), 1596-1600; L. M. Ross and others, "Medication Errors in a Paediatric Teaching Hospital in the UK: Five Years Operational Experience," *Archives of Disease in Childhood* 83, no. 6 (2000), 492-497; CL Bosk, *Forgive and Remember: Managing Medical Failure* (Chicago, Ill: University of Chicago Press, 1979).

Advocates of tort reforms also provide evidence that some medical malpractice reforms accomplished their goals of curbing both damage awards and malpractice premiums thereby alleviating liability pressures on health care providers. It is estimated that the average recovery by Alabama plaintiffs decreased by about \$20,000 after a \$400,000 cap on non-economic damages, a \$250,000 cap on punitive damages and a \$1 million cap on wrongful deaths were installed in Alabama in 1987.⁶² The same study also found that the average awards by Alabama plaintiffs almost doubled after the caps were ruled unconstitutional by the Alabama Supreme Court in 1991, 1993 and 1995 respectively. Another study revealed that enacting state-level award caps on non-economic damages or both economic and non-economic damages could lower medical malpractice underwriters' loss ratio by 11.7% and their earned premium per physician by 12.7 percent.⁶³

However, consumer advocacy groups and trial lawyers who believe that the current medical malpractice crisis is an insurance crisis rather than a liability crisis call for changes in the regulation of the insurance industry. They cite California's Proposition 103 as the paradigm for such regulation. They argue that it is Proposition 103, passed in 1988, rather than MICRA which went into effect in 1975, that has kept medical liability insurance available and affordable for medical providers in California.

Opponents of tort reforms point out that California still suffered skyrocketing medical malpractice premiums and withdrawal of insurance firms from the state in the mid-1980s, even though by that time MICRA had been in effect for a decade. In general, medical malpractice premiums in California closely followed the trend in the rest of the

⁶² Albert Yoon, "Damage Caps and Civil Litigation: An Empirical Study of Medical Malpractice Litigation in the South," *American Law and Economics Review* 3, no. 2 (2001), 199-227.

country from the mid-1970s to the mid-1980s.⁶⁴ However, the co-movement broke when Proposition 103 was passed in 1988 and since then California's medical malpractice insurance market has been relatively stable.

Proposition 103 keeps medical malpractice premiums in check with emergency measures including a 20 percent insurance premium rollback in 1988 and a one-year freeze on premiums after the rollback, as well as longer-term measures such as imposing stringent disclosure and pre-approval regulation on insurance companies seeking rate increases; giving consumers the right to challenge insurance rate hikes in court or before the Department of Insurance; and repealing anti-competitive laws to encourage market competition and reduce individual insurance companies' pricing power. With rights granted by Proposition 103, both the public and the Insurance Commissioner have successfully blocked or reduced premium increases proposed by insurance companies. For example, in 2003, the rate increase requested by the largest and the fifth largest medical malpractice insurance provider in California was cut by 71 percent and almost a third respectively and the rate adjustment proposed by the second largest malpractice underwriter was rejected altogether. The Foundation for Taxpayer and Consumer Rights (FTCR), a nonprofit organization, alone has reportedly blocked nearly \$50 million in increases in physician premium in recent years.⁶⁵

Using state-level medical malpractice premium data from Medical Liability Monitor (MLM)⁶⁶ and malpractice claim payout data from NPDB, Baicker and Chandra

⁶³ Thorpe, *The Medical Malpractice 'Crisis': Recent Trends and the Impact of State Tort Reforms*.

⁶⁴ Harvey Rosenfield, *Insurance Regulation Vs. Tort Reform* (Santa Monica, CA: Foundation for Taxpayer and Consumer Rights, 2003), <http://www.consumerwatchdog.org/healthcare/rp/rp003105.pdf>.

⁶⁵ Foundation for Taxpayer and Consumer Rights, "Insurance Industry Reform, Not Liability Limits, Lowered and Stabilized Insurance Rates in California,"

⁶⁶ Medical Liability Monitor is an independent reporting service that tracks medical liability trends. It has conducted a nationwide survey of medical liability insurance premiums every year since 1991.

(2004) found a weak relationship between malpractice payment and insurance premiums and concluded that ‘increases in malpractice payments made on behalf of physicians do not seem to be the driving force behind increases in premiums.’⁶⁷ Interestingly, insurance companies that underwrite medical malpractice policies seem to have provided evidence for supporting consumer advocates and trial lawyers’ opposition to tort reform. In a letter to the Texas Department of Insurance for a proposed 19 percent rate increase starting in June 2004, GE Medical Protective, the largest medical malpractice insurer in the state, claimed that the \$250,000 cap on non-economic damages that went into effect in 2003 would only reduce malpractice costs by 1 percent because ‘non-economic damages are a small percentage of total losses paid’.⁶⁸ In 1986, St. Paul Insurance made similar arguments in its petition to the Florida Department of Insurance for a rate increase, concluding that the reform package Florida had adopted -- including a non-economic damage cap of \$450,000, reform on joint and several liability, and mandatory periodic payment rule on losses above \$250,000 -- would ‘produce little or no savings to the tort system as it pertains to medical malpractice’.⁶⁹ A 2003 study by Weiss Ratings Inc. comparing states with caps on non-economic damages with states that did not have caps found that limits on non-economic damages lowered the medium malpractice payout by 15.7 percent and slowed the rate of increase by 53 percent from 1991 to 2002. However, the same study found that lower malpractice payouts did not translate into lower malpractice premiums. In states with non-economic damage caps, the median

⁶⁷ Katherine Baicker and Amitabh Chandra, "The Effect of Malpractice Liability on the Delivery of Health Care," *NBER*, no. 10709 (2004).

⁶⁸ Foundation for Taxpayer and Consumer Rights, "Nation's Largest Medical Malpractice Insurer Declares Caps on Damages Don't Work, Raises Docs' Premiums," <http://www.consumerwatchdog.org/insurance/pr/pr004698.php3>.

⁶⁹ *ibid.*

annual premium went up faster than that in states without caps by 34 percent between 1991 and 2002.⁷⁰ Furthermore, 18.7 percent of states that did not adopt a cap experienced flat or declining premium during the twelve-year period, compared to only 10.5 percent among those that did enact non-economic damage caps.

Perhaps the most compelling reason for consumer rights advocacy groups to oppose tort reform, especially proposals imposing limits on non-economic damages or total damages, is their belief that such measures will deprive patients of fair compensation for the disability and/or pain and suffering resulting from negligence-induced injuries. In other words, they believe tort reforms drive the tort system farther away from its equality goal. Research suggests that the impact of caps on damages varies by plaintiffs' demographic characteristics and the severity of the injuries they suffer as a result of their health care providers' negligence. Those who suffer severe injury or death, those who are at the two ends of the age distribution, and those who are female tend to bear the negative repercussions from the caps disproportionately, both in terms of the frequency of jury awards being reduced and the extent to which the awards are cut back because of the caps. A 2004 RAND study found that in California, with the \$250,000 limit on non-economic damages imposed under MICRA (with no allowance for inflation over time), more than half of the plaintiffs who suffered the worst injuries such as brain damage, paralysis or other catastrophic losses had their awards capped. The median reduction in their jury awards was more than a million dollars between 1995 and 1999, almost four times the median reduction in jury awards for all medical malpractice cases in the state. Among different demographic groups, infants less than one-year old, elderly

⁷⁰ Weiss Ratings Inc., *The Impact of Non-Economic Damage Caps on Physician Premiums, Claims Payout Levels, and Availability of Coverage* (Internet: Weiss Ratings Inc., [2003]),

aged 65 and above and women are shown to be more adversely affected by the cap. Relative to the general population, for these groups either the cap is imposed more frequently, or it is imposed more severely (in terms of absolute or relative reduction in awards), or both. Seventy-one percent of cases involving injured babies less than one-year old had their jury awards reduced by the cap and the median reduction was as high as 1.5 million dollars. Two-thirds of elderly plaintiffs incurred cuts in their jury awards due to the cap, though the median reduction for this group was relatively small. Female plaintiffs experienced a median cut of one-third of the total verdicts, compared with a median cut of one-quarter of total verdicts for male plaintiffs.⁷¹ A 2004 Harvard study drew similar conclusions to those of the RAND study. It found that the non-economic damage cap in California has an inequitably large adverse impact on people suffering severe injuries.⁷² These findings, together with the sliding scale for attorney contingency fees also embedded in MICRA, imply that lawyers' incentives to represent vulnerable populations such as women, infants, the elderly or those suffering the most severe injuries diminish, possibly to a significant extent. Lawyers may seek cases with substantial economic damages which are not capped by MICRA, weakening the odds that members of vulnerable populations will win – or even bring – malpractice cases in the first place.

Even those consumer rights advocates that are receptive to the idea of imposing caps on non-economic damages in order to strike a balance between efficiency and equity argue that the \$250,000 cap stipulated in MICRA needs to be adjusted for inflation over

<http://www.weissratings.com/malpractice.asp>.

⁷¹ Nicholas M. Pace, Daniela Golinelli and Laura Zakaras, *Capping Non-Economic Awards in Medical Malpractice Trials California Jury Verdicts Under MICRA*, [2004],

<http://www.rand.org/publications/MG/MG234/MG234.pdf>.

⁷² David M. Studdert, Tony Y. Yang and Michelle M. Mello, "Are Damages Caps Regressive? A Study of Malpractice Jury Verdicts in California," *Health Affairs* 23, no. 4 (2004), 54-67.

the three decades since MICRA was enacted. Using the seasonally adjusted annual CPI published by the Bureau of Census, a cap of a quarter million dollars in 1975 amounts to \$854,000 in 2003, more than three times of the original cap.

D. A Practical Approach to Assessing the Efficacy of Tort Reform

It appears that the current debate about whether malpractice claims caused rapid insurance increases and whether tort reforms were effective in curbing premium hikes boils down to what data were used in the analyses. To date, there is no complete and consistent data on the frequency of malpractice claims against medical care providers and the severity of malpractice claims measured by total payouts to the injured party. As demonstrated earlier, none of the three major data sources for malpractice claims -- JVR, PIAA or NPDB – covers all malpractice claims made against health care providers in the US. JVR contains only claims settled in court; PIAA gathers information on both jury awards and cases settled outside of court, but only from a limited number of its members. NPDB is more comprehensive, collecting information on all claims against health care practitioners that ended with a positive payout. However, it has its own limitations and flaws. A 2000 GAO report highlighted major problems with NPDB, ranging from significant underreporting and incomplete information to inaccurate and even misleading information. Moreover, it does not contain malpractice claims made against institutional health care providers such as hospitals and nursing homes, which have increasing shares in medical malpractice claims.⁷³

⁷³ United States. General Accounting Office and United States. Congress. House. Committee on Government Reform. Subcommittee on National Economic Growth, Natural Resources, and Regulatory Affairs, *National Practitioner Data Bank : Major Improvements are Needed to Enhance Data Bank's Reliability : Report to the Chairman, Subcommittee on National Economic Growth, Natural Resources and*

Lack of complete and comprehensive data on medical malpractice claims makes it difficult to directly determine whether the current medical malpractice crisis has arisen because insurance premiums are too high relative to the risks faced by health care providers or because the risks to health care providers posed by malpractice lawsuits simply cannot be managed in a cost effective manner. Acknowledging this constraint, this thesis tackles the issue from a different perspective. From a public health perspective, identifying appropriate remedies for the current rapid increases in medical malpractice insurance premiums and a contraction of insurance suppliers is important. Otherwise, lack of affordable medical malpractice insurance would continue to worsen, potentially driving up health care costs, threatening access to care and possibly leading to worse health outcomes. It is therefore useful to examine the effect of a proposed solution on access to care, health outcomes and health care costs, even if the underlying cause of the phenomenon is not known with certainty. In this thesis, I will investigate the effect of tort reform – the most frequently proposed remedy for the recurrent episodes of rapid increases in malpractice premiums and reductions in the supply of malpractice insurance that raise alarms among health care providers and policy-makers – on access to care. In particular, I will study whether state-level tort reforms in the past two decades affected obstetric services provided by hospitals. In addition to their value to policy making, tort reforms, to the extent that they are effective in changing health care providers’ perception of medical malpractice pressures, provide a means to study defensive medicine.

There are at least three main reasons for focusing on access to hospital-based obstetric services. First, OB/GYN has been among the hardest hit medical specialties

Regulatory Affairs, Committee on Government Reform, House of Representatives (Washington, D.C.: The Office, 2000).

when the malpractice insurance market experienced significant increases in premiums and withdrawal of insurance providers in the past three decades. OB/GYNs pay higher malpractice insurance premiums than most other specialties. They are more likely to be sued, to be ruled against once sued, and to be required to pay large damages once losing a case. Therefore if there is an impact of tort reform on physician behavior, we might reasonably expect these responses to be among OB/GYNs. Second, since 99 percent of births take place in hospitals, deterioration in access to hospital-based obstetric services could have serious repercussions on birth outcomes for babies and their mothers. Third, there has been a clear downward trend in the provision of obstetric services by hospitals in the US over the past two decades, raising concerns among policy-makers about access to obstetric care, especially for underserved women.

Chapter 2 The Decline of Obstetric Services Provided by Hospitals from 1985 to 2002

From the mid-1980s to the year 2000, there was a steady decline in the total number of hospitals⁷⁴ in the United States. Even though this trend appears to have leveled-off in the early 2000s, there were still significantly fewer hospitals in the country in 2002 than in 1985 (5,923 vs. 6,997, or 15 percent fewer). One consequence of the decline in the number of hospitals is that over time, an increasing fraction of counties lost the provision of medical care by a local hospital. In the early 2000s, almost one-fifth of counties lacked a single hospital, up from 16% in 1985. Moreover, hospitals that stayed in operation had on average fewer beds. The average number of beds per hospital fell steadily from 200 in 1985 to 166 in 2000, a 17 percent drop over fifteen years. The decline in the number of hospitals and the number of beds per hospital nationwide has been accompanied by even more pronounced declines in certain types of health services provided by hospitals. From 1985 to 2000, the number of hospitals that provided obstetric services dropped by 23 percent. As a result, more than one-third of counties in the US lacked hospital-based obstetric services in 2000, significantly more than the one-fifth of counties without hospital-based obstetric services in 1985.

Health researchers, federal and state policy-makers, and local health officials are concerned that the combined effect of fewer hospitals and changing patterns of practice may have led to a critical lack of access to certain types of health services in some geographic regions. They are particularly concerned that women in rural communities

⁷⁴ In this study, hospitals refer to those registered by the American Hospital Association (AHA). AHA has a set of criteria (such as a minimum of 6 beds, cribs or bassinets continually available for patient care, see http://www.aha.org/aha/resource_center/content/registration%20requirements%20for%20hospitals.pdf for

may have inadequate access to obstetrics services. This chapter documents changes in the total number of hospitals as well as changes in the number of hospitals providing obstetric services between 1985 and 2002. It then examines the availability of hospital-based medical care in general and obstetric care in particular at the county level during the same period of time. Finally, it compares the availability of hospital services and hospital-based obstetric services in rural areas with that in non-rural areas to determine whether access to obstetric services in rural communities was disproportionately affected by the nationwide trend.⁷⁵

A. Data

The main source of data underlying the analysis in this chapter is the survey databases from the American Hospital Association (AHA). The AHA has been conducting a survey of hospitals annually since 1946 and these survey databases are regarded as the most comprehensive source of data available on individual hospitals. The main information collected in the survey includes organizational structure, facilities and services, total facility beds and utilization, staffing and finances. Some data items collected in the survey change over time, reflecting the evolution of the hospital sector and the environment in which hospitals operate. However, the majority of data elements have been collected repeatedly over years, making the AHA annual survey databases an

details) for registration as a hospital facility. Registered hospitals include AHA member hospitals as well as nonmember hospitals.

⁷⁵ Due to lack of county-level data for most variables used in this study, Alaska is excluded from all analyses. US outlying and associated areas are also excluded because data are not available for them for the early years of the time series this study examines. Independent cities are grouped with their original counties because we expect that economic behaviors in independent cities would not only be similar to but also integrated in their original counties to a large extent.

important source for cross-sectional as well as longitudinal studies of hospitals. We obtained AHA survey databases for each year from 1985 to 1995 and from 2000 to 2002.

The AHA annual surveys are a census of all registered hospitals. Response rates for the survey were above 90 percent throughout the 1980s, but have declined since 1990. In 2000, about 81 percent of registered hospitals responded to the survey. When a hospital did not respond to the survey, the AHA treated different fields in the survey differently. For some fields such as those on utilization, expenditures and staffing, the AHA imputed values based on models that took into consideration the demographic characteristics of the hospital's surrounding area. For fields such as those on the organizational structure, number of beds and administrative information, the AHA used information from the most recent prior year in which data were reported.⁷⁶

As described below, there were frequent mergers and acquisitions and de-mergers among hospitals during the past two decades. When hospitals merged, the AHA annual survey databases report data only for the resulting entity, even if the merging hospitals continued to operate. In order to be able to treat hospitals consistently over time, we consolidated information for hospitals that have merged or de-merged so that each hospital in our panel represented the most encompassing organization it was ever a part of during our study period. For example, if hospital A was acquired by hospital B in 1988, we consolidated all the data on hospital A with those on hospital B for the years before 1988 so that in all years in our panel, only the resulting hospital after the merge was present. For illustration purposes, we refer to A and B as the component hospitals of the resulting hospital from the merger. For qualitative variables such as the ownership of a hospital, we generally applied the value for the resulting hospital from a merger or the

original hospital before a de-merger to the variables in years before a merger or years after a de-merger. However, when a number of component hospitals with different values for a qualitative variable were combined into a single merged entity, we set the variable for the merged entity to that of the majority of the component hospitals for years before the merger. For quantitative variables such as the number of beds set up and staffed, we added the values across all component hospitals for years before a merger or years after a de-merger.

Using supplemental information in the documentation of the AHA annual survey databases as well as information from state hospital associations, we compiled a separate database containing detailed information on hospital closures, mergers and acquisitions, de novo hospital openings, de-mergers, and conversions between hospitals and other types of institutional health care providers from 1984 to 2000. This database provides a record of the dynamics of the hospital sector between the mid-1980s and 2000. Equally important for our purposes, it contains hospital IDs related to mergers and de-mergers needed to do the merger/de-merger data adjustments described above. Without this supplemental information, it would be impossible to construct consistent data for hospitals over time.

B. The Loss of Hospitals from 1985 to 2002

Our database shows that hospital closures and mergers outpaced new openings and de-mergers during the period of 1985 to 2000, resulting in a net loss of hospitals nationwide. Between 1985 and 2000, 1,242 hospitals closed. The largest number of closing occurred in 1999, when 120 hospitals closed their doors. During the same period

⁷⁶ See ‘Explanation of Codes and Fields’ in the AHA annual survey database documentation for details.

of time, 888 hospitals merged. The four years from 1994 to 1997 were the most important in terms of mergers and acquisitions. The peak of this merger wave occurred in 1997 when mergers or acquisitions affected 117 hospitals. Even though some hospitals stayed in operation on their original sites after a merger, others were closed in order to fulfill the strategic or cost-control objectives of the merged identity. Moreover, 289 hospitals were reorganized into institutions other than hospitals between 1985 and 2000, further reducing the number of hospitals serving communities around the country. In contrast, our database documents only about 1,000 new additions to the list of hospitals in the US from 1985 to 2000. Such additions resulted from new openings, re-openings after previous closures, reorganizations of existing hospitals as multiple entities, and conversions of other types of institutions into hospitals.

As a result of the dynamics of the hospital industry, there were significantly fewer hospitals in the early 2000s than in the mid-1980s. According to our panel data constructed from AHA's annual surveys, 6,997 hospitals, including short-term general hospitals, short-term non-general hospitals and long-term hospitals, operated in the US in 1985.⁷⁷ This number dropped to 6,779 in 1990 and further declined to 6,421 in 1995. In 2000, the AHA annual survey reported 5,952 hospitals in operation in the US, 1.2 percent

⁷⁷ A hospital is categorized as 'short-term' or 'long-term' if the length of stay variable in the AHA database has the value 1 or 2 respectively. AHA determines the value of the length-of-stay (LOS) variable as follows:

If separate short-term and long-term units are reported and short-term admissions are greater than long-term admissions, then LOS is 1; if long-term admissions are greater than short-term admissions, then LOS is 2. If separate units are not reported and the ratio of discharge days to discharges is less than 30, then LOS is 1; if the ratio of discharge days to discharges is 30 or greater, then LOS is 2. If separate units, discharges and discharge days are not reported and the ratio of inpatient days to admissions is less than 30, then LOS is 1; if the ratio of inpatient days to admissions at least 30 days, then LOS is 2.

A 'general' or 'non-general' hospital is defined using the 'service code' (SERV) variable in the AHA annual survey database – those with SERV equal to 10 (general medical and surgical) are general hospitals while hospitals with SERV equal to any other value is a 'non-general' hospital. Non-general hospitals provide specialized services such as psychiatric, obstetrics and gynecology, rehabilitation, or various medical and surgical services to children.

fewer than a year before and 14.9 percent fewer than in 1985. However, the most recent AHA survey data available suggest that the downward trend in the total number of hospitals servicing the country flattened between 2000 and 2001 and may have even reversed itself – 2001 only saw a 0.7 percent decrease in the number of hospitals while 2002 saw a 0.2 percent increase over 2001 (see Figure 1).

Figure 2 shows that the decrease in the number of hospitals in rural counties followed a similar pattern to that of the nation as a whole. To identify rural counties, we used the 1995 Rural-Urban Continuum Codes for Metro and Non-metro Counties developed by the Department of Agriculture,⁷⁸ which is available in the Area Resource Files (ARF).⁷⁹ A county is defined as rural if it did not have a place within the county with a population of 2,500 or more per square mile in 1990, whether or not the county is adjacent to a metropolitan area. In the 768 counties that fall into this category, there were 488 hospitals in 1985, 457 in 1990, 432 in 1995, and 416 in 2000. From 1985 to 2000, the total number of hospital in rural counties dropped by 14.8 percent. Consistent with the pattern observed for all counties, the decline in the number of hospitals in rural counties also flattened and even reversed after 2000. Rural counties only lost 3 (0.7 percent) hospitals from 2000 to 2001, followed by a gain of 1 hospital (0.2 percent) in 2002.

⁷⁸ The rural/urban continuum codes were first designed in 1975 based on the 1970 census. The codes were later updated after the 1980 and the 1990 census using the original coding scheme with somewhat more restrictive procedures for determining metro adjacency. In 2003, major changes were incorporated in the coding scheme, making the 2003 rural/urban continuum codes noticeably different from earlier versions. Since our study focuses on the period between 1985 and 2002, we use the 1995 version of the rural/urban continuum codes throughout the study.

⁷⁹ The ARF is a secondary data source published by the Bureau of Health Professions every year. The ARF contains about 6,000 county-year variables on health professions, health facilities, measures of resource scarcity and health status compiled from various primary sources such as the AMA physician master file, the population census, and the mortality and natality data extracted by the National Center for Health Statistics from death and birth certificates.

C. The Decline in the Number of Hospitals that Provided Obstetric Services

The reduced physical presence of hospitals could pose a problem for access to care, especially in those communities that lost their only local hospitals. Clearly, local hospitals offer patients a level of convenience not offered by hospitals farther away. Greater distance increases the costs – both in terms of time and money – of obtaining ongoing or scheduled services such as elective procedures and preventative care. Hadley et al. (2002) found that the distance to the nearest radiation therapy hospital was associated with a lower likelihood of receiving the treatment of breast conservation with radiation but a higher probability of receiving mastectomy or breast conservation without radiation for elderly women diagnosed with breast cancer, probably because radiation therapy requires multiple sessions over several weeks.⁸⁰ When emergency or unscheduled services are required, absence of a local hospital can pose a more immediate danger to patient health. McClellan et al. (1994) found that the shorter the distance a Medicare beneficiary was from a hospital that provided intensive treatments for heart attacks, the more likely the person would receive invasive procedures after suffering an acute myocardial infarction (AMI). Furthermore, they found that invasive procedures lowered mortality rates at 1 to 4 years after Medicare enrollees suffered AMI.⁸¹ In the case of obstetrics services, the absence of a local hospital means that pregnant women not only must travel farther to deliver their babies, they might also find it more difficult or costly to obtain prenatal care. Nesbitt et al. (1990) found that in rural communities in

⁸⁰ Jack Hadley and others, "Outcome Measurement an Exploratory Instrumental Variable Analysis of the Outcomes of Localized Breast Cancer Treatments in a Medicare Population," *Health Economics* 12, no. 3 (2002), 171.

⁸¹ Bosk, *Forgive and Remember: Managing Medical Failure*.

Washington State, women who delivered at local hospitals were less likely to suffer from complications and their babies were less likely to be premature and incurred lower costs of neonatal care.⁸² McDonald and Coburn (1988) found that the longer the travel distance, the less likely a woman got prenatal care.⁸³ Kalmuss and Fennelly (1990) reported that low-income women in New York City cited travel distance and transportation problems among the top barriers to prenatal care.⁸⁴

Concerns about the potential negative impact of declining hospital presence on access to certain types of care, such as obstetric care, are exacerbated by the fact that even among hospitals that stayed open, some have opted to stop providing obstetric services. In addition to the downward trend in the total number of hospitals, Figure 1 also documents a decline in the number of hospitals that provided obstetric services over time. Using our panel data set constructed from the AHA annual survey databases, we define a hospital as providing obstetric services if the hospital had at least one obstetric bed or one pediatric bassinet, or delivered more than 15 babies in a given year.⁸⁵ The time trend in the availability of hospital-based obstetric services looks similar to that of the total number of hospitals from the mid-1980s to 2000. In 2001 and 2002, however, the number of hospitals that provided obstetric care continued to fall noticeably while the total number of hospitals changed little. Overall, the rate of decline in the number of hospitals providing obstetric care was more significant than the rate of decline in the total

⁸² T. S. Nesbitt and others, "Access to Obstetric Care in Rural Areas: Effect on Birth Outcomes," *American Journal of Public Health* 80, no. 7 (1990), 814.

⁸³ TP McDonald and AF Coburn, "Predictors of Prenatal Care Utilization," *Social Science & Medicine* 27, no. 2 (1988), 167.

⁸⁴ D. Kalmuss and K. Fennelly, "Barriers to Prenatal Care among Low-Income Women in New York City," *Family Planning Perspective* 22, no. 5 (1990), 215.

⁸⁵ The 15 births a year threshold is to account for instances where a hospital does not provide obstetric services but expecting mothers had nowhere else to go other than the local hospital and their babies were delivered in the hospital's emergency department.

number of hospitals. From 1985 to 2002 the number of hospitals providing obstetric services fell by 22.8 percent while the total number of hospitals (both with and without obstetric facilities) fell by a more modest 15.3 percent. The number of hospitals providing obstetric services fell more rapidly than the total number of hospitals because the share of hospitals providing obstetric services has declined over time. In 1985, 65.6 percent of hospitals provided obstetric services. By 2002, the share of hospitals providing obstetric services had declined to 59.8 percent.

A greater proportion of hospitals in rural counties discontinued the provision of obstetric services than in non-rural areas. Figure 2 shows dramatically diverging trends of the loss of hospitals and the loss of hospital-based obstetric care in rural counties. In 1985, over 86 percent of rural hospitals provided obstetric services. Seventeen years later, less than half of existing hospitals offered obstetric services to their communities. The 52.0 percent drop in the share of rural hospitals providing obstetric care was more than five times that of the 8.8 percent decline in the share of all hospitals providing obstetric services.

D. Lack of Hospital-based Obstetric Services at the County Level

One consequence of the net loss of hospitals is that over time, more and more counties lacked a single hospital providing services to their residents.

Figure 3 shows the downward trend in the percentage of counties that did not have a hospital over our study period. In 2000 there were 22.3 percent more counties without a single hospital than in 1985. As of the early-2000s, almost one-fifth of counties did not have a hospital, compared with 16 percent of counties in 1985.

However, with the slowdown and reversal of the downward trend in the number of hospitals in the early 2000s, the number of counties without a hospital also stabilized. The share of counties without hospital services fell by a modest 0.5 percent from 2000 to 2001 and 2002 saw no changes in the percentage of counties with hospital services.

Figure 3 also shows that rural counties are much less likely to have a local hospital than non-rural counties and the gap between rural and non-rural counties seems to have widened over time. Forty-six percent of rural counties did not have a local hospital in 1985. Since the mid-1990s, more than half of rural counties lacked a hospital facility while less than one in ten non-rural counties lacked a hospital facility. At the beginning of our study period, about 30 percent more rural counties did not have a hospital than their non-rural counterparts and by the end of our study period the difference had risen to 34 percent.

Declines in the number of hospitals and the proportion of hospitals providing obstetric services have resulted in a significant fall in the number of counties with hospital-based obstetric care. As shown in Figure 4, there was an upward trend in the percentage of counties with no hospital-provided obstetric services over the past two decades for both rural and non-rural counties. Even though non-rural counties experienced a more drastic drop in the frequency of hospitals that obstetric services than did rural counties (116.2 percent vs. 51.6 percent), rural residents were far less likely to have access to obstetric care in a local hospital. In the mid-1980s, residents in about half of all rural counties had access to obstetric services in a local hospital; in the early 2000s only about one-fifth of the rural counties had at least one hospital providing obstetric services.

In summary, hospital closures, mergers and acquisitions, and conversion into non-hospital facilities outpaced hospital openings and de-mergers and resulted in 15.3 percent fewer hospitals in 2002 than in 1985. The number of hospitals seems to have reached the trough in 2001 and appears to have stabilized in 2002. The decline in the number of hospitals was accompanied by lower hospital capacities. From 1985 to 2000, the average number of beds set up and staffed per hospital fell by 17 percent. Rural and non-rural counties were equally affected by the loss of hospitals. However, hospitals that opened or stayed in business in rural counties were more likely to discontinue the provision of obstetric services. As a result, rural counties saw a 52.0 percent reduction in the percentage of hospitals that provided obstetric services from 1985 to 2002 while non-rural areas only incurred a 4.5 percent loss. Residents in rural counties had less access to hospital services in general and obstetric services in particular than residents in non-rural counties. More than half of rural counties did not have a hospital and only about one-fifth of rural counties had hospital-based obstetric services. In contrast, less than one-tenth of non-rural counties lacked a hospital and more than three-quarters of non-rural counties had at least one hospital that provided obstetric services to their residents.

Figure 1: Time trends of the number of hospitals and the number of hospitals with obstetric services

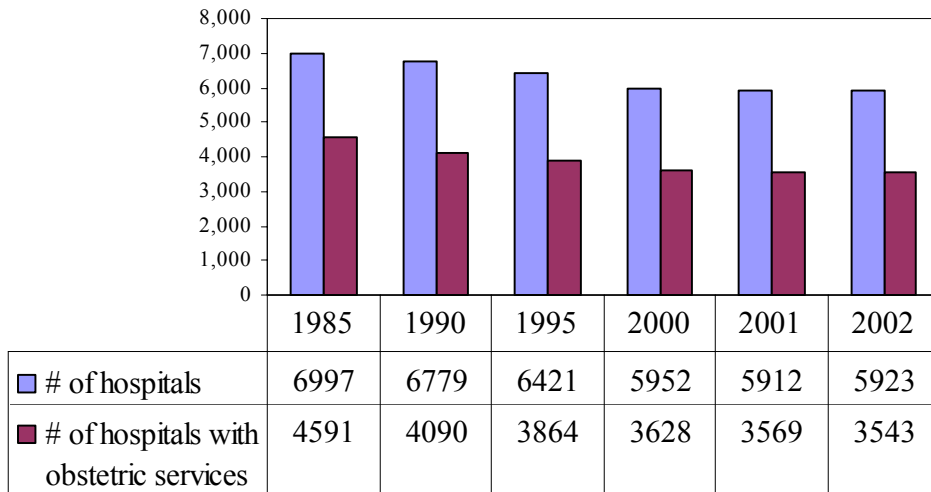


Figure 2: Time trend of the number of hospitals and hospitals with obstetric services, rural counties only

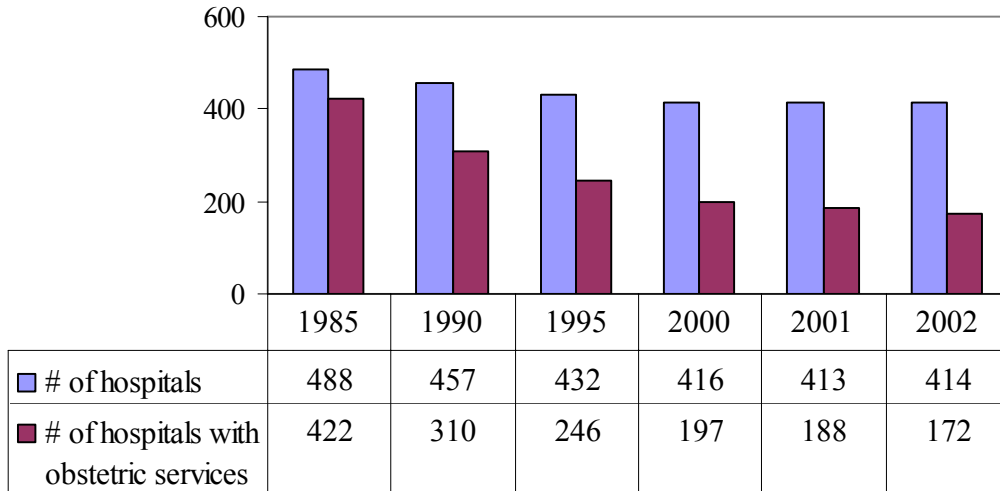


Figure 3: Percent of counties with no hospital

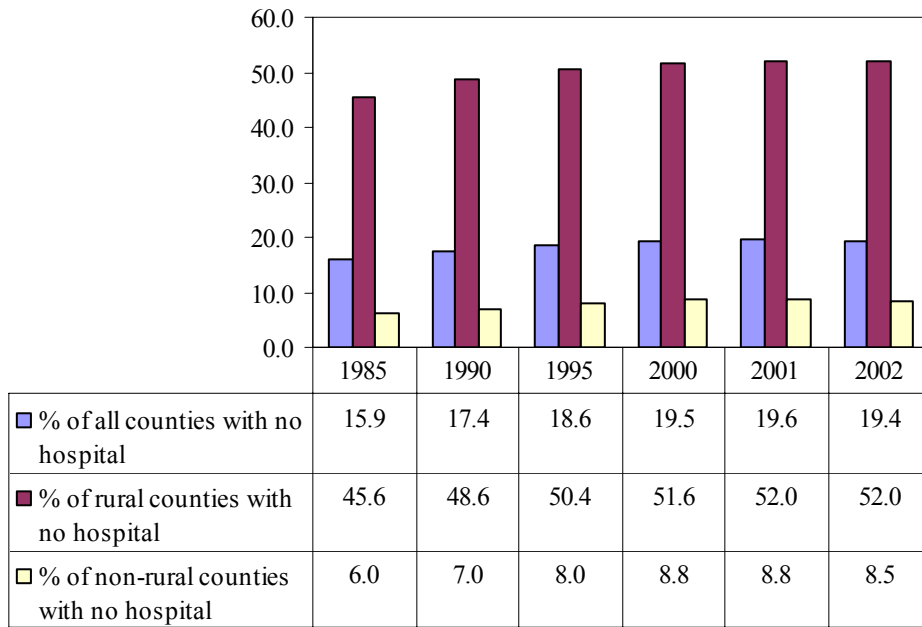
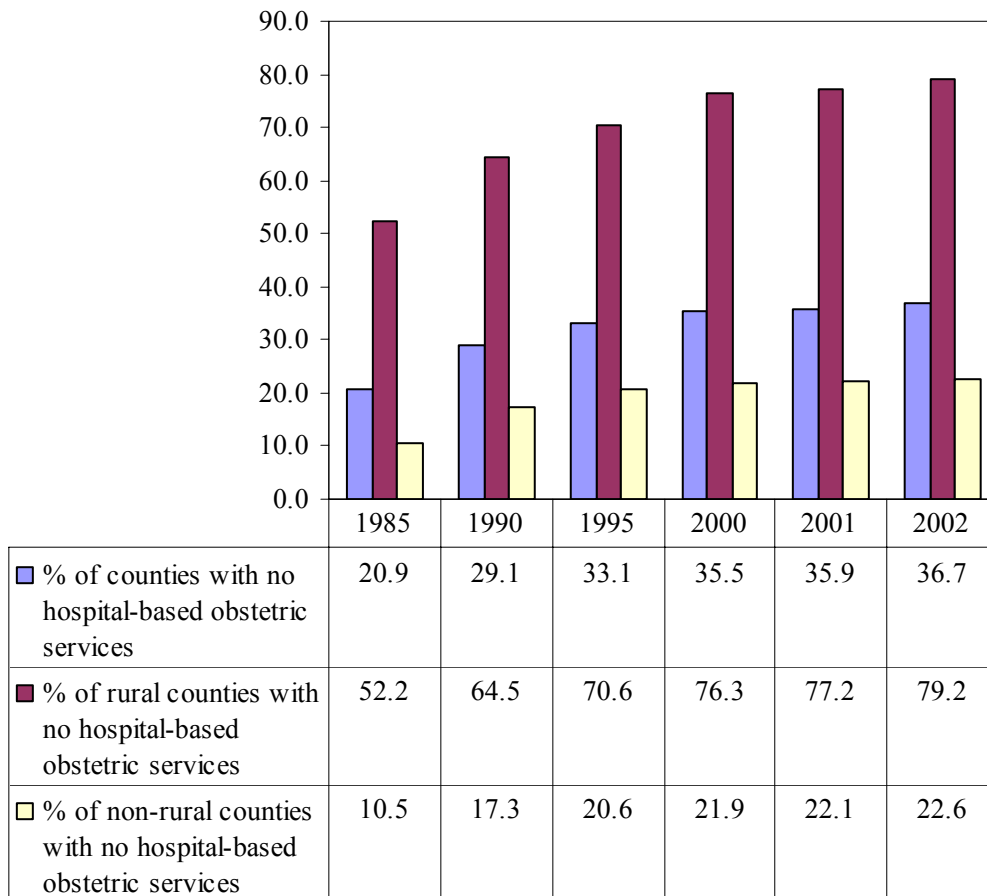


Figure 4: Percent of counties with no hospital-based obstetric services



Chapter 3 State-level Medical Malpractice Reforms in the Past Three Decades

The previous chapter shows a clear pattern of declining hospital-based obstetric services between 1985 and 2002. Over this period the number of hospitals operating in the United States fell and it also became less likely that those hospitals that continued to operate would provide obstetric services. As a result, by 2002, 487 fewer counties had at least one hospital that provided obstetric services to residents. While a variety of factors on both the demand- and supply-sides could have contributed to this decline, the recurrent medical malpractice insurance crises during the same period of time beg a question: could the costs associated with medical malpractice litigation have played a role? In other words, could health care providers have practiced negative defensive medicine, thereby reducing the supply of medical services to communities? We address this question by examining the relationship between tort reforms and county-level availability of hospital-based obstetric services.

Defensive medicine has been defined as ‘a deviation from what the physician believes is sound practice, and is generally so regarded, induced by a threat of liability’ (Hershey, 1972). In contrast to positive defensive medicine, the practice of over-utilization of medical resources, negative defensive medicine is characterized by health care providers’ reluctance and refusal to provide services to certain populations or communities in order to avoid potential liability. To find out whether the steady decline in hospital-based obstetric services between the mid-1980s and 2000 is attributable to negative defensive medicine, we use state-level tort reforms to gauge changes in liability

pressures and examine the relationship between tort reforms and the likelihood that a county has hospital-based obstetric services.

We use tort reforms instead of direct measures of liability threat such as the frequency of malpractice claims and the amount of malpractice claims payouts for three reasons. First, as illustrated in Chapter 1, existing data on the frequency and the severity of medical malpractice claims are incomplete, incomprehensive, and hard to obtain. Second, due to the complexity of malpractice claims and awards, it is difficult to construct a county-level index that can objectively capture differences in malpractice pressure perceived by health care providers in different parts of the county. Tort reforms, on the other hand, are shocks to the liability system that affect all health care providers' perceptions of liability pressures. Therefore tort reforms serve as an identifiable source of variation in malpractice threats that can be used to test the hypothesis of the existence of negative defensive medicine. Third, the practical benefits of using tort reforms to study negative defensive medicine aside, gauging the effects of tort reforms on access to care is interesting in and of itself since such an assessment bears directly on current policy debates over the value and effectiveness of tort reforms. This chapter will provide an overview of medical malpractice reforms adopted by states between the mid-1970s and the early 2000s.

Traditionally, medical malpractice tort law has been the province of state courts and legislatures in the US. Discussions of medical malpractice reforms thus generally refer to state efforts to enact new legislation or amend existing legislation that governs civil lawsuits arising from medical malpractice. A tort is defined as 'a wrongful act or an infringement of a right (other than under contract) leading to legal liability'. Since

medical malpractice is only one type of tort, reforms specific to medical malpractice legislation reflect a specific form of tort reform. Broader tort reforms usually apply to medical malpractice. Therefore, we use the terms ‘tort reform’ and ‘medical malpractice reform’ interchangeably in this thesis, although broader tort reforms may have impacts to sectors of the economy rather than just medical malpractice.

Over the past three decades, medical malpractice reforms have been triggered by crises in the medical malpractice insurance market. From time to time, rapidly increasing insurance premiums, shrinking availability of insurance providers and harsher underwriting terms are suspected to drive up health care costs and threaten the viability of the practices of doctors and other health care providers and hence access to care in some communities. State legislatures have responded by modifying laws by which medical malpractice claims are tried or settled. Medical malpractice reforms examined in this thesis refer to these efforts by states to *alleviate* liability pressure on health care providers by changes in tort law.

In order to compile a comprehensive database on various types of state tort reforms enacted between 1975 and 2002, I did an extensive search in publications in paper form or on the internet by government agencies, state legislatures, trade associations and law firms. To ensure as much as possible the precision of the dates on which the reforms were passed in legislature, enacted, amended, sunset, repealed, or ruled unconstitutional by the court, I checked multiple sources against one another. When two secondary sources provided conflicting information, I studied state statutes or annotated state codes whenever possible and resorted to additional secondary sources when state statutes or annotated codes were not readily accessible. The major secondary

sources for the compilation of the state tort reform database include the Compendium of State Systems for Resolution of Medical Injury Claims (both the 1991 and 1996 versions) published by the Agency for Health Care Policy and Research, the American Medical Association's Compendium for Tort Reform (1989), Summary of Medical Malpractice Law produced by McCullough, Campbell & Lane as well as papers that investigate various aspects of medical malpractice reforms.

Tort reforms in the past three decades are widespread across states and cover multitude aspects of medical malpractice. Different types of tort reforms mitigate liability threats in different stages of the lawsuit process. They can make it more difficult to file a malpractice lawsuit; they can reduce the probability of a finding in favor of a plaintiff; and they can lower the amount of awards to plaintiffs when they prevail in court. Accordingly, tort reforms can be grouped into three major categories – those that set up barriers to suit; those that alter plaintiffs' burden of proof; and those that reduce damage awards. Table 1 gives the definition of specific reforms that fall into each category.

The first group of reform measures is designed to set up barriers to suit, making it less likely for a claim to reach the court. Among the six entries in this group, limiting plaintiffs' attorneys' contingency fees has caught the most attention and has generated considerable controversy. In most medical malpractice cases, plaintiffs' attorneys work on a contingency basis; they get paid only when a case is won or settled. In the absence of legislative intervention, contingency fees can sometimes be as high as 50 percent of total awards. Most states that have enacted reform on attorney contingency fees have adopted various forms of sliding scales; a small number of states have imposed single

caps on the percentage of total awards that plaintiffs' lawyers can collect; and a few others have given judges authority to determine the reasonableness of contingency fee contracts. Perhaps the most important state-level medical malpractice reform effort, California's MICRA, limits the amount attorneys in a medical malpractice case can collect to 40 percent of the first \$50,000, 33 1/3 percent of the next \$50,000, 25 percent of the next \$50,000, and 15 percent of any amount that exceeds \$60,000.⁸⁶ Between 1975 and 2000, 19 other states enacted similar sliding scales or imposed a maximum percentage cap on contingency fees. Another 6 states passed legislation that required the court to review the reasonableness of attorney fees in tort cases.

Restrictions on attorney contingency fees such as these have been the source of heated debates concerning whether they would effectively deter excessive tort claims and whether they would potentially violate the right to sue and thus hurt the plaintiffs. Some argue that restricting fees promotes the tort system's role of compensating victims by allowing the plaintiffs to keep a larger proportion of the awards they win. However, others argue that a sliding scale might change the portfolio of malpractice cases attorneys represent by forcing them to abandon cases with potentially small awards. A 2004 study by Pace et al. at the RAND Corporation examined the effect of MICRA on jury awards through 257 malpractice cases in California that all had court verdicts favoring the plaintiffs. The study, by comparing the simulated amount of fees attorneys would have made had there been no cap on non-economic damages or restrictions on attorney fees with the actual recorded attorney fees associated with the 257 cases, found that MICRA's \$250,000 cap on non-economic damages and the sliding scale of attorney fees reduced attorney fees by 60 percent. The sliding scale of attorney fees alone reduced attorney

⁸⁶ Summary of Medical Malpractice Law, McCullough, Campbell & Lane.

fees by 46 percent.⁸⁷ Significant reductions in fees imply that attorneys need to take on cases with higher expected value if their profit margins are to remain unchanged. This could mean more careful screening of cases based on merit to improve the chance of winning, which in general is consistent with the purpose of tort reform. However, it could also mean more careful screening based on the amount of potential awards, which would not only skew the distribution of lawsuits toward large payouts but also hurt people who have suffered less severe negligence-induced injuries or in the presence of a cap on non-economic damages, people for whom the recovery of economic damages are very limited.

Implementing changes in the statute of limitation, setting penalties on frivolous claims or defense, and using pre-trial screening panels to rule out claims that lack merit before they are filed in court are also popular tort reform measures adopted by states. From the mid-1970s to 2000, almost all states (46) shortened the time period in which a lawsuit could be filed or changed the application of the discovery rule for latent injuries and suits brought by minors; 34 states stipulated penalties such as paying the other party's attorney fees and court costs if a party is found to have asserted a meritless claim or defense; and 32 states mandated or allowed the merit of malpractice claims to be assessed by screening panels composed of physicians, attorneys, judicial officers and lay persons before they could be brought to court.

The second group of reform measures aims to alter plaintiffs' burden of proof, making it harder for them to win cases that are brought to court. Such measures range from stricter standards for expert witnesses to changes in the standards by which judges

⁸⁷ Pace, Golinelli and Zakaras, *Capping Non-Economic Awards in Medical Malpractice Trials California Jury Verdicts Under MICRA*, 9-115.

and juries are required to evaluate claims of harm and negligence. While a number of states have adopted one or more of these measures since 1975, they are not as widespread as the first group of reform measures. For example, only about one-third of all states (19) went beyond the requirement of expert witness in a medical malpractice claim. These states specified additional standards for an eligible expert witness, such as that he or she be in the same or similar medical specialty as the defendant, that he or she have a practice near where the plaintiff was treated (so that the expert has good knowledge of the standard of care in the area), or that he or she be board-certified and active in practicing medicine.

The third group of reform measures focuses on the size of awards for medical malpractice claims. Among these, caps on damages, especially caps on non-economic damages, are the most frequently proposed and are also the most controversial. Based on the distinct functions they serve, damages can be classified as either compensatory or punitive. Compensatory damages are damages awarded according to the amount of actual harm suffered by the plaintiff and are awarded before punitive damages are considered.⁸⁸ Punitive damages are considered punishment and are awarded when the defendant's behavior is found to be especially harmful, but are normally not awarded in the context of a breach of contract claim. Punitive damages are awarded in addition to actual damages in certain circumstances.⁸⁹ Compensatory damages can be further divided into economic damages and non-economic damages. Economic damages are relatively well defined and include the costs of future medical treatment and lost wage and salary arising from the

⁸⁸ Definition by the Legal Information Institute and can be found at http://www.law.cornell.edu/lexicon/compensatory_damages.htm.

⁸⁹ Definition by the Legal Information Institute and can be found at: http://www.law.cornell.edu/lexicon/punitive_damages.htm

injury. In contrast, non-economic damages intended to compensate plaintiffs for harms such as pain and suffering, emotional distress, and loss of consortium or companionship, are often hard to quantify.

To opponents of caps on non-economic damages, these awards are viewed as an important source of compensation for their injuries, especially in cases that are enormously distressful to the injured and/or their families but involve little financial loss, such as the death of an infant during delivery. However, proponents of caps on non-economic damages argue that the size, uncertainty, and perceived arbitrariness of awards for non-economic damages are significant contributors to the recurrent medical malpractice insurance crises. California, through the adoption of the MICRA law in 1975, enacted a \$250,000 cap on non-economic damages and many states have since followed suit. In the 18-year period between 1975 and 2002, 29 states established statutory limits on non-economic damages, ranging from \$250,000 to one million dollars. However, in 10 of these states, the cap was repealed or ruled unconstitutional.

From 1975 to 2002, 15 states passed caps on total damages, including both non-economic damages and economic damages. While different interest groups may have contrasting views about the appropriate level of compensation for pain and suffering, there seems to be little dissonance concerning whether injured people should be fully compensated for the economic costs associated with their injuries. Consequently, most caps on total damages enacted by states were subsequently removed by either repeal or court ruling. By the end of 2002, only 5 states (Alaska, Louisiana, New Mexico, Nebraska, and Virginia) still had a cap on total damages in effect.

State legislatures can also set statutory limits on punitive damages. Punitive damages serve as punishment for intentional, willful, wanton, or malicious acts by defendants that cause the plaintiffs' injuries. They are also intended to discourage such acts in the future. Twenty-one states established a cap on punitive damages between 1975 and 2002, but 4 states removed the caps after state supreme courts ruled them unconstitutional. Caps on punitive damages are set as a fixed amount in some states and relative to compensatory damages in others. For example, Illinois does not allow punitive damages at all, setting an effective cap of zero dollars on punitive damages, while Texas limits punitive damages in cases arising after September 1, 1995, to (a) two times the amount of economic damages, plus (b) an amount equal to non-economic damages or \$200,000, whichever is greater.

In addition to caps on damages, the offset of collateral source rule and the imposition of arrangements for periodic payment of awards can also substantially reduce defendants' financial burdens from medical malpractice claims. The offset of collateral source rule requires a plaintiff's jury award to be offset by monetary compensation from other sources (called collateral sources) such as payments from the plaintiff's life insurance or health insurance providers. The main normative argument for the offset of collateral source rule is that plaintiffs should not be compensated for their injuries more than once. Those who argue against the rule point out that negligent doctors should not benefit from a plaintiff's choice to protect him or herself against risks by enrolling in a life insurance and/or a health insurance plan. Moreover, such protection involves costs such as insurance premiums. To address concerns from both sides, some states have adopted the offset of collateral source rule but only require that the net compensation

from collateral sources (i.e., the total compensation minus the costs the plaintiff incurred in order to receive the compensation) be deducted from jury awards. When applying the collateral source rule, some states make the offset mandatory while others allow for jury discretion. Unlike the mandatory offset of collateral source rule which stipulates that net payment from collateral sources must be subtracted from the total jury award, the discretionary offset of collateral source rule only gives defendants the opportunity to present evidence concerning what the plaintiff has or will receive from collateral sources. Given such evidence, it is up to the jury to decide whether to take compensation from collateral sources into consideration when determining the award. It is not uncommon for states to choose a discretionary collateral source rule first and switch to a mandatory rule later or vice versa. As a result, there are more incidences of state reforms on collateral sources than on any other reform. From 1975 to 2002, 26 states put into effect the mandatory collateral source rule and 3 of them repealed it later; 15 states adopted the discretionary collateral source rule, but almost half of these states either repealed the rule or chose not to renew it once the rule expired.

The periodic payment arrangement allows part or all of future damages to be disbursed in the form of an annuity that pays out over time. Some states even relieve the defendants of the remaining damages that represent compensation for future pain and suffering and medical expenses when the plaintiff dies. Since a noticeable proportion of medical malpractice claims are awarded or settled with a substantial amount of money, not having to pay the total award in a lump sum could not only make the financial burden more manageable but may also mitigate emotional stress for the defendants at the time of the verdict or settlement. Between 1975 and 2002, 26 states enacted legislation that

allowed periodic payment of future damages or no payment of damages for future pain and suffering and medical expenses at a plaintiff's death, or both.

There is a number of other, albeit more minor reforms that fall into this group. Sixteen states enacted reforms on prejudgment interest since 1975. Under these reforms, defendants are no longer required to pay interest on either the non-economic or total damages accruing from the date of injury or the date of the filing of the lawsuit.

Traditionally, if there are multiple defendants in a medical malpractice suit, each and every defendant is liable for the full amount of the damages, or in legal jargon, all defendants are held jointly and severally liable for the total damages. If some defendants fail to pay their share of the judgment, the burden is automatically transferred to the other defendants, regardless of the extent to which each defendant is responsible for the plaintiff's injury. For instance, suppose two doctors were found negligent in a medical malpractice claim but one of them was 90 percent responsible for the resulting injury while the other was only 10 percent responsible. Under joint and several liability, the latter doctor would have to pay the full damage if his colleague could not afford his share of the damage. To align defendants' financial liability better to their responsibility for the injury, states have moved toward a several-only liability system. The several-only liability rule is applied only to non-economic damages in some states, such as California and New York, but to total damages in other states, such as Florida and Pennsylvania. The extent to which the defendants are excused from joint liability can depend on a range of factors from the amount of damages to the proportion of a defendant's responsibility relative to that of the plaintiff's in causing the injury. Between 1975 and 2002, 14 states abandoned the joint rule and kept the several-only liability rule without any qualification.

More often, states allowed the several-only liability rule with qualifications. Twenty-seven states would not hold a defendant responsible for the total damage given default in payment by other defendants only if he/she is less responsible than the plaintiff for the injury, and/or when the damage exceeds a certain threshold. Undoubtedly, the move from holding all defendants severally as well as jointly responsible to only severally responsible for medical malpractice claims could save a significant amount of money and therefore alleviate the liability pressure for some tortfeasors. However, since the effective target of this particular type of reform is malpractice cases in which at least one defendant fails to pay, and since such cases are limited in number, these reforms may not have as significant an effect as caps on damages, the collateral source rule, or periodic payment arrangements.

In summary, the last three decades saw an array of tort reforms in general and medical malpractice reforms in particular introduced at the state level. However, these reforms were not evenly distributed across time and geography. Rather, there are three detectable waves of reforms between the mid-1970s and the early 2000s. The timing of these waves seems to reflect the cyclical characteristic of their underlying driver: the episodes of premium hikes and withdrawal of insurance underwriters in the medical malpractice insurance market. Figure 5 shows the time pattern of the introduction of tort reforms in all 50 states and the District of Columbia from 1975 to 2002. Only five types of reforms -- caps on total damages, caps on non-economic damages, caps on punitive damages, the mandatory offset of collateral source rule and periodic payment arrangements -- are included as they arguably have a more direct and significant impact on the size of medical malpractice awards than other types of reforms. In the analysis

that follows, these five types of reforms will be referred to as direct reforms. Table 2 documents the years in which the enactment or setback (including repeal and court ruling as unconstitutional) of direct reforms took place in each state.

During our study period, there are clearly three distinct clusters of reforms. As can be observed in Figure 5, the first wave occurred between 1975 and 1977 and was led by California's MICRA legislation. This wave of reform can be ascribed to the availability and affordability problems in malpractice insurance during the same period. During the three-year period, 10 states established a cap on total damages and 5 established a cap on non-economic damages; 11 states mandated the offset of net compensation from collateral sources; and 5 states allowed periodic payment of future damages. Overall, 1975 saw the most activities in tort reform in this wave as 14 states enacted one or more forms of tort reform in the year.

The second major wave of tort reforms spanned from 1984 to 1990 and was once again a response to rapidly rising medical malpractice insurance premiums and a reduction in malpractice insurance providers. A flurry of tort reforms went into effect in these years, especially in 1986 when as many as 14 states instituted caps on non-economic damages and 4 states instituted caps on punitive damages. In addition, 10 states gave defendants the option to make periodic payments of damage awards, and 6 states enacted the mandatory offset of collateral source rule. The intensity of reforms dropped a little bit in 1987 and tapered off thereafter. Altogether, the number of states that enacted some form of direct reforms peaked at 19 in 1986, followed by 9 in 1987 and 7 in 1986. In 1992 and 1993, there again emerged signs of another medical malpractice insurance crisis, as health care providers complained about remarkable increases in

insurance premiums. Fortunately, this mini-crisis did not develop into a full-blown national phenomenon as it had in the mid-1970s and the mid-1980s. Accordingly, it triggered the third wave of tort reforms albeit on a much smaller scale, and with a longer delay than in the past. In 1995, 8 states initiated some form of direct reforms, most in the form of caps on non-economic and punitive damages.

It is interesting to note that the majority of the statutory limits on total damages were adopted in the first wave of reforms, on average ten years earlier than when most statutory limits on non-economic damages were started. As tort reforms were reactions to malpractice insurance premium hikes, it was natural for states to resort to caps on total damages as these were presumably most directly linked to insurance companies' costs and insurance premiums they set. However, over time the argument that it is unfair to deprive the injured of full compensation for their economic losses by statutory limits took hold and one after another states scrapped caps on total damages and turned to caps on non-economic damages instead. Caps on punitive damages are an even more recent instrument in states' efforts to mitigate medical malpractice risk. The enactment of caps on punitive damages was not observed in the first wave and was distributed almost evenly in the last two waves of tort reforms.

Figure 5: Number of states enacting direct reforms

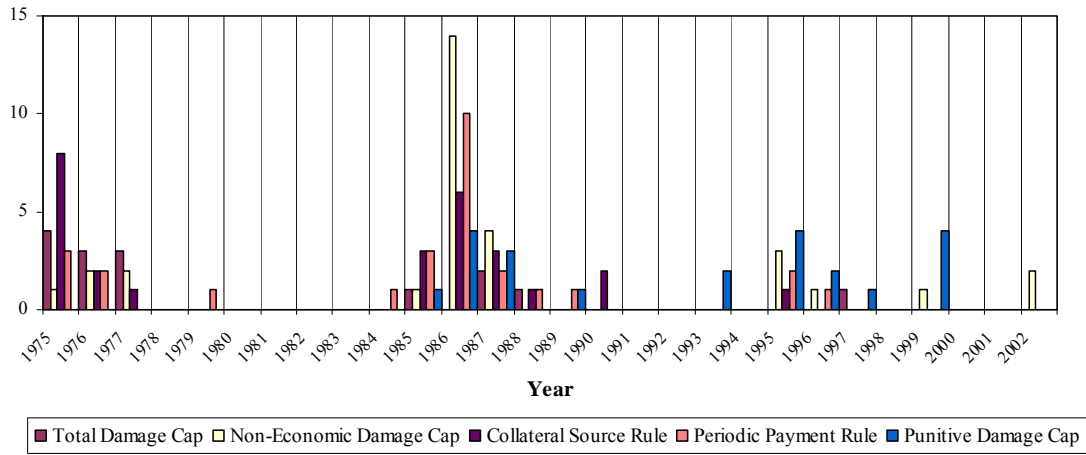


Table 1: Description of different types of medical malpractice reforms

Reform	Description
<i>I. Barriers to Suit</i>	
Frivolous suit penalties	The party asserting a meritless claim or defense is required to pay the other party's attorney fees and court costs.
Limits on attorney fees	Either subject the attorney fees to a sliding scale or require that attorneys' fees be 'reasonable' and subject fees to review by the court.
Immunity	Accord immunity to physicians participating in obstetrics programs and providing voluntary care in clinics.
Notice of intent to sue/Notice of merit	Require plaintiffs to provide notice to potential defendants before filing a lawsuit or require plaintiffs who have filed suit or at the time of filing to provide a certificate or affidavit it prepared by an expert that states the underlying facts and opinions that professional negligence has occurred.
Pre-trial screening panels	Mandatory or voluntary screening by panels composed of physicians, attorneys, judicial officers and lay persons of medical claims before suit is filed.
Statute of limitation	Shorten the time period in which a lawsuit may be filed or change the application of the discovery rule for latent injuries and suits brought by minors.
<i>II. Altering the Plaintiff's Burden of Proof</i>	
Expert witness rules	Impose more strict standards that expert witness must meet for their testimony to be admissible by the court.
Level of proof	Codify the common law evidentiary burden upon plaintiffs in civil tort litigation so that the plaintiff's burden may be increased beyond 'preponderance of the evidence'.
The standard of care	Reverse to the locality factor in defining the standard of care, include a cost-benefit analysis in selecting treatment options and develop standard of medical practice guidelines.
<i>III. Reducing Damage Awards</i>	
Ad damnum clause	Prohibit plaintiffs from stating specific dollar amounts when filing the Lawsuit.
Offset of Collateral source rule	Require a plaintiff's damage award to be offset by compensations from collateral sources.
Joint and several liability rule	Limit recovery from multiple defendants to the amount equal to each defendant's proportional responsibility for the injury
Limits on damages	Set a maximum amount payable for the total or non-economic or punitive damages.
Periodic payment of awards	Allow part or all of damages to be disbursed in the form of an annuity that pays out over time.
Prejudgment interest	Interest on either non-economic or total damages accruing from the date of the injury or the date of the filing of the lawsuit not mandatory.

Table 2: Dates direct medical malpractice reforms were introduced and removed from 1975 to 2002.

State	Caps						Periodic Payment Rule	Collateral Source Rule	
	Total Damages		Non- Economic Damages		Punitive Damages			Int.	Rem.
	Int.	Rem.	Int.	Rem.	Int.	Rem.			
Alabama	1987	1995	1987	1991	1987, 1999	1993	1975		
Alaska	1997		1986		1997		1986		1976
Arizona							1989	1994	
Arkansas							1979		
California			1975				1975		
Colorado	1988		1986		1986	1991	1988		1986
Connecticut					1992		1986	1987	1985
Delaware									
District of Columbia									
Florida			1986	1987	1986		1986		1975
Georgia					1987				
Hawaii			1986	1993					
Idaho	1977	1981	1987						1975, 1990
Illinois	1975	1976	1995	1997	1985		1985		1976
Indiana	1975				1995				
Iowa									1975
Kansas	1987	1988	1987		1987		1976	1988	1988
1993									1993
Kentucky									
Louisiana	1975						1984		
Maine			1999		1999		1985		1990
Maryland			1986						
Massachusetts			1986		1986				1986
Michigan			1986				1986		1986
Minnesota			1986	1990					1986
Mississippi			2002						
Missouri			1986				1986		
Montana			1995				1995		1987
Nebraska	1976								
Nevada			2002		1989				1975
New Hampshire			1977, 1986	1980, 1991	1986				1977
New Jersey					1995				1987
New Mexico			1976				1976		
New York							1985		1986

State	Caps						Periodic Payment Rule	Collateral Source Rule	
	Total Damages		Non- Economic Damages		Punitive Damages			Int.	Rem.
	Int.	Rem.	Int.	Rem.	Int.	Rem.			
North Carolina					1996				
North Dakota	1977	1978	1995		1993			1987	
Ohio	1975	1991	1996	1999	1996	1999	1987	1995	1975
Oklahoma	1976	1988			1995				
Oregon			1987	1999					
Pennsylvania					1997		1996		1975 1980
Rhode Island									1986
South Carolina									
South Dakota	1985	1996	1976				1986		
Tennessee									1975
Texas	1977	1988	1977	1988	1987, 1995	1991			
Utah			1986				1986		1985
Vermont									
Virginia	1976				1988				
Washington			1986	1989			1986		
West Virginia			1986						
Wisconsin			1985				1975, 1995	1986	1995
Wyoming									

Note: 'int' and 'rem' refer to the introduction and the removal of tort reforms, respectively.

Chapter 4 Literature Review

The extant literature on the existence and the extent of negative defensive medicine is comprised of two major bodies of studies: one based on survey information and the other based on utilization and provider data. Both approaches have advantages and limitations.

A. Research on Negative Defensive Medicine Based on Survey Data

Since the first episode of rapid increases in medical malpractice insurance premiums and withdrawal of insurance providers from the market aroused public awareness of the issue, a large number of surveys have tried to measure health care providers' perception of liability pressure and document how they would respond to these pressures. Many surveys indicate that obstetricians or family physicians would change the level or type of care they render in response to malpractice pressures. In 1989, the American College of Obstetricians and Gynecologists (ACOG) conducted a survey on its members' attitude toward medical malpractice. More than half of the respondents cited malpractice concerns as a major motivation for changing their obstetric services. In Georgia, for instance, 55 percent of OB/GYNs who dropped obstetrics identified malpractice concerns as the sole reason for their decision. In Illinois, 57 percent of OB/GYNs cited malpractice insurance costs and 44 percent cited the risk of being sued as reasons for changes in their practice. Responses to a 2003 survey of Pennsylvania physicians in 6 high-risk specialties including OB/GYN revealed that 42 percent of the survey participants had engaged in some sort of negative defensive medicine in the 3 years prior to the survey. Steps reported by respondents included removing surgeries

with high risk of complication from the list of services provided and shunning patients who were perceived to be litigious or who had high risk of suffering from adverse outcomes.⁹⁰

Malpractice premiums and risks have also encouraged physicians to quit providing obstetric services. According to a 1998 ACOG survey, 8.9 percent of its responding members reported they no longer practiced obstetrics, 18.7 percent had decreased the level of high-risk obstetrical care and 6.3 percent had decreased the number of deliveries over the period from 1992 to 1995. In other surveys, physicians who had discontinued providing obstetric services stated that they would consider resuming them if malpractice premiums were lowered (Nesbitt et al. 1992, Greer et al. 1992). As much as 46 percent of OB/GYNs responding to the 2003 survey of Pennsylvania physicians indicated that they had already stopped or were likely to stop practicing obstetrics completely within the next two years.⁹¹

Family practitioners who also provide some obstetric services react in a similar way to liability pressures. A 1987 American Academy of Family Physicians (AAFP) survey of family practitioners who ever included obstetrics in their practice found that 8.9 percent had either decreased the number or the type of obstetrical procedures they performed or that they had discontinued obstetrics services altogether because of the costs or availability of professional liability insurance.

While survey results convey health care providers' perception of the threat of liability and to some extent capture the corresponding behavioral changes, they suffer

⁹⁰ David M. Studdert and others, "Defensive Medicine among High-Risk Specialist Physicians in a Volatile Malpractice Environment," *JAMA: The Journal of the American Medical Association* 293, no. 21 (2005), 2609-2617.

⁹¹ *ibid.*

several intrinsic drawbacks. First, selection bias in a survey could produce misleading results. For example, physicians who are most dissatisfied with their malpractice insurance premiums might be more likely to respond to the relevant survey questions, resulting in an overstatement of the true percentage of physicians who believe that there is a malpractice crisis. Second, physicians' perception of the malpractice problem is subjective and hard to verify. It is possible that survey respondents might strategically overstate the problem in order to swing public sentiment as well as political maneuverings in their favor. Moreover, even if physicians accurately state how anxious they feel about liability pressures, their desire to quit from medicine or to change the scope of their practice may not be as strong as that portrayed in a survey, thus overestimating the degree of negative defense medicine. Third, most of the surveys to date only survey physicians from one state, making it difficult to generalize results to health care providers in other states. More importantly, the single-state setting makes it difficult to separate the effects of medical malpractice pressures from other state-specific factors that might affect physicians' patterns of practice. Last, the analyses of information collected from surveys have mostly been descriptive in nature, relying mainly on tabulations of the provision of obstetric services and measures of medical malpractice pressure. Simple tabulations are of limited utility for analyzing multiple factors at the same time. These sorts of studies are thus likely to confound the effects of other determinants with those from the liability threat.

A few studies, such as the study on defensive medicine by researchers at the Harvard School of Public Health and the Columbia Law School,⁹² do make use of more sophisticated data analysis methods. They conducted a survey of physicians in six

specialties at high risk of liability in Pennsylvania in May 2003. In the survey, physicians were asked how frequently medical malpractice pressure caused them to engage in four forms of positive defensive medicine (order more tests than medically indicated; prescribe more medications than medically indicated; refer to specialists in unnecessary circumstances; and suggest invasive procedures against professional judgment) and two forms of negative defensive medicine (avoid conducting certain procedures/interventions and avoid caring for high-risk patients). In addition to presenting findings from the survey with descriptive statistics, the study also presented findings from a multivariate analysis of the cause and effect of liability threat and defensive medicine. Three objective and two subjective measures of malpractice risk were included in their conditional logistic regressions. After controlling for physician characteristics (years in practice and gender) and practice type, the multivariate analysis revealed that malpractice risks were correlated with defensive behaviors, although objective measures of liability threat were of less effect. Nevertheless, this study still suffers from other drawbacks of survey-based research. The survey was done in Pennsylvania only and the results may not be easily generalized to other locations or malpractice environment. Moreover, the dependent variables in the study are all reported by physicians, and as acknowledged by the authors, ‘physician self-reports of defensive medicine may be biased toward giving a socially desirable response or achieving political goals’.

B. Research of Negative Defensive Medicine based on Utilization Data

⁹² *ibid.*

To complement findings from self-reported surveys and overcome their drawbacks, health policy researchers have employed objective and systematic health care utilization and provider data to study the association between the malpractice environment and physician behaviors in the provision of obstetric services. Grumbach et al. (1997) examined whether liability pressure led to OB/GYNs and family practitioners' withdrawing from medical practice in New York State between 1980 and 1989. They calculated regional malpractice insurance charges and used these charges as an approximate measure for liability pressures. In addition, their analysis considered physician and practice characteristics. Contrary to some anecdotal evidence, they found no association between increases in regional malpractice insurance charges and the discontinuation of medical practice in general or the withdrawal from obstetric practice in particular.⁹³

Studies of this type, while possibly improving on survey-based research by using observed rather than hypothetical changes in obstetric practice, have problems of their own. Their validity hinges on the assumption that insurance premiums correctly manifest liability pressures at the aggregate level. As noted earlier, however, it is arguable whether changes in malpractice climates, reflected in the frequency and the size of malpractice awards, are directly related to insurance premiums.⁹⁴ Consequently, liability insurance premiums may not fully capture the threat of malpractice litigation. In general, the appropriate way to accurately quantify the legal environment in which physicians practice remains unsettled. More fundamentally, aggregate measures of the severity of

⁹³ Kevin Grumbach and others, "Charges for Obstetric Liability Insurance and Discontinuation of Obstetric Practice in New York," *Obstetrical & Gynecological Survey* 52, no. 9 (1997), 541-542.

malpractice climates may not be appropriate for investigating the effects of defensive medicine. Defensive medicine has its roots in the individual health care providers' decision making processes. How they perceive the liability threat is what drives their behavior. To date, there is no evidence that the frequency and severity of malpractice claims at aggregate levels is an accurate measure of physicians' perceptions about liability pressure.

To get around the weaknesses embedded in attempts to measure liability threats directly, Kessler and McClellan (1996) proposed a different approach to study the impact of malpractice risk on positive defensive medicine in the treatment of two cardiac diseases.⁹⁵ Using hospital-level data, Kessler and McClellan compared the time paths of expenditures and mortality rates for heart attack patients in states before and after liability reforms (the treatment group) with trends in states with no reforms (the control group). They found that malpractice reforms that directly reduce provider liability pressure lead to reductions of 5 to 9 percent in medical expenditures without substantial effects on mortality or medical complications. Since positive defensive medicine is by definition not medically valuable, these two results suggest malpractice does encourage defensive medicine.

Even though the 1996 Kessler and McClellan paper focused on the detection of positive defensive medicine, it readily lends its methodology to the investigation of negative defensive medicine. Variations in the legal environment across states resulting from tort reforms are potentially an identifying shock to malpractice pressure. Some

⁹⁴ P. M. Danzon, "Liability and Liability Insurance for Medical Malpractice," *Journal of Health Economics* 4, no. 4 (1985), 309-331; Baicker and Chandra, *The Effect of Malpractice Liability on the Delivery of Health Care*.

⁹⁵ Kessler and McClellan, *Do Doctors Practice Defensive Medicine?*

studies have shown that reforms are effective in cutting down the frequency of malpractice claims and curbing malpractice payouts. Danzon (1985) found that states enacting caps on awards or mandating the offset of compensation from collateral sources had lower jury awards.⁹⁶ Elimination of the plaintiff's right to explicitly specify the amount of his/her claim (the ad damnum clause) appears to have reduced total claim cost while limitations on contingent fees showed some sign of reducing severity and total claim costs. Sloan, Mergenhagen and Bovbjerg (1989) confirmed that dollar ceilings on recoveries, costs awardable provisions and mandatory collateral offsets reduced paid claim size.⁹⁷ Danzon (1986a, 1986b) also found that reforms relating to the collateral source rule and the statute of limitations reduced malpractice premiums.⁹⁸ Kessler and McClellan (1997) reported that physicians from states enacting direct reforms experience lower growth over time in malpractice claims rates and in real malpractice insurance premium.⁹⁹ Thorpe (2004) found that malpractice insurance premiums in states that cap awards are 17.1 percent lower than in states that do not cap awards.¹⁰⁰

Two recent papers used information on malpractice reforms to test the existence of negative defensive medicine in the context of the supply of physicians including OB/GYNs. Kessler et al. (2005) examined the average impact of tort reforms on the growth rate of physicians at the state level between 1985 and 2001.¹⁰¹ They found that

⁹⁶ Danzon, *Liability and Liability Insurance for Medical Malpractice*, 309-331.

⁹⁷ Sloan, F.A., Mergenhagen, P.M., Bovbjerg, R.R., "Effects of Tort Reforms on the Value of Closed Medical Malpractice Claims: A Microanalysis," *Journal of Health, Politics, Policy and Law*, no. 14 (1989), 663-689.

⁹⁸ Danzon, *The Frequency and Severity of Medical Malpractice Claims: New Evidence*, 57-84.

⁹⁹ Daniel D. Kessler and Mark B. McClellan, "The Effects of Malpractice Pressure and Liability Reforms on Physicians' Perceptions of Medical Care," *Law and Contemporary Problems* 60, no. 1&2 (1997), 81-106.

¹⁰⁰ Thorpe, *The Medical Malpractice 'Crisis': Recent Trends and the Impact of State Tort Reforms*.

¹⁰¹ Kessler, Sage and Becker, *Impact of Malpractice Reforms on the Supply of Physician Services*, 2618-2625.

the adoption of reforms that directly affect the size of malpractice awards is associated with faster growth in the number of physicians in a state, after controlling for state political and market conditions, time-invariant state characteristics and the time trend in the supply of physicians. Moreover, reforms that had been in place for at least 3 years had a greater impact on the growth of physician supply than reforms that had been in effect for only one or two years. The effect of direct reforms is also shown to vary by practice type (grouped vs. non-grouped), physicians' years of experience (fewer than 20 years vs. 20 and plus years), and the management care penetration in the state. However, this study did not find a statistically significant impact of direct reforms on the supply of OB/GYNs. In contrast to direct reforms, reforms that do not affect the size of malpractice claims such as caps on attorneys' contingency fees and the modification of the joint and several liability rule, appear to be negatively related to the growth in physician supply, i.e., states with indirect reforms saw a slower growth in physician supply than states without indirect reforms.

The second study, carried out by researchers at the Agency for Healthcare Research and Quality (AHRQ) investigated the relationship between caps on non-economic damages and the level of physician supply from 1985 to 2000. Their analysis showed that counties in states with non-economic damage caps in place had approximately 2.2 percent more physicians per capita than those in states without such caps.¹⁰² Caps on non-economic damages have a more significant impact on physician supply in rural areas; rural counties in reform states had 3.2 percent more physicians per capita than those in non-reform states. Moreover, caps with a limit of \$250,000 have a larger impact than those with higher limits. About 5.4 percent more OB/GYNs were

available for the care of women of childbearing age in rural counties with a \$250,000 cap on non-economic damages than in rural counties with no cap or caps above \$250,000, everything else held equal. This study also found that caps on non-economic damages enacted less than 2 years earlier than the study year had no statistically significant impact on physician supply. Instead, only caps that had been in place for at least three years were found to be effective in stimulating physician supply.

Both of these studies shed light on the existence of negative defensive medicine by demonstrating that direct tort reforms lead to an increased supply of physicians. The first study took a step further by examining the mechanisms through which direct reforms affect the growth of physician supply differently in both reform and non-reform states. They found that direct reforms had a greater impact on physicians' decisions to enter into and exit from the profession than they had on their movement between reform states and non-reform states. This finding suggests that direct reforms improve the welfare of the society as a whole, rather than being a zero-sum game where one state's gain is another's loss. It also suggests that direct reforms would increase the availability of physicians even after all states have adopted them. The special contribution to policy making of the AHRQ study, on the other hand, comes from its rural focus. Rural populations are often medically underserved relative to non-rural populations. Policy tools that could specifically benefit rural residents are therefore of particular interest to policy-makers. The AHRQ study found that caps on non-economic damages boost the supply of physicians in rural communities more than they do in non-rural areas, thus potentially providing policy-makers with an effective tool to improve the availability of physician services in rural areas.

¹⁰² Encinosa and Hellinger, *Have State Caps on Malpractice Awards Increased the Supply of Physicians?*

These two papers have made important contributions to the study of negative defensive medicine as they are the first published research on this topic to use rigorous multivariate analyses with observed provider data rather than self-reported survey data. There are however weaknesses and limitations, both individual and shared, in these studies.

First, the way tort reforms are handled in the AHRQ study introduces potential bias in the estimates of direct reforms. In addition, both studies may overstate the statistical significance of estimates of the effects of tort reforms. The AHRQ study covered five types of tort reforms in their study, including caps on non-economic damages and punitive damages and reforms on the collateral source rule, the joint and several liability rule, and prejudgment interest. The study found that caps on non-economic damages were the most effective. Curiously, the study did not include caps on total damages. If caps on non-economic damages raise the number of physicians by reducing the expected value of malpractice claims and thus mitigating physicians' perception of liability threat, then one can reasonably expect that caps on total damages should have a similar, if not greater, effect. After all, non-economic damages only represent a portion of the total payouts for malpractice claims. If total damages are capped, their components, including both economic and non-economic damages, are capped as well. On the other hand, if, in the presence of caps on non-economic damages, judges and juries find ways to substitute economic for non-economic damage awards, caps on non-economic damages may do little to reduce the expected value of malpractice claims. Under these circumstances, imposing a limit on non-economic damages will be unlikely to reduce physicians' fear of liability in this case since defendants and/or their

insurers are ultimately responsible for total damages. Omitting the potentially effective reform of caps on total damages from the ARHQ study could lead to bias in the estimates of the effects of those reforms included in the study. As a result, it is possible that in the ARHQ study, caps on non-economic damages appear to be effective in improving physician supply only because they are reflecting the effect of caps on total damages.

The study by Kessler et al. did include caps on total damages among a more comprehensive list of reforms. However, this study introduced the reforms in its multivariate analyses as two generalized dummy variables – direct reforms and indirect reforms. If a state had any of the four types of direct reforms in effect, the state was considered to have direct reforms in that year. Indirect reforms, which encompass five different types of reforms, were defined in the same way. Such a specification does not permit a detailed understanding at the effectiveness of individual types of reforms, thus limiting the practical value at the policy front.

Even though the Kessler et al. study covered more reform types than the AHRQ study, both studies could still suffer from an omitted variable problem as there are other time-dependant state-level factors such as state licensing regulations and scope of practice laws that could have affected overall physician supplies and/or the number of physicians in some specialties. Although the odds that these missing policy variables are correlated with tort reforms is probably low given that tort reforms appear to be more closely related to insurance business cycles than to health care demand and supply, the fact that they changed over time means that their effects on the dependant variable cannot be controlled for using county or state fixed effects. Since they were state policies and thus were applied uniformly to all counties within a state, they would inevitably result in

error correlations between counties within each state. In addition, auto-correlations for each tort reform across years are common as tort reforms often stay in effect for an extended period of time once enacted. Failure to account for such within-state correlations when measuring the variance of parameter estimates would overstate the significance level of these estimates, which could lead to spurious beliefs about the impact of malpractice reforms on the supply or growth of physicians including OB/GYNs.

Second, both studies allowed for the possibility that it may take some years for tort reforms to have their greatest impact. However, there seems to be room for improvement in their treatment of the reversal of tort reforms. As illustrated in the previous chapter on malpractice reforms, it is not infrequent for malpractice reforms to be repealed or declared unconstitutional. The removal of tort reforms, just as the adoption of reforms, disturbs the tort system and changes physicians' perception of liability pressures. Therefore the reversal of malpractice reforms also serves as an identifying source for variations in liability pressure which can be used to more accurately measure the effects of liability pressure. The AHRQ study appears to have ignored reversals of malpractice reforms. Kessler et al. did recognize the repeal of tort reforms when they defined their current-year reform dummies. However, they seem to have ignored information on repeals when creating dummies differentiating reforms' short-term and long-term effects. This implies that a state that has repealed direct reforms would be treated the same in years after the repeal as a state that has never enacted direct reforms. If it is reasonable to argue that reforms do not exert their designed effects overnight, it would also be reasonable to assume that it would take time for the effect of repealed

reforms on physician supply to wear off gradually. For example, Kessler et al.'s paper indicates that direct reforms encourage entry into the medical profession. It takes years to school and train a physician and thus increased entry cannot occur in a short time. Similarly, it is unlikely that physicians who have invested significant fixed costs in their education and career would rapidly exit a market when reforms are repealed.

Third, even though both studies examined OB/GYNs as part of their analyses, they focused on the impact of tort reforms on the number of physicians or the changes in the number of physicians, rather than on any direct measure of the availability or the quantity of obstetric services. More physicians may not necessarily mean a higher level of supply of medical services and, strictly speaking, findings from the two studies do not necessarily imply the existence of negative defensive medicine. Increases in the number of physicians in practice might reflect shorter physician work hours on average so that the net effect could be unchanged or even decreased amount of medical care provided. Moreover, since some physician services can only be provided in a hospital, the amount of medical care provided to a community might be constrained by a lack of hospitals rather than a lack of physicians. This is certainly true for obstetric services. Every year, about 99 percent of births take place in a hospital setting;¹⁰³ so does some prenatal care, especially when there are complications associated with pregnancies. Although OB/GYNs are needed to staff hospital obstetric units, there are other factors that enter into hospitals' decision-making process with regard to the maintaining and the size of obstetric units. More OB/GYNs do not naturally lead to more access to obstetric services provided in hospitals. Since hospitals have to obtain malpractice premiums by

¹⁰³ The natality detail files reveal that the percentage of deliveries that took place in hospitals ranged from 98.73% in 1989 to 99.05% in 1999 during the period of 1985 to 2000.

themselves and they could be sued for negligence independent of doctors, tort reforms are expected to affect hospitals just as they affect physicians. A study examining the impact of tort reforms on the availability of hospital-based obstetric services would complement the two existing analyses on negative defense medicine and provide a better understanding of how malpractice reforms affect access to obstetric care.

Chapter 5 Methods and Data

A. *Econometric Model*

In this section we outline a methodology similar to that developed in Kessler and McClellan (1996) to examine the effects of changes in the perceived threat of malpractice liability on the provision of obstetrics services. As in the Kessler et al. and AHRQ studies reviewed in the previous chapter, we use shocks created by state tort reforms as a source of variation in malpractice climates and physicians' perception of liability threat. Instead of physician supply however, this analysis focuses on the provision of obstetric services by hospitals. In particular, we examine whether a county has at least one hospital that provides obstetric services in a particular year. Since the majority of births take place in hospitals, lack of access to a hospital within reasonable distance from a mother's residence could cause delayed or even missed treatments when needed during pregnancy and delivery, increasing the risk of adverse health outcomes for mothers and newborns.¹⁰⁴ We use the availability of hospital-based obstetric services within a county as an approximate measure of the ease with which women can obtain obstetric care in a hospital and aim to determine whether tort reforms along with other demand- and supply-side factors play a role in improving access to obstetric care.

We identify the impact of tort reform on negative defensive medicine within a multivariate difference-in-difference model applied to a county-year panel data. Our panel includes both counties in states that adopted reforms and counties in states that did not adopt reforms. Within states that adopted reforms, the presence of reforms changed

¹⁰⁴ Nesbitt and others, *Access to Obstetric Care in Rural Areas: Effect on Birth Outcomes*, 814.; Kalmuss and Fennelly, *Barriers to Prenatal Care among Low-Income Women in New York City*, 215.; McDonald and Coburn, *Predictors of Prenatal Care Utilization*, 167.

over time; different reform measures were adopted and/or removed at different dates spanned by the panel. We compare the time trend of the provision of hospital-based obstetric services in counties in reform states before and after tort reforms were introduced or repealed with the time trend of hospital-based obstetric services in counties in non-reform states. This allows us to tease out changes in the availability of county-level hospital-based obstetric services that are attributable to factors other than tort reforms.

Given the data available, an analysis of the effects of tort reform on access to hospital-based obstetric services might have been conducted using states, hospitals, or counties as the unit of observation. We do not examine the effects of reforms at the state level because although tort reforms are imposed and removed by state legislatures and courts, state-level measures of service availability are not likely to bear much relevance to access to care. We also do not carry out our analyses at the hospital level even though the main source of data provides information on individual hospital characteristics. A hospital-level analysis could tell us whether tort reform decreased the chance a hospital dropped obstetric services. However, a hospital-based analysis could not tell us whether these reforms improved access to care. The closing of an obstetric unit in an individual hospital, for example, may or may not adversely affect access to care for local residents as the closing may simply reflect over-supply of obstetric services in the local market. In addition, a panel of hospital-level data will be unbalanced because of entries and exits of hospitals over time. Tort reforms could change the composition of hospitals and the impact of tort reforms on hospitals' decision on whether or not to offer obstetric services could be confounded by the impact of tort reforms on hospitals' decision on entry and

exit. In the context of a difference-in-difference approach, there may not exist a ‘before’ or ‘after’ episode for some hospitals even if these hospitals belonged to the treatment group.

Subsequently, this study examines access to care at the county level. We define this population as women of childbearing age within a county, and hence, conduct our analysis at the county level. Focusing on county-level measures provides a meaningful geographic-based measure of access to care. As we demonstrated above, county-level measures of access to hospital obstetric care have decline considerably in recent years. Although county boundaries are arbitrary, they better approximate markets for care in comparison to states. Finally, using the county as the unit of analysis allows us to better control for variations in socioeconomic characteristics and other demand and supply factors that may affect the availability of hospital-based obstetric services.

Our county-level panel data covers the years 1985, 1990, 1995 and 2000. Data constraints limited the years that could be studied in this analysis. We only have access to the AHA annual hospital survey for years 1984-1995 and 2000. Some control variables, such as the total number of births born to residents in a county, are only available for a limited number of years after 1990. We choose to use four years at five-year intervals to mitigate potential autocorrelations while making use of available data as much as possible.

Our econometric analysis is based on the following linear model:

$$y_{cst} = \alpha_c + \gamma_t + \gamma_t * \text{Rural} + X_{cst}\beta + r_{st}\lambda + \mu_{cst} \quad (1)$$

where c indexes counties and s indexes 49 states and the District of Columbia (Alaska is excluded); t indexes the years 1985, 1990, 1995 and 2000. The dependant variable y_{cst} is an indicator variable that is equal to one if county c in state s had at least one hospital that provided obstetric services in year t . The variable α_c is a county fixed effect capturing the influence of time-invariant characteristics in each county and γ_t is a year fixed effect that accounts for idiosyncratic factors affecting all counties uniformly in a given year. We also included the interactions of γ_t and the rural status of a county ($\gamma_t * \text{Rural}$) to examine possible differing time trends in rural and non-rural counties. The vector X_{cst} contains variables that reflect time-varying socioeconomic characteristics and other factors believed to affect the demand for or supply of hospital-based obstetric services in county c of state s in year t . Specifically, X_{cst} include the natural logarithm of real per capita income, the natural logarithm of real wage per job, the unemployment rate, the percentage of women at childbearing age who are black, the percentage of hospitals that are government owned, the number of births born to women living in the county, the population of the county and the fraction of the population that are elderly (age 65 and above). These variables might affect the demand and/or the supply of obstetric services regardless of the liability climate in a county.

The vector r_{st} contains the treatment variables of interest for this study and includes information on five types of direct reforms: caps on total damages, caps on non-economic damages, caps on punitive damages, mandatory offset of collateral source rule and periodic payment arrangement of future damages. Instead of including reforms as dummy variables in our regression, we define an element of r_{st} as the number of years in which state s had had a particular type of reforms in the five most recent years including

year t . It usually takes time for changes in laws to affect economic agents. Medical malpractice disputes involve multiple parties, including patients, health care providers, lawyers and insurance companies, who all need time to identify the possible consequences of the reforms and make appropriate behavioral adjustments. For example, malpractice insurance premiums, one possible channel for altering physicians' perception of liability pressures, might take years to respond to changes in the legal environment. Even if insurance companies were perfectly forward looking in calculating premiums, they have to take into account the fact that malpractice lawsuits take 7 years to settle on average. More generally, changes in the provision of hospital-based obstetrics services cannot happen overnight. Opening or closing an obstetric unit by a hospital is a strategic decision that requires careful planning and may involve the acquisition of equipment and facility space and the recruitment of OB/GYNs and possibly doctors from other specialties such as anesthesia as well as supporting staff. Furthermore, liability reforms could have long-run effects on hospitals' ability to maintain obstetric facilities by affecting medical students' choice of specialty and thus the supply of OB/GYNs. For all these reasons, we use the number of the previous five years with reform to accommodate the lingering nature of tort reforms. As there is no evidence concerning whether it takes more time for a county to reap any potential benefits of reforms after their adoption or to lose the benefits of reforms after their repeal, we define r_{st} in such a way that the impact of changes in reforms is symmetric. For example, if state s enacted a cap on total damages in 1986 and repealed it in 1990, we assume counties in state s felt the same impact from the cap in 1991 as in 1988 as r_{st} takes on the value of 3 in both years. In an analysis of the robustness of the impact of direct reforms on the provision of hospital-

based obstetric services discussed later in this paper, we consider other definitions of direct reforms.

The variable μ_{cst} is an error term. In contrast to previous studies, we do not treat μ_{cst} as independent and identically distributed (i.i.d.) across all observations in the panel. While an ordinary least squares regression is used to obtain point estimates of the model parameters, the regression method used to estimate standard errors for those parameters is robust to arbitrary correlation across errors for counties within a state. Specifically, the standard errors are computed using the nonparametric general estimating equation (GEE) method proposed by Liang and Zegar (1986).¹⁰⁵ Unlike the standard errors commonly reported for OLS regressions, which are biased in the presence of error correlations across observations, the standard errors reported for this study are unbiased even if, for example, errors are auto-correlated across observations for a given county over time or if all counties within a state are affected by common time-varying effects that are independent of the right-hand-side variables included in the regression.

Even though the dependant variable in our analysis is discrete, we choose a linear probability model rather than a logistic model in order to control for county fixed effects. Although fitting a linear probability model to a discrete dependant variable has some inherent weaknesses, such as the possibility of having predicted probabilities falling out of the [0, 1] range, it is commonly argued that a linear probability model produces estimates that are comparable to those from a generalized linear model such as a logistic

¹⁰⁵ We used the GENMOD procedure in SAS with a repeated statement where states were specified as the repeated subject.

model.¹⁰⁶ On the other hand, aside from the county socioeconomic characteristics included in our model, there are many time-invariant county characteristics that also affect the probability that a county has hospital-based obstetric services. Yet, these characteristics may not be easily measured or data measuring them may not be available. Controlling for these characteristics with county fixed effects is important for producing unbiased estimates of the reforms variables as it is possible that some of the missing county characteristics could be correlated with both the likelihood that a county is subject to tort reforms and the likelihood the county has hospital-based obstetric services. A simple comparison demonstrates the explanatory power of the missing time-invariant county characteristics captured with county fixed effects. When we estimated the simplest version of Equation (1) by including only the reform variables, the R^2 was 0.018; when we controlled for county fixed effects in addition to the reform variables, the R^2 increased to 0.831. However, since there are more than 3,000 counties in the US, controlling for county fixed effects in a logistic model is not computationally feasible with the current computing technology available to us.¹⁰⁷

B. Data Sources

Variables in this analysis were constructed from several sources. The dependant variable describing whether a county had at least one hospital that provided obstetric services in a given year was derived from the AHA annual survey of hospitals databases. We first examined each hospital in a county to determine whether it provided obstetric

¹⁰⁶ Robert S. Pindyck and Daniel L. Rubinfeld, *Econometric Models and Economic Forecasts*, (New York: McGraw-Hill, 1981); John H. Aldrich and Forrest D. Nelson, *Linear Probability, Logistic and Probit Models*, Vol. 45 (SAGE Publications, 1984).

services in a particular year and then aggregated the information to the county level. To determine whether a hospital had provided obstetric services or not, we combined three questions in the AHA survey. We classified a hospital as providing obstetrics services if the hospital 1) had at least one bassinet set up and staffed, or 2) had at least one hospital bed designated for obstetric care, or 3) delivered at least 15 babies.¹⁰⁸ If any hospital in a county had provided obstetric services in a given year we categorized the county as having hospital-based OB services in that year.

To construct an alternative measure for hospital-based obstetric services, we extracted the information on the number of beds in a hospital's neonatal intensive care unit (NICU) from the AHA annual survey databases. NICUs provide specialized care for babies born with complications and may face a different level of liability pressure than an obstetric facility. Based on the number of NICU beds, we constructed a dummy variable that indicates whether or not a hospital provided NICU care. Then we derived a county-level indicator variable that takes on the value of one if at least one hospital in the county provided NICU care in a given year.

We also extracted ownership information on hospitals from the AHA annual surveys. Previous research has demonstrated an association between hospital ownership and the productivity in medical care¹⁰⁹ which affects a hospital's competitiveness and its chance of remaining in business. More importantly, government-owned hospitals often benefit from special state policies that enhance their capability to stay open and to

¹⁰⁷ We tried to fit our model with a logistic link function, but it failed to converge when county fixed effects were included.

¹⁰⁸ We use 15 deliveries to tease out hospitals that did not provide obstetric services regularly but delivered babies in emergency cases.

¹⁰⁹ D. P. Kessler and M. B. McClellan, "The Effects of Hospital Ownership on Medical Productivity," *The Rand Journal of Economics* 33, no. 3 (2002), 488-506.

provide certain types of services. For example, most states grant special treatment to public entities with respect to liability. In some cases they grant public entities full immunity from liability; in other cases they impose lower caps on damages. For example, Article I, section 14 of the Alabama Constitution of 1901 provides that the State of Alabama may never be made a defendant in any court of law or equity. The absolute immunity provided by this section extends to state universities, including affiliated hospitals. In Florida, neither the state nor any of its political subdivisions is liable for punitive damages. In addition, the state or its political subdivisions are only liable for compensatory damages up to \$100,000 per claimant and \$200,000 per occurrence while for non-government entities there was no cap on damages until a cap of \$500,000 on non-economic damages was established in late 2003. As a result, government-owned hospitals may feel less medical malpractice pressure than privately-owned hospitals and may be more likely to offer obstetric services than privately-owned hospitals under the same liability environment. We created a dummy variable to distinguish government-owned hospitals from non-government owned hospitals. This variable takes the value of one if a hospital was owned by the federal government or any non-federal government including a state, county, city or hospital district or authority and 0 otherwise. These dummy variables were aggregated to the county level to produce a measure of the percentage of hospitals owned by government in each county in each of the study years.

The second data source we used is the Area Resource File (ARF). The ARF is a secondary data source that contains about 6,000 county-year variables on health professions, health facilities, measures of resource scarcity and health status compiled from various primary sources such as the AMA physician master file, the population

census, and the mortality and natality data extracted by the National Center for Health Statistics from death and birth certificates. The ARF is released every year, but not all variables are updated in each new release. To construct a complete time series that covers all years in our study period for each variable in our analysis, we used the ARF released both in 1996 and 2002. We obtained the number of active physicians, the number of family practitioners and OB/GYNs in patient care for 1985 and 1990 from the 1996 ARF and those for 1995 and 2002 from the 2002 ARF. The 2002 ARF also provided us with the total number of births by mother's county of residence for the years 1985, 1995 and 2000. This variable measures the demand for hospital-based obstetric services since 99 percent of births occur in hospitals. We also extracted the unemployment rate from 1985 to 2000. The unemployment rate measures the economic activity in the county and would affect residents' willingness and ability to pay for medical services. The rural status of a county was derived from MSA level variable on ARF 2002. We defined rural counties as those not contained in a Metropolitan Standard Area (MSA).

The third source of data is the Bureau of Economic Analysis (BEA) of the Department of Commerce. The BEA provides information on county-level per capita income and wage per job between 1985 and 2000. Per capita income and wage per job are used to gauge county residents' demand for and ability to pay for medical care, including obstetric services. Both variables are expressed in 1985 prices using the

Consumer Price Index obtained from the Bureau of Labor Statistics for all urban consumers, from 1985 to 2000.¹¹⁰

The fourth source of data is the Census Bureau. We obtained population estimates by age, sex and race/ethnicity for all counties between 1980 and 2000. Data were available in three separate files: one for 1980-1989, one for 1990-1999 and one for the year 2000. We also calculated the number of women of childbearing age (between 14 and 45 years old) per square mile¹¹¹ in each county. This variable is used in our model as an additional direct measure of demand for hospital-based obstetric services. To capture the differences in the preferences for obstetric services by different races, we calculated the percentage of women of childbearing age who were black in each year. In addition, we calculated total population by county as well as the percentage of the elderly (age 65 or older) in a county's population, which serves as an approximation for Medicare enrollment. County population is to control for demand for over medical services. The fraction of county population that is elderly is included in regressions as an approximate measure of the financial viability of hospitals in the county.

The fifth source of data is the 1990 natality detail file created by NCHS. The natality detail files are published every year and include all births occurring in the US in a calendar year. They contain a wealth of information on the socioeconomic characteristics of newborns and their parents; geographic information related to the birth such as the mother's county of residence and the county of occurrence of the delivery; information on prenatal care; and medical and health data on the mother and the newborn associate

¹¹⁰ CPI was downloaded from <http://data.bls.gov/cgi-bin/surveymost?cu>, choosing 'U.S. All items, 1982-84=100 - CUUR0000SA0' and year from 1985 to 2000. Then per capita income and wage per job were multiplied by the ratio of the CPI for a given year to the CPI for 1995.

¹¹¹ The denominator is the area in square miles of a county in 1990 from the 1996 ARF.

with the pregnancy and the delivery.¹¹² For this part of the thesis, we used information on mother's county of residence from the 1990 natality detail file to calculate the total number of births by mother's county of residence in 1990. This supplements the total number of births for 1985, 1995 and 2000 created from the 2002 ARF.

Finally, the treatment variables of interest (i.e. the number of years with each of the five types of direct reforms in the five most recent years) were created from the database on tort reforms by states between 1975 and 2002. The compilation of this database is described in Chapter 3.

Because our panel data were constructed from many different data sources and covered a long time span, special care was needed to be taken in constructing county-year variables. The AHA has its own set of county codes and even though county FIPS codes are present in the annual survey databases, they are incomplete and dated. As a result, we employed the cross-walk between zip codes and FIPS codes published by the Census Bureau¹¹³ and constructed the FIPS county code for each hospital through its 5-digit zip code as reported by the AHA.¹¹⁴ The boundaries of US counties changed a little over time and not all data sources treat geographic boundary information in a consistent manner. During the time period covered by our panel some counties ceased to exist and were merged with neighboring counties while other counties were split apart. In addition, Virginia independent cities are treated differently by different data sources, and

¹¹² The US birth certificate underwent a major design change in 1989. Medical and health data such as the method of delivery and obstetric procedures, detailed medical risk factors and other risk factors such as mother's smoking and drinking habit, detailed complications of labor and/or delivery and detailed abnormal conditions of the newborn were not asked in the birth certificate and thus not available in the natality detail files before 1989.

¹¹³ This is the November, 1999 version and is, to our knowledge, the last such crosswalk available from the Census Bureau.

¹¹⁴ The FIPS codes are necessary for merging variables created from the AHA data to other variables for the analysis.

sometimes even by the same data source in different years. For example, the ARF reported data for independent cities as part of the counties where they were located prior to the February 2001 release. Since then data for Virginia independent cities have been broken out if the data reported are for years later than 1991. To address these issues so that comparisons of a county over time are consistent, we define a county as the largest boundary that it has ever belonged to during our study period. Therefore if at some point during our study period more than one county belonged to a single larger county then all data for the smaller counties would be aggregated to produce variables for the single ‘mother’ county in all years. Similarly, Virginia independent cities are all treated as part of their original counties. The state of Alaska is excluded from this study because there are no consistent data at the borough level.

C. Descriptive Statistics

Table 3 shows that there are systematic differences in socioeconomic characteristics between counties with and without hospital-based obstetric services. In general, those counties with hospital-based obstetric services were economically better-off, reflected in higher real per capita incomes, higher real wages per job, and lower unemployment rates. There are other persistent differences as well. Counties with hospital-based obstetric services had more women of childbearing age per square mile, lower proportions of women of childbearing age who were black, more births to women residing in the county, much bigger populations and slightly lower fractions of Medicare recipients. Counties with hospital-based obstetric services were also more likely to have hospitals owned by the government.

Per capita income and wage per job grew over time in both counties with and without hospital-based obstetric services. However, counties with hospital-based obstetric services experienced higher growth rates in both real per capita income and real wage per job (see Table 3). In 1985, per capita income was 12 percent higher in counties with hospital-based obstetric services. The difference grew to 15 percent in 1990, 17 percent in 1995 and 18 percent in 2000. Wage per job increased faster in counties with hospital-based obstetric services too, although the difference in its growth rate between counties with and without hospital-based obstetric services was slightly smaller than in the case for real per capita income. In 1985, wage per job in counties with hospital-based obstetric services was 12 percent higher than in counties without hospital-based obstetric services and in 2000 the difference reached 16 percent. In addition to earning less, people in the labor force in counties where there was no access to obstetric services in hospitals were less likely to be employed. The average county unemployment rate was 0.7 percentage points or 8 percent higher in counties without hospital-based obstetric service in 1985 and was as much as 14 percent higher in 1990 than the average county unemployment rate in counties with hospital-based obstetric services. The overall job market improved significantly in the 1990s, with unemployment rates lowered to below 7 percent for both counties with and without hospital-based obstetric services. However, the average county unemployment rate was still 11 percent higher in counties without hospital-based obstetric services in 2000.

Counties with hospital-based obstetric services also appear to have higher densities of women of childbearing age and more babies born to women of childbearing age living in the county (see Table 3). The number of women of childbearing age per

square mile remained at 8 in counties with no hospital-based obstetric services in all the four years in our study period. In comparison, counties with hospital-based obstetric services not only had much higher densities of women of childbearing age each year, they also saw the densities grow over time. The ratio of the densities of women of childbearing age in counties with hospital-based obstetric services to those in counties without hospital-based obstetric services was 6.9, 8.2, 8.6, and 9.0 in 1985, 1990, 1995 and 2000 respectively. Among women of childbearing age, counties with hospital-based obstetric services had a lower percentage who were black relative to counties without hospital-based obstetric services. The difference varied between 1.5 to 2.5 percentage points. The birth rate (number of births per woman of childbearing age living in the county) was slightly higher in counties with hospital-based obstetric services each year. It dropped by 2.4 percent and 3.4 percent from 1985 and 1990 and more drastically by 9.5 percent and 8.7 percent from 1990 to 1995 in counties with and without hospital-based obstetric services respectively. The falling trend reversed from 1995 to 2000 and increased by 4 percent and 4.3 percent respectively. Higher densities of women of childbearing age and higher birth rates indicate that counties with hospital-based obstetric services had a higher demand for obstetric care. Whether the racial composition of women of childbearing age would affect demand for hospital-based obstetric services is not definitive. While black women have higher birth rates than women of other races, they receive less prenatal care.¹¹⁵ This phenomenon may partly be explained by differences in financial resources available to women of different races to pay for medical

¹¹⁵ Black women have higher birth rate than women of other races (see table at http://www.cdc.gov/nchs/fastats/pdf/nvsr52_10t1.pdf), but they are less likely to seek prenatal care than others except women of Hispanic origin. For example, my tabulation of the natality detail files shows that

services. It could also be because of other systematic socioeconomic and cultural differences between black women and women of other races.

A higher proportion of counties without hospital-based obstetric services were rural (i.e. not part of a Metropolitan Statistical Area) compared to counties with hospital-based obstetric services (see Table 3). Rural counties accounted for 85 percent of all counties without hospital-based obstetric services in 1985. This share increased to 87 percent in 1990 and remained at 87 percent in 1995 and 2000. In contrast, 70 percent of counties with hospital-based obstetric services were rural in 1985 and the percentage declined to 67 percent in 1990, 66 percent in 1995, and 65 percent in 2000.

Hospitals in counties with hospital-based obstetric services were more likely to be owned by the government than hospitals in counties without hospital-based obstetric services, although the difference in the likelihood decreased over time. In 1985, an average of 43.5 percent of hospitals in counties where at least one hospital provided obstetric services were government-owned, 2.5 times higher than the average percentage of hospitals owned by the government in counties with no hospital-provided obstetric services. However, fewer hospitals remained in the control of the government in counties with hospital-based obstetric services over time. The average percentage of hospitals owned by the government fell to 40.4, 38.4 and 33.7 percent in 1990, 1995, and 2000 respectively. Meanwhile, the average percentage of government-owned hospitals in counties without hospital-based obstetric serviced almost doubled from 12.3 percent in 1985 to 21.3 percent in 1990 and remained stable at 22.1 percent in 1995 and 22.3 percent in 2000. The diverging time trends in the share of government-owned hospitals

the percentage of black women who had no prenatal visit was 2.3% compared with 0.9% for white women and the average number of prenatal visits was 10 for black women compared with 11 for the white in 2000.

between counties with and without hospital-based obstetric services did not, however, change the fact that the average proportion of hospitals owned by the government was higher in counties with hospital-based obstetric services than in counties without those services. Since government-owned hospitals often have the particular goal of providing medical care to under-served populations and benefit from special treatment in policies and regulations (including, in some cases, immunity from tort liabilities or lower caps on tort damages), we hypothesize that a higher proportion of government-owned hospitals increases the probability of the provision of obstetric services by hospitals.

Table 3 also shows that in 1985, counties with hospital-based obstetric services had about 7 times the average population as counties with no hospital-based obstetric services. Over time, the difference in the average sizes of populations grew gradually. In 2000, the average population in counties with hospital-based obstetric services was almost 8 times that in counties without hospital-based obstetric services. A larger population implies higher demand for hospital services and thereby more hospitals in a county. The more hospitals there are in a county, the more likely at least one of them would provide obstetric services. Therefore, we hypothesize that a larger population is associated with a higher probability that a county has hospital-based obstetric services.

The fraction of Medicare-eligible population was slightly lower in counties with hospital-based obstetric services than counties with no hospital-based obstetric services (see Table 3). The differences grew over the years, from less than half a percentage point in 1985 to a little more than 1 percentage point or a 7.7 percent difference. The fraction of Medicare population in a county may affect the financial viability of hospitals in the county. Overall, the elderly account for 18 percent of the population and research such as

Cutler and Meara (1998, 2001) shows that increases in medical expenditures are heavily tilted toward the elderly population as technological change in medical care is tilted toward the aged population. As a result, reimbursements for care rendered to the elderly become a more and more important source of revenue for health care providers. Some studies have shown that Medicare involvement increases hospital profitability and/or lowers the risk of hospital closure. Rizzo (1991) found that greater Medicare involvement was associated with higher patient care as well as overall profitability for urban hospitals.¹¹⁶ Williams et al. (1992) found that lower Medicare involvement lowered profitability and increased the risk of hospital closure.¹¹⁷ Since the more hospitals there are in a county, the higher probability that at least one of them provides obstetric services, a higher fraction of Medicare population should be expected to be positively related to the likelihood that a county has hospital-based obstetric services.

¹¹⁶ JA Rizzo, "Has Medicare been a 'Bad Deal' for Rural Hospitals?" *Journal of Rural Health* 7, no. 5 (1991), 599.

¹¹⁷ D. Williams, J. Hadley and J. Pettengill, "Profits, Community Role, and Hospital Closure: An Urban and Rural Analysis," *Medical Care* 30, no. 2 (1992), 174.

Table 3: Comparisons of mean values of county socioeconomic variables and other demand- and supply-side variables between counties with and without hospital-based obstetric services

	1985		1990		1995		2000	
	OB	No OB	OB	No OB	OB	No OB	OB	No OB
Per Capita Income	12,023 (2,557)	10,752 (2,492)	13,085 (2,941)	11,361 (2,437)	13,520 (2,970)	11,529 (2,224)	15,025 (3,764)	12,684 (2,781)
Wage per Job	14,892 (2,960)	13,268 (3,363)	14,836 (2,965)	13,010 (2,927)	15,070 (2,993)	13,157 (2,701)	16,198 (3,585)	13,978 (2,759)
Unemployment Rate	8.52 (3.77)	9.20 (4.59)	5.97 (2.53)	6.78 (3.26)	5.76 (2.82)	6.39 (3.43)	4.57 (2.41)	5.06 (2.79)
Share of Women of Childbearing Age who are Black	8.5 (14.4)	10.0 (17.3)	8.3 (14.1)	10.8 (18.1)	8.5 (14.4)	10.8 (18.4)	9.0 (14.5)	10.6 (18.3)
Rural	0.698 (0.459)	0.847 (0.360)	0.673 (0.469)	0.867 (0.339)	0.662 (0.473)	0.867 (0.340)	0.654 (0.476)	0.867 (0.339)
Share of Hospitals Owned by Government	43.5 (43.4)	12.3 (32.5)	40.4 (42.7)	21.3 (40.3)	38.4 (42.7)	22.1 (40.6)	33.7 (41.8)	22.3 (41.0)
Women Density	58 (412)	8 (21)	65 (438)	8 (19)	70 (452)	8 (18)	73 (465)	8 (17)
Births per 1,000 Woman of Childbearing Age	71 (33.58)	70 (16.43)	69 (12.46)	67 (13.18)	63 (11.19)	62 (12.25)	65 (28.54)	64 (15.57)
Share of Population who are Elderly	13.98 (4.07)	14.28 (4.24)	14.71 (4.31)	15.46 (4.32)	14.68 (4.15)	15.50 (4.30)	14.42 (3.99)	15.54 (4.20)
Population (in 10,000s)	9.41 (28.22)	1.40 (1.85)	10.82 (31.37)	1.48 (1.83)	11.97 (33.30)	1.60 (1.98)	13.23 (36.17)	1.71 (2.16)
Number of Counties	2,427	647	2,177	897	,054	1020	1,982	1092

Notes:

- 1) Columns labeled “OB” describe counties that have at least one hospital that provides obstetric services.
- 2) Columns labeled “No OB” describe counties that have no hospital that provides obstetric services.
- 3) Standard deviations are reported in parenthesis below each population mean.

Chapter 6 Empirical Results

A. *Bivariate Analysis of Direct Reforms and Hospital-based Obstetric Services*

Table 4 reports the fraction of counties that had hospital-based obstetric services among different groups of counties that were exposed to each type of direct reform for different lengths of time. For each type of direct reform in each of the four study years, counties are grouped into those that were not subject to the reform in the most recent five years, those that were subject to the reform for 1 to 2 of the last five years, those that were subject to the reform for 3 to 5 of the last five years. Within each group, the table reports the percentage of counties that had hospital-based obstetric services.

For caps on total damages or caps on punitive damages, there does not seem to be a consistent pattern concerning the relationship between the number of years that a cap was imposed and the likelihood that a county provided hospital-based obstetric services. In some years, counties in states that had imposed caps on total or punitive damages in one or more of the previous five years appeared to be somewhat less likely to provide hospital-based obstetric services. In other years, the fraction of counties with hospital-based obstetric services simply appeared to be unrelated to the number of prior years that caps were imposed.

On the other hand, the presence of caps on non-economic damages, periodic payment arrangements, and mandatory offset of collateral source rules were almost all associated with greater frequencies of the provision of hospital-based obstetric services.

¹¹⁸ Compared with not having a cap on non-economic damages, having a cap on non-economic damages was associated with increased likelihood of having hospital-based

obstetric services in a county if the cap was in place for at least three of the last five years. It is not clear however, whether having a cap on non-economic damages in place for less than three of the prior five years improved the odds that a county had hospital-based obstetric services. In 1985, it appears that caps on non-economic damages improved the odds that counties had hospital-based obstetric services, but the effect was the strongest when the caps had been in effect for one to two years. In other years, only caps on non-economic damages that had been in effect for at least three years were associated with an increased frequency of counties with hospital-based obstetric services.

Imposition of periodic payment requirements and the mandatory offset of collateral source rule in a state in at least one of the prior five years both appear to be positively correlated with the frequency of counties with hospital-based obstetric services. Except for the periodic payment arrangement requirement in 1985, the effects of these two types of direct reforms on the availability of hospital-based obstetric services seem to be the strongest when they had been enforced for one to two years and wear off thereafter.

B. Multivariate Analysis of Direct Reforms and Hospital-based Obstetric Services

Although the simple cross-tabulation results presented in Table 4 do not show a straightforward association between the direct reforms and the percentage of counties that had hospital-based obstetric services, the evidence is far from conclusive. Other confounding factors such as county socioeconomic characteristics may obscure the true effects of tort reforms. To control for these possible confounding factors, a multivariate

¹¹⁸ The only exception was caps on non-economic damages in 1990.

analysis of the effects of direct tort reforms on the availability of hospital-based obstetric services in a county is needed.

In Table 5, we present basic results from estimation Equation (1). We start with a simple model to examine the effects of the reforms, controlling for county-specific time-invariant factors only. The results of this regression are shown in the first column in the table. Caps on total damages appear to increase the likelihood that hospital-based obstetric services were available in a county. The model predicts that an additional year with a cap on total damages in effect increases the probability that a county has hospital-based obstetric services by 1 percentage point. The estimated coefficient for this reform is statistically significant at the 5 percent level ($p \leq 0.05$). However, the other four types of direct reforms were negatively correlated with the probability of a county having hospital-based obstetric services. Moreover, the coefficients corresponding to caps on punitive damages and periodic payment arrangements were not negligible and were statistically significant. These seemingly counter-intuitive results may be biased due to omitted variables, as we have not controlled for specific confounding factors such as time-varying county socioeconomic characteristics and other demand- and supply-side factors.

Model 2 in Table 5 improves on Model 1 by including time-varying county-level covariates. The results on direct reforms differ from those of Model 1 substantially. The imposition of all direct reforms except that of periodic payment arrangements was found to be associated with an increased likelihood of having hospital-based obstetric services. The magnitude of these effects is relatively modest however, and only the coefficient for the mandatory offset of collateral source rule (hereafter referred to as the offset rule) is

marginally statistically significant at the 10 percent level ($p=0.11$). The offset rule and caps on total damages have the most notable impact on the provision of obstetric services by hospitals in a county – an additional year over the five most recent years with the offset rule or a cap on total damages in effect would increase the probability of a county having hospital-based obstetric services by 0.6 and 0.5 percentage points respectively. Caps on non-economic damages have about half the impact as caps on total damages on the likelihood of a county having hospital-based obstetric services. Caps on punitive damages and periodic payment arrangements appear to bear little impact on the probability that a county has hospital-based obstetric services available.

One concern about the specification of the treatment variables in our model and a possible cause of the lack of statistical power of the point estimates is multi-collinearity among the reform variables. Since states often introduce more than one type of tort reform at a time, it is possible that our reform variables are highly correlated with one another that the effects of individual reforms cannot be independently measured. However, an examination of the correlations among different reform variables used in our study suggests that multi-collinearity is not a serious problem. The highest correlation observed among reform variables in a given study year was 0.36 (between variables for the presence of caps on total damages and periodic payment arrangements in 1985). The reasonably low correlations among the five types of reforms partly reflect the discussion from Chapter 3 that some tort reforms preceded others. For example, the majority of caps on total damages were introduced in the mid-1970s; most caps on non-economic damages were enacted in the mid-1980s; and caps on punitive damages were introduced more recently. Furthermore, even though the introduction of reforms tends to have been

clustered in distinct waves, the repeal or invalidation of reforms was very much a state-by-state phenomenon.

The point estimates of the effects of direct reforms are not statistically significant so we cannot reject the hypothesis that the coefficients on the reform variables are zero. Unfortunately, given the size of the parameter estimates and the large standard errors on the parameters, we cannot be sure that the offset rule, caps on total damages and caps on non-economic damages had no effect on hospital-based obstetric services. If we construct a 95 percent confidence interval around the parameter estimates, we note that for the three variables listed above, the upper value of the 95 percent confidence interval is somewhat large. So although the coefficients are statistically insignificant, we are unsure whether the law had any impact on outcomes. Our data set and econometric model simply do not have enough power for us to draw firm conclusions about the existence or non-existence of the effects of direct reforms.

Table 6 reports two different measures of the impacts of direct reforms implied by Model 2. These measures are derived by comparing two hypothetical scenarios concerning the patterns of reforms imposed in states as well as the actual patterns of reforms in the year 2000. Under the hypothetical “No Reform” scenario, we assume that no states had imposed a given reform during the five-year period from 1996 to 2000 (i.e., the reform variable is set equal to zero for all counties). In the “Actual” scenario, we use the observed values of the reform variables for 2000. In the “Full Reform” scenario we assume that the reform of interest was imposed in all states in all five years from 1996 to 2000 (i.e., the reform variable is set to five for all counties). The first two columns of Table 6 report predicted differences under the “Full Reform” and the “No Reform”

scenarios in the number of counties with hospital-based obstetric services and the percentage changes in the number of women of childbearing age living in those counties. The last two columns of the table report differences under the “Full Reform” scenario and the “Actual” scenario. Thus, the figures in the first column capture the gross nationwide impact of a reform, while those in the second column capture the net impact of imposing a reform in those states where it had not been fully adopted.

According to Model 2, 93 more counties¹¹⁹ would have had hospital-based obstetric services available if all states required mandatory offset of compensations from collateral sources in malpractice claims for at least five years than if no states had imposed this reform. About 3 percent more women of childbearing age would have access to hospital-based obstetric care under the “Full Reform” scenario for the offset rule than under the “No Reform” scenario. Imposing caps on total damages nationwide would have increased the number of counties that had hospital-based obstetric services by 78, relative to not imposing the cap in any state. This thereby provides access to hospital-based obstetric care for about 2.5 percent of women of childbearing age. The gross effect of the cap on non-economic damages would be to increase the number of counties with hospital-based obstetric services by 40, affecting about 1.3 percent of women of childbearing age. If all five types of direct reforms were imposed in all states for five years, 202 more counties would have been on the list of counties that had at least one hospital that provided obstetric services than if no reforms were imposed in any state.

Of course, some states did have reforms in place between 1996 and 2000, so the measures of gross impacts overstate the actual potential effects of introducing new direct

¹¹⁹ This is based on the fact that there are about 3,100 counties in the US when we combine Virginia independent cities with their original counties.

reforms predicted by Model 2. In year 2000, 1,993 counties did not have an offset rule in any year from 1996 to 2000. The rest of the counties, in contrast, had had an offset rule for all five years between 1996 and 2000. If all 1,993 counties that did not have an offset rule adopted one and kept it in place for five years, 60 additional counties would have gained hospital-based obstetric services. Model 2 also predicts that 1.7 percent¹²⁰ of women of childbearing age would have gained access to hospital-based obstetric services in their home county. Applying the same simulation method to caps on total damages and caps on non-economic damages, Model 2 predicts that 67 and 27 counties would be added to the list of counties that had hospital-based obstetric services, had all states imposed the two types of caps for five years respectively. The increases in the number of counties with hospital-based obstetric services imply a 2.3 percent and 0.9 percent increase, due to the imposition of caps on total damages and caps on non-economic damages respectively, in the number of women of childbearing age who would have had access to hospital-based obstetric services in 2000. It should be noted though, that since the estimated coefficients are not statistically significant at conventional levels, one cannot discount the possibility that these reforms have no meaningful effects on the provision of hospital-based obstetric services. The econometric model does not provide enough precision to accurately measure the effects of these reforms.

Estimated coefficients for some demand- and supply-side factors are statistically significant at the 5 percent level ($p \leq 0.05$). These factors include the share of

¹²⁰ Suppose X_n number of counties had a mandatory offset of collateral source rule for n years between 1996 and 2000 where $0 \leq n \leq 5$; there were W_n number of women of childbearing age in X_n counties in 2000 and the total number of women of childbearing age in 2000 is W , then the percentage of women gaining access to hospital-based obstetric services if all states imposed a mandatory offset of collateral source rule would be: $100 * (0.0060 * 5 * X_0 * W_0 + 0.0060 * 4 * X_1 * W_1 + 0.0060 * 3 * X_2 * W_2 + 0.0060 * 2 * X_3 * W_3 + 0.0060 * 1 * X_4 * W_4) / W$.

government-owned hospitals, county population, and the fraction of elderly county residents. The model predicts that a 10 percentage point increase (equivalent to about one third of the share of government ownership in 2000) in hospital ownership by the government would lead to a 1 percentage point increase in the probability of a county having hospital-based obstetric services. A 1 percentage point increase is equivalent to about a 1.5 percent increase in the number of counties that have hospital-based obstetric services from year 2000 when about 64 percent of all counties had hospital-based obstetric services. A county with 10,000 more residents than an otherwise identical county would be 3 percentage points more likely to have hospital-based obstetric services available. A 10 percentage point increase in the fraction of elderly residents in a county is found to be associated with an 8 percentage point increase in the probability that a county has hospital-based obstetric services.

Estimated coefficients for other socioeconomic characteristics and demand- or supply-side variables included in the model all have expected signs but are not statistically significant. Women living in counties with higher real per capita incomes and wages per job and lower unemployment rates were more likely to have access to obstetric services provided by hospitals. The density of women in a county and the number of births per woman of childbearing age in the county are also positively related to the likelihood that a county will provide hospital-based obstetric services. A higher proportion of black women among women of childbearing age in a county are found to be associated with a greater likelihood of hospital-based obstetric services in the county.

All year dummies have a negative sign and are statistically significant, implying a downward time trend across all counties from 1985 to 2000. Moreover, the interaction of

county rural status with year fixed effects in Model 2 suggests that rural counties had a steeper downward trend than non-rural counties. All else equal, a rural county was about 11 percentage points less likely to have hospital-based obstetric services in 1990 than in 1985. Over the same period the likelihood that a non-rural county had hospital-based obstetric services declined by only 4 percentage points. The gap between rural counties and non-rural counties widened over time. In 1995, a rural county was 16 percentage points less likely to have at least one hospital that provided obstetric services than in 1985 while a non-rural county was only 7 percentage points less likely to have obstetric services. In 2000, the difference further increased to 11 percentage points with rural counties being 19 percentage points less likely to have hospital-based obstetric services than in 1985.

Since rural counties experienced more pronounced declines in hospital-based obstetric services in the past two decades and health researchers and policy-makers are particularly concerned with access to obstetric care for women living in rural communities, we conducted a separate set of analyses of the impact of direct reforms on the provision of hospital-based obstetric services in rural counties only. Columns (2) and (4) in Table 5 show these results from models for rural counties with and without covariates respectively. Direct reforms, especially the offset rule, appear to have a stronger impact on the probability of a county having hospital-based obstetric services in rural areas than it does in non-rural areas. After controlling for confounding factors, a rural county in a state that enforces the offset rule in one of the five most recent years is found to be 0.76 percentage points more likely to have at least one hospital that provides obstetric services than a rural county in a state that does not impose such a rule. The

cumulative effect of having the offset rule in place for five consecutive years amounts to a 3.8 percentage point increase in the fraction of rural counties with hospital-based obstetric services. The relative impact of the offset rule is even more notable in rural counties than in non-rural counties if we take into account the fact that a lower fraction of rural counties have hospital-based obstetric services. In 2000, about 58 percent of rural counties had hospital-based obstetric services while among non-rural counties, the fraction was 83 percent. A 3.8 percentage point increase in rural counties amounts to a 6.6 percent higher probability that a rural county had hospital-based obstetric services than the probability that it had hospital-based obstetric services in 2000; a same percentage point increase in non-rural counties would only amount to a 4.6 percent higher probability that a non-rural county had hospital-based obstetric services than the probability that it had hospital-based obstetric services in 2000. The impact of caps on different components of malpractice claims are similar in rural counties as that in all counties combined. In general, rural counties in states that impose all five types of direct reforms in at least one of the five prior years are 1.56 percentage points more likely to have hospital-based obstetric services than rural counties in states that do not impose any of the direct reforms. The similarity of the effects of reforms (with the exception of the offset rule) estimated under Model 2 using data on all counties and that estimated using only data on rural counties is probably due to the fact that non-rural counties generally had hospital-based obstetric services and did not see any significant change in the availability of hospital-based obstetric services over the study period. Only 8.5 percent of non-rural counties had ever changed status over the four study years compared to 21.4

percent of rural counties. Consequently, 87.1 percent of counties that had variations in the dependant variable were in rural areas.

Table 7 reports simulated gross and net effects of caps on total damages, caps on non-economic damages, and the presence of an offset rule in rural areas based on estimated coefficients from Model 2. “Gross” and “net” effects are defined in the same way as in Table 6. If all states with rural counties were to move from not having a cap on total damages in the prior five years to having one for five years, about 81 rural counties, or 2.7 percent of women of childbearing age living in rural counties would have access to hospital-based obstetric services. The imposition of an offset rule in all states with rural counties for five years would make hospital-based obstetric services available to 3.8 percent women in rural areas. However, because many states had reforms in place in 2000, the net effect of the imposition of new caps on total damages, offset rules, or caps on non-economic damages for five years in all counties would only have increased the fraction of women having access to hospital-based obstetric services in their home county by 2.4, 2.5 and 1.0 percent respectively.

C. Tests of Robustness of the Impact of Direct Reforms

Economic theory provides little guidance with respect to the functional relationship between tort reforms and the likelihood that a county provides hospital-based obstetric services. The specification of the tort reform variables used in Models 1 and 2 was designed to capture in a parsimonious way the fact that (i) tort reforms are likely to affect the availability of obstetric care with a lag, and (ii) the influence of tort reforms are

likely to be greater the longer reforms are in place. In this section, we examine alternative specifications of the tort reform variables.

We first consider whether the marginal contribution of an addition year of tort reform might differ depending on how long the reform has been in effect. In Model 3, we included two dummy variables for each type of reform indicating whether that reform was in place during the study year, and whether it was in place four years prior to the study year. For example, if a state enacted a cap on total damages in 1980 and repealed it in 1992, then the current year dummy for caps on total damages is equal to 1 in 1985 and 1990 and 0 in 1995 and 2000 for all counties in the state. The ‘four years before’ dummy on the other hand, takes on the value of 1 in 1985, 1990, and 1995 and 0 in 2000.

Results from Model 3 are generally consistent with those from Model 2 (see Table 8). Caps on total damages and the offset rule, whether they were in effect in the study year or four years before, are both associated with a higher probability that hospital-based obstetric services were available in a county. A cap on total damages that was in place in a study year and had already been in effect four years earlier would increase the likelihood that a county had hospital-based obstetric services by 0.35 percentage points while a cap on total damages that was only enacted in the study year or any of the three prior years would increase the likelihood by 0.14 percentage points. It appears that caps on non-economic damages would not increase the likelihood that hospital-based obstetric services were available in a county if the caps were in effect in a study year but not four years earlier. These findings indicate that it takes time for both caps on total damages and caps on non-economic damages to exert their full impact on the provision of obstetric services by hospitals. Effects of the offset rule also

strengthened over time – compared with a county that only had an offset rule in the study year, a county that had already had the reform four years earlier would be 0.71 percentage points more likely to have hospital-based obstetric services. However, the marginal benefit of having this reform four years prior to the study year is only one third of that of having the reform in place during the study year. Caps on punitive damages and periodic payment arrangements appear to have little impact on the availability of hospital-based obstetric services in a county.

Since Model 3 indicates that all direct reforms except caps on punitive damages have a positive marginal impact on the availability of hospital-based obstetric services at the county level at least five years after they went into effect, it is useful to examine whether the probability that a county has hospital-based obstetric services might continue to grow in an even longer period of time after a reform is introduced. In Model 4 we extended the time horizon used for defining reform variables to ten years. In order to minimize multi-collinearity among the treatment variables, we defined our reform variables in Model 4 as the number of years a reform has been in effect in the ten most recent years in the state to which the county belongs. As in Model 3, this definition allows for changes in the legal environment in both directions, either the enactment or the repeal of a reform, to have symmetric effects on hospitals' perception of liability pressures.

Results from Model 4 are reported in Table 9. These results are reasonably consistent with information revealed in Model 2 and Model 3. Caps on total damages and non-economic damages and the offset rule all appear to be effective in increasing the probability that a county provides hospital-based obstetric services. The magnitude of

the cumulative impact of caps on total damages and that of caps on non-economic damages over a ten-year period are about the same, followed by that of the impact of the offset rule. The model implies that if a cap on total damages has been in effect in a state for ten years, the likelihood that a county will provide hospital-based obstetric services is 1.9 percentage points higher than an identical county in a state that never enacted the reform in the prior ten years. This is slightly smaller than the 2.5 percentage point five-year cumulative effect implied by Model 3, possibly indicating that the effects of caps on total damages wear off some time after five years of their enactment. The offset rule and caps on punitive damages also seem to have a greater impact in the first five years after they go into effect than in later years. In contrast, caps on non-economic damages increase the probability of a county having hospital-based obstetric services by 2.0 percentage points if they have been in effect for ten years, a larger impact than the five-year cumulative effect of a 1.5 percentage point increase. The difference, however, is not significant in the economic sense.

In Model 5, we collapsed the direct reforms into two categories to examine whether caps on damages as a group have different effects on the availability of hospital-based obstetric services in a county compared to reforms that do not set a limit on the various components of malpractice claims. The treatment variables in Model 5 include the number of years out of the five most recent years over which a county has been subject to any kind of caps on damages and the number of years over which the county has been subject to the offset rule or periodic payment arrangements. Both caps and non-cap reforms are found to be associated with an increased probability that a county has hospital-based obstetric services. The incremental effect of caps for each year in the

prior five years is smaller than that of non-cap reforms. According to this Model, if all states were to enforce the offset rule or require periodic payment arrangements, about 59 more counties would provide hospital-based obstetric services to their residents than when no state had an offset rule or periodic payment arrangements in place in the prior five years. The imposition of a cap on any component of compensatory and punitive damages by all states for five years, on the other hand, would only result in access to hospital-based obstetric care for women living in an additional 26 counties (comparison between the 'Full Reform' scenario and the 'No Reform' scenario).

Figure 6 provides an illustration of the general differences in the cumulative effects of reforms implied by Models 2, 3, and 4 discussed above. In Model 2, the effect of a reform is assumed to increase linearly for the first five years a reform is in place, and to remain constant thereafter. Under Model 3, the cumulative effect of a reform is assumed to be constant for the first four years that the reform is in place and to jump to a higher level in the fifth year and later years. Model 4 is similar to Model 2, but it assumes that the effects of reforms grow linearly over the first ten years following the enactment of the reform.

We applied Models 3 to 5 to rural counties to examine whether or not the effects of direct reforms are robust in rural areas. Results from Models 3 and 5 are fairly consistent with those from Model 2, both in terms of the order of the effects and the relative impact of direct reforms in rural counties compared to that in non-rural counties. The offset rule seems to be the most effective in increasing the probability that a rural county provides hospital-based obstetric services; this is followed by caps on non-economic damages and caps on total damages. A county that had these reforms in a

study year would have a higher likelihood that it had hospital-based obstetric services if it also had these reforms in place four years prior to the study year. This finding indicates that the effects of these three direct reforms strengthen over time. In most cases in Models 3 to 5, estimated coefficients suggest that direct reforms have a greater impact in rural areas than in rural and non-rural counties combined.

It should be emphasized that, while these robustness tests are informative, most of the point estimates of these effects are not statistically significant. Therefore, most of the estimated parameters lack sufficient precision to make firm conclusions concerning the effects of tort reforms on the availability of hospital-based obstetric services at the county level. In general, we cannot reject the hypothesis that reforms had no effect on access to hospital-based obstetric services at conventional levels.

D. The Impact of Direct Reforms on Other Measures of Access to Care

Hospital-based obstetric facilities are only one of the many providers that render obstetric services to women. While lack of access to hospital-based obstetric care in a county may imply additional costs to women seeking certain types of obstetric services and potentially higher risks to newborns and their mothers, the problem could be partially mitigated if a county has sufficient access to OB/GYNs or family practitioners providing obstetric care outside of hospitals. OB/GYNs and family practitioners provide most prenatal care. A large body of existing research shows that the earlier initiation of prenatal care and more frequent prenatal visits are associated with better birth outcomes,

as measured by low birth weight and perinatal mortality.¹²¹ Hence, to some extent, access to prenatal care provided by OB/GYNs and family practitioners outside of hospitals may provide a substitute for access to obstetric care in hospital facilities. Neonatal intensive care units (NICU) in hospitals serve a different role from obstetric units or OB/GYNs and family practitioners. NICUs are designed to improve the odds of survival for neonates in serious conditions. Although NICUs are not required for most deliveries, they provide an important complement to hospital obstetric facilities in difficult cases such as premature births where specialized care is required.

This section examines whether access to obstetric care outside of a hospital and access to a NICU is influenced by tort reforms. We first take a brief look at whether the supply of OB/GYNs and family practitioners and the availability of NICUs differ systematically among counties with and without hospital-based obstetric care. We then examine the effects of direct reforms on the supply of OB/GYNs and the availability of care in NICUs. Finally, we compare the effects of direct reforms on the supply of OB/GYNs per woman of childbearing age with those on the supply of all physicians per capita in a county to assess whether direct reforms affect access to obstetric care differently than access to other types of medical care.

Table 10 shows that, in addition to having access to hospital-based obstetric services, residents in counties with hospital-based obstetric services have more office-

¹²¹ Boss, D.J and others. "Clinical obstetric outcomes related to continuity in prenatal care." *The Journal of the American Board of Family Practice / American Board of Family Practice* 14 (2001):418-23; Herbst, M.A. and others "Relationship of prenatal care and perinatal morbidity in low-birth-weight infants." *American Journal of Obstetrics and Gynecology* 189 (2003):930-3; Petrou, S. and others "Antenatal visits and adverse perinatal outcomes: results from a British population-based study." *European Journal of Obstetrics, Gynecology, and Reproductive Biology* 106 (2003):40-9.

based medical services and more obstetric services in particular than those living in counties without hospital-based obstetric services. There were 10.8 physicians per 10,000 persons in counties with hospital-based obstetric services, compared with only 3.7 in counties without hospital-based obstetric services in 1985. Over time, both groups of counties were served by more physicians relative to their populations. In counties with hospital-based obstetric services, the physician to population (in 10,000s) ratio grew by 11, 13, and 19 percent over the three five-year intervals from 1985 to 2000; in counties without hospital-based obstetric services, the ratio grew by 11, 2, and 20 percent during the same five-year intervals. The differing growth rates led to a widening over time of the gap in physicians per capita in counties with and without hospital-based obstetric services.

The ratio of family practitioners and OB/GYNs to women of childbearing age at the county level also increased from 1985 to 2000 (see Table 10). Counties without hospital-based obstetric services saw an increase of 28 percent in the number of family practitioners and OB/GYNs per woman of childbearing age from 1985 to 1990. This growth rate was 7 percentage points higher than that of counties with hospital-based obstetric services during the same time period. The growth rate in the ratio of family practitioners and OB/GYNs to women of childbearing age slowed for both groups of counties from 1990 to 1995, reaching only 14 percent for counties with hospital-based obstetric services and 10 percent for counties without hospital-based obstetric services. It accelerated from 1995 to 2000 however, reaching 23 and 22 percent for counties with and without hospital-based obstetric services respectively. Although the supply of family practitioners and OB/GYNs increased over time, fewer family practitioners and

OB/GYNs served women of childbearing age in counties without hospital-based obstetric services. In counties with hospital-based obstetric services, there was more than 1 family practitioner and/or OB/GYN for each 1,000 women of childbearing age in all four sample years -- 1.1 in 1985, 1.3 in 1990, 1.5 in 1995 and 1.9 in 2000. In contrast, the ratio of family practitioners and OB/GYNs to women of childbearing age (in 1,000s) was only 0.5, 0.7, 0.7, and 0.9 in the four years respectively in counties without hospital-based obstetric services. This difference suggests that women of childbearing age who lived in counties without hospital-based obstetric services might have had more limited access to office-based obstetric services as well. In addition, Table 10 shows that if no hospital in a county provides obstetric services, it is almost certain that no hospital would operate an NICU. This is not surprising since there are presumably strong economies of scope in the provision of obstetric and neonatal care. Of counties where hospital-based obstetric services were available, the proportion of counties in which at least one hospital provided NICU care increased steadily from about 13 percent in 1985 to 20 percent in 2000.

Information presented in Table 10 indicates that lack of access to obstetric care in one setting is usually associated with a lack of access to obstetric care in a different setting. Women who have to travel outside their home county for deliveries are more likely to have trouble finding an obstetrician or family practitioner who can provide prenatal care and, not surprisingly, counties that do not have access to hospital-based obstetric facilities also lack access to NICUs. Direct tort reforms might therefore be especially valuable to medically underserved women if, in addition to their impact on access to hospital-based obstetric services, they are shown to be effective in increasing the number of OB/GYNs per woman of childbearing age and the availability of NICUs.

To examine the effects of tort reforms on broader measures of access to obstetric care, we applied the specification of Models 2 and 3 defined in the previous section to the number of OB/GYNs and family practitioners per woman of childbearing age, the number of physicians in active patient care per 10,000 persons, and an indicator of whether or not there is at least one NICU in a county.

Table 11 shows that direct reforms that increase the probability that a county has hospital-based obstetric services are also positively associated with the number of OB/GYNs and family practitioners active in patient care. As in the case of hospital-based obstetric services, the offset rule has the greatest impact on the supply of OB/GYNs and family practitioners in a county. Model 2 predicts that if a state imposed the rule for five years, counties in the state would see about 1.7 more OB/GYNs or family practitioners per 10,000 women of childbearing age. 1.7 OB/GYNs and/or family practitioners is about 11.3 percent of the average number of OB/GYNs or family practitioners per 10,000 women of childbearing age in practice in 2000. Imposing a cap on total damages for five years in a state would increase the number of OB/GYNs or family practitioners by 1 per 10,000 women of childbearing age. Estimates of the effects of the offset rule and those of caps on total damages are both statistically significant. The coefficient that captures the effect of caps on non-economic damages, though positive, is not significant in either an economic or statistical sense. The magnitude of the effects of the offset rule and caps on total damages is very similar in rural counties to those in all counties combined (see Column 2 under Model 1 in Table 11). Since the ratio of OB/GYNs and/or family practitioners to woman of childbearing age is slightly lower in rural counties than that in non-rural counties (1.5 vs. 1.7), the effects of direct reforms are

relatively bigger in rural areas than in non-rural areas, even though the differences are modest.

An alternative specification of the reform variables, as defined in Model 3, indicates that the offset rule has a larger impact on the supply of OB/GYNs or family practitioners per woman of childbearing age if the rule was in effect four years before a study year than if it was in effect in the study year, all else held equal. In other words, the cumulative effect of having a reform in place for at least five years is more than double the effect of having a reform in place for four or fewer years. The estimated coefficients indicate that not only this reform has lingering effects on the supply of OB/GYNs or family practitioners to, the magnitude of the effect increases with time. This is true when all counties are studied together as well as when rural counties are studied separately. When we look at rural counties only, caps on total damages imposed for at least one year or for at least five years were both found to be associated with an increased supply of OB/GYNs and/or family practitioners per woman of childbearing age. This implies that the effects of caps on total damages in rural counties strengthen with their duration. Moreover, Model 3 predicts that the marginal effect of having a cap on total damages four years before a study year is almost six times the marginal effect of having the cap in the study year. Among rural counties, if a cap on total damages had been in effect for at least five years, the county would see about 1.1 more OB/GYNs or family practitioners per 10,000 women of childbearing in the study year. This estimated effect is very close to the cumulative effects predicted by Model 2.

Table 12 shows that direct reforms have a smaller influence on the physician to resident ratio than on the ratio of OB/GYNs per woman of childbearing age in a county.

Caps on total damages have the largest impact on physician supply relative to other types of direct reforms (see Model 2 in Table 12). The model predicts that a state that has a cap on total damages for five years would increase the supply of physicians per 100,000 residents by 6.4, amounting to 5.1 percent of the average number of physicians per 100,000 residents in 2000. Rural counties seem to benefit from the offset rule in addition to caps on total damages. However, the magnitude of the effect is smaller than that of caps on total damages. Model 2 predicts that a rural county subject to a cap on total damages for five years would have 5.7 more physicians per resident than if it had no cap on total damages in the prior five years. This is equivalent to 6.6 percent of the average ratio of physicians per 100,000 residents among rural counties in 2000.

Table 13 shows that the probability that a county has at least one NICU is affected by different types of direct reforms than other measure of access to care examined in this study. When all counties are studied together, the largest impact on the probability of a county having an NICU is associated with caps on punitive damages. The model predicts that imposing a cap on punitive damages in a state for five years would increase the probability that counties in the state have an NICU by about 1 percentage point. This appears to be small in the economic sense. However, since only about 13 percent of hospitals had an NICU in 2000, the 1 percentage point increase is equivalent to 7 percent of the probability that a county provided NICU care in 2000. The seemingly small size of the estimated coefficients of direct reforms could mean substantial increases in the likelihood that NICU care is available, especially in rural areas. Model 2 predicts that if a cap on total damages were imposed in a rural county for five years, the probability that at least one hospital in the county would provide NICU care would be increased by 0.5

percentage points. This amounts to 18.5 percent of the probability that a county has NICU care in 2000, as only 2.3 percent of rural counties had NICU care available in 2000. Imposing a cap on punitive damages in a rural county for five years would increase the probability that the county has NICU care by 0.15 percentage points, which is equivalent to 5.5 percent of the probability that a county had NICU care in 2000.

Figure 6: Illustration of the cumulative effects of reforms under different model specifications

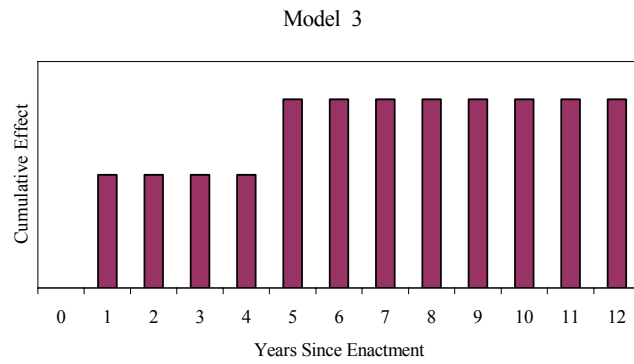


Table 4: Distribution of counties with hospital-based obstetric services, by number of years direct tort reforms were enforced.

Number of the prior five years reform was enforced		1985		1990		1995		2000	
		Num	%	Num	%	Num	%	Num	%
Cap on Total Damages	0	2,242	79.9	2,007	71.7	2,531	68.2	2,664	65.4
	1-2	66	69.7	436	73.2	0	.	0	.
	3-5	766	77.0	631	66.4	543	60.6	410	58.8
Cap on Non-economic Damages	0	2,592	78.3	1,750	69.1	2,063	66.2	1,963	63.3
	1-2	72	93.1	321	64.5	215	60.9	118	62.7
	3-5	410	80.5	1,003	75.8	796	70.0	993	67.0
Cap on Punitive Damages	0	2972	79	2,118	74.3	1,867	69.7	1,596	65.7
	1-2	102	73.5	17	58.8	511	65.9	83	67.5
	3-5	0	.	939	63.3	696	59.6	1,395	62.9
Periodic Payment Arrangement	0	2,421	77.4	1,921	70.0	1,906	66.4	1,941	63.8
	1-2	244	81.1	127	85.8	128	75.8	0	.
	3-5	409	86.6	1,026	70.6	1,040	66.5	1,133	65.7
Offset of Collateral Source Rule	0	2,569	78.9	1,960	67.4	1,888	62.6	1,993	61.3
	1-2	37	81.1	60	78.3	177	80.2	0	.
	3-5	468	79.3	1,054	76.8	1,009	72.4	1,081	70.4

Table 5: Effects of state direct tort reforms on the availability of hospital-based obstetric care, Models 1 & 2.

<i>Dependant variable: whether or not a county had hospital-based obstetric services</i>	Model 1		Model 2	
	(1)	(2)	(3)	(4)
<i>Years with Reform in the 5 Most Recent Years</i>				
Cap on Total Damages	0.0103* (0.0053)	0.0118 (0.0053)	0.0050 (0.0068)	0.0053 (0.0070)
Cap on Non-economic Damages	-0.0032* (0.0036)	-0.0031 (0.0040)	0.0026 (0.0037)	0.0027 (0.0042)
Cap on Punitive Damages	-0.0119* (0.0029)	-0.0153 (0.0033)	0.0000 (0.0029)	0.0006 (0.0034)
Periodic Payment Arrangements	-0.0064* (0.0028)	-0.0086 (0.0030)	-0.0006 (0.0022)	-0.0017 (0.0028)
Mandatory Offset of Compensation from Collateral Sources	-0.0034 (0.0032)	-0.0045 (0.0037)	0.0060 (0.0037)	0.0076 (0.0051)
<i>County Socioeconomic Characteristics</i>				
log of Per Capita Income			0.0020 (0.0445)	-0.0021 (0.0471)
Wage per Job			0.0340 (0.0566)	-0.0138 (0.0641)
Unemployment Rate			-0.0016 (0.0018)	-0.0023 (0.0020)
% of Women at Childbearing Age who are Black			0.2690 (0.3426)	-0.2783 (0.5087)
% of Hospitals Owned by Government			0.1005* (0.0261)	0.1095* (0.0303)
Births per Woman at Childbearing Age			0.1926 (0.1316)	0.4293 (0.2466)
Women Density			0.0001 (0.0001)	-0.0041 (0.0051)
Ratio of the Elderly to Population			0.7973* (0.4118)	0.7216* (0.3864)
Population (in '10,000s)			0.0027** (0.0010)	0.0793** (0.0141)
<i>Time Trend</i>				
Year 1990			-0.0418* (0.0144)	-0.1019* (0.0191)
Year 1995			-0.0650* (0.0170)	-0.1420* (0.0226)

Dependant variable: whether or not a county had hospital-based obstetric services				
	Model 1		Model 2	
	(1)	(2)	(3)	(4)
<i>Years with Reform in the 5 Most Recent Years</i>				
Year 2000			-0.0837*	-0.1739*
			(0.0227)	(0.0226)
Year 1990 * rural			-0.0780*	
			(0.0131)	
Year 1995 * rural			-0.0983*	
			(0.0161)	
Year 2000 * rural			-0.1083*	
			(0.0165)	
Number of Observations	12,296	8,912	12,176	8,912
R ²	0.831	0.818	0.841	0.831

Notes:

- 1) Columns (1) and (3) are estimations based on all counties.
- 2) Columns (2) and (4) are estimations based on rural counties only.
- 3) Standard errors are reported in parenthesis below the estimates.
- 4) Standard errors reported assume arbitrary correlations between errors within a state.
- 5) Both models include county fixed effects.
- 6) * and ** denote statistical significance at 5% and 10% level respectively.

Table 6: Simulated effects of direct reforms on number of counties and share of women of childbearing age gaining access to local hospital-based obstetric services, all counties.

	Estimates from Model 2	Number of counties without reform in 2000	Gross Effect		Net Effect	
			Number of counties	Share of women of child-bearing age	Number of counties	Share of women of child-bearing age
Caps on total damages	0.0050	2664	78	2.5	67	2.3
Mandatory offset of collateral source rule	0.0060	1993	93	3.0	60	1.7
Caps on non-economic damages	0.0026	1963	40	1.3	26	0.9

Table 7: Simulated effects of direct reforms on number of counties and share of women of childbearing age gaining access to local hospital-based obstetric services, rural counties.

	Estimates from Model 2	Number of counties without reform in 2000	Gross Effect		Net Effect	
			Number of counties	Share of women of child-bearing age	Number of counties	Share of women of child-bearing age
Caps on total damages	0.0053	1950	81	2.7	52	2.4
Mandatory offset of collateral source rule	0.0076	1481	117	3.8	56	2.5
Caps on non-economic damages	0.0027	1399	41	1.4	20	1.0

Table 8: Effects of state direct tort reforms on the availability of hospital-based obstetric care, Model 3.

	Model 3	
	(1)	(2)
<i>Dependant variable: whether or not a county had hospital-based obstetric services</i>		
<i>Dummy Variables</i>		
Cap on Total Damages		
Current Year	0.0143 (0.0231)	0.0088 (0.0225)
Four Years Before	0.0206 (0.0146)	0.0249** (0.0151)
Cap on Non-economic Damages		
Current Year	-0.0054 (0.0129)	-0.0057 (0.0152)
Four Years Before	0.0148 (0.0110)	0.0170 (0.0125)
Cap on Punitive Damages		
Current Year	0.0008 (0.0151)	0.0019 (0.0182)
Four Years Before	-0.0016 (0.0109)	-0.0021 (0.0145)
Periodic Payment Arrangements		
Current Year	-0.0092 (0.0140)	-0.0129 (0.0159)
Four Years Before	0.0051 (0.0152)	0.0014 (0.0165)
Mandatory Offset of Collateral Sources		
Current Year	0.0225 (0.0177)	0.0327 (0.0227)
Four Years Before	0.0071 (0.0133)	0.0090 (0.0168)
Number of Observations	12176	8,912
R ²	0.841	0.831

Notes:

- 1) Column (1) is estimation based on all counties.
- 2) Column (2) is estimation based on rural counties only.
- 3) Standard errors are reported in parenthesis below the estimates.
- 4) Standard errors reported assume arbitrary correlations between errors within a state.
- 5) County fixed effects are included in the model.
- 6) * and ** denote statistical significance at 5% and 10% level respectively.

Table 9: Effects of state direct tort reforms on the availability of hospital-based obstetric care, Models 4 & 5.

	Model 4		Model 5	
	(1)	(2)	(3)	(4)
<i>Dependant variable: number of OB/GYNs and family practitioners per 1,000 woman of childbearing age</i>				
<i>Years with Reform in the 10 Most Recent Years</i>				
Cap on Total Damages	0.0019 (0.0032)	0.0018 (0.0031)		
Cap on Non-economic Damages	0.0020 (0.0019)	0.0025 (0.0022)		
Cap on Punitive Damages	-0.0012 (0.0022)	-0.0017 (0.0025)		
Periodic Payment Arrangements	-0.0002 (0.0016)	-0.0006 (0.0017)		
Mandatory Offset of Compensation from Collateral Sources	0.0013 (0.0021)	0.0017 (0.0028)		
<i>Direct Reforms Collapsed into Two Groups</i>				
Caps on Damages in the Past 5 Years			0.0017 (0.0035)	0.0023 (0.0043)
Non-Cap Direct Reforms in the Past 5 Years			0.0038 (0.0028)	0.0040 (0.0033)
Number of Observations	12,176	8,912	12176	8912
R ²	0.841	0.831	0.841	0.830

Notes:

- 1) Columns (1) and (3) are estimations based on all counties.
- 2) Columns (2) and (4) are estimations based on rural counties only.
- 3) Standard errors are reported in the parenthesis below the estimates.
- 4) Standard errors reported assume arbitrary correlations between errors within a state.
- 5) Both models have county fixed effects.
- 6) * and ** denote statistical significance at 5% and 10% level respectively.

Table 10: Comparison of alternative measures of access to care and obstetric care between county with and without hospital-based obstetric services.

	1985		1990		1995		2000	
	OB	No OB	OB	No OB	OB	No OB	OB	No OB
Number of Physicians per 10,000 Person	10.8 (11.6)	3.7 (3.3)	11.9 (12.6)	4.1 (3.6)	13.4 (14.9)	4.2 (3.8)	15.9 (30.0)	5.0 (4.8)
Number of FPs and OB/GYNs per 1,000 Woman of Child-bearing Age	1.10 (0.74)	0.52 (0.67)	1.33 (0.82)	0.66 (0.74)	1.52 (0.90)	0.73 (0.83)	1.88 (1.53)	0.89 (1.07)
Share with Neonatal Intensive Care Unit	13.48 (34.15)	0.00 (0)	16.08 (36.75)	0.11 (3.39)	18.97 (39.21)	0.00 (0)	19.90 (39.94)	0.00 (0)
Number of Counties	2,427	647	2,177	897	2,054	1020	1,982	1,092

Notes:

- 1) Columns labeled "OB" describe counties with at least one hospital that provides obstetric services.
- 2) Columns labeled "No OB" describe counties with no hospital that provides obstetric services.
- 3) Standard deviations are reported in parentheses below population means.

Table 11: Effects of state direct tort reforms on the supply of OB/GYNs and family practitioners

<i>Dependant variable: number of OB/GYNs and family practitioners per 1,000 woman of childbearing age</i>	Model 2		Model 3	
	(1)	(2)	(3)	(4)
<i>Years with Reform in the 5 Most Recent Years</i>				
Cap on Total Damages	0.0212*	0.0255		
	(0.0073)	(0.0095)		
Cap on Non-economic Damages	0.0027	-0.0073		
	(0.0083)	(0.0086)		
Cap on Punitive Damages	-0.0142**	-0.0061		
	(0.0083)	(0.0082)		
Periodic Payment Arrangements	-0.0067	-0.0129		
	(0.0077)	(0.0073)		
Mandatory Offset of Compensation from Collateral Sources	0.0347*	0.0344		
	(0.0126)	(0.0114)		
<i>Dummy Variables</i>				
Cap on Total Damages				
Current Year			-0.0269	0.0187
			(0.0587)	(0.0513)
Four Years Before			0.1173*	0.1163*
			(0.0347)	(0.0347)
Cap on Non-economic Damages				
Current Year			-0.0098	-0.0498*
			(0.0368)	(0.0251)
Four Years Before			0.0183	-0.0034
			(0.0273)	(0.0291)
Cap on Punitive Damages				
Current Year			-0.0099	0.0150
			(0.0305)	(0.0297)
Four Years Before			-0.0766*	-0.0487
			(0.0323)	(0.0412)
Periodic Payment Arrangements				
Current Year			-0.0122	-0.0584**
			(0.0383)	(0.0322)
Four Years Before			-0.0224	-0.0097
			(0.0231)	(0.0186)
Mandatory Offset of Collateral Sources				
Current Year			0.0905*	0.0705*
			(0.0340)	(0.0360)

Dependant variable: number of OB/GYNs and family practitioners per 1,000 woman of childbearing age

	Model 2		Model 3	
	(1)	(2)	(3)	(4)
Four Years Before			0.1100*	0.1342*
			(0.0405)	(0.0445)
<i>County Socioeconomic Characteristics</i>				
Log of Per Capita Income	0.0861	0.1392	0.1058	0.1590
	(0.1271)	(0.1298)	(0.1255)	(0.1287)
Wage per Job	-0.1669	-0.0536	-0.1888	-0.0859
	(0.1474)	(0.1757)	(0.1482)	(0.1782)
Unemployment Rate	0.0106**	0.0023	0.0102**	0.0021
	(0.0059)	(0.0051)	(0.0061)	(0.0052)
% of Women at Childbearing Age who are Black	-1.9570	0.0015	-2.0136	-0.0855
	(1.6863)	(0.9687)	(1.7055)	(0.9936)
Births per Woman at Childbearing Age	14.3084*	0.1330	14.3456*	0.2357
	(3.2838)	(1.2218)	(3.2503)	(1.2434)
Ratio of the Elderly to Population	4.9530*	3.9368	4.7978*	3.8019*
	(0.9442)	(1.0274)	(0.9623)	(1.0612)
<i>Time Trend</i>				
Year 1990	0.0987*	0.1252	0.0840*	0.1115*
	(0.0412)	(0.0430)	(0.0405)	(0.0439)
Year 1995	0.3921*	0.2218	0.3864*	0.2144*
	(0.0610)	(0.0554)	(0.0650)	(0.0627)
Year 2000	0.7142*	0.4812	0.7102*	0.4754*
	(0.1048)	(0.0731)	(0.1097)	(0.0805)
Year 1990 * rural	0.0786*		0.0761*	
	(0.0236)		(0.0237)	
Year 1995 * rural	-0.0171		-0.0189	
	(0.0317)		(0.0325)	
Year 2000 * rural	-0.0836		-0.0845	
	(0.0635)		(0.0645)	
Number of Observations	12,176	8,912	12,176	8,912
R ²	0.738	0.765	0.739	0.765

Notes:

- 1) Columns (1) and (3) are estimations based on all counties.
- 2) Columns (2) and (4) are estimations based on rural counties only.
- 3) Standard errors are reported in parenthesis below the estimates.
- 4) Standard errors reported assume arbitrary correlations between errors within a state.
- 5) Both models have county fixed effects.
- 6) * and ** denote statistical significance at 5% and 10% level respectively.

Table 12: Effects of state direct tort reforms on the supply of physicians

	Model 2		Model 3	
	(1)	(2)	(3)	(4)
<i>Dependant variable: number of physicians per 1,000 persons</i>				
<i>Years with Reform in the 5 Most Recent Years</i>				
Cap on Total Damages	0.0128*	0.0114*		
	(0.0051)	(0.0042)		
Cap on Non-economic Damages	0.0059	-0.0025		
	(0.0062)	(0.0026)		
Cap on Punitive Damages	-0.0147	-0.0023		
	(0.0120)	(0.0041)		
Periodic Payment Arrangements	0.0023	-0.0026		
	(0.0042)	(0.0021)		
Mandatory Offset of Compensation from Collateral Sources	-0.0018	0.0078*		
	(0.0099)	(0.0028)		
<i>Dummy Variables</i>				
Cap on Total Damages				
Current Year			0.0043	0.0089
			(0.0250)	(0.0192)
Four Years Before			0.0594*	0.0542*
			(0.0231)	(0.0144)
Cap on Non-economic Damages				
Current Year			0.0282	-0.0078
			(0.0261)	(0.0117)
Four Years Before			0.0127	-0.0016
			(0.0150)	(0.0109)
Cap on Punitive Damages				
Current Year			-0.0165	0.0112
			(0.0303)	(0.0149)
Four Years Before			-0.0700**	-0.0212
			(0.0425)	(0.0161)
Periodic Payment Arrangements				
Current Year			-0.0034	-0.0084
			(0.0145)	(0.0118)
Four Years Before			0.0063	-0.0032
			(0.0151)	(0.0101)
Mandatory Offset of Collateral Sources				
Current Year			-0.0027	0.0243*
			(0.0300)	(0.0097)
Four Years Before			-0.0118	0.0122
			(0.0266)	(0.0101)

Dependant variable: number of physicians per 1,000 persons				
	Model 2		Model 3	
	(1)	(2)	(3)	(4)
<i>County Socioeconomic Characteristics</i>				
Log of Per Capita Income	0.4258*	0.2021*	0.4349*	0.2051*
	(0.1492)	(0.0790)	(0.1500)	(0.0777)
Wage per Job	0.1792**	0.0336	0.1717**	0.0212
	(0.0994)	(0.0680)	(0.1011)	(0.0693)
Unemployment Rate	0.0114**	0.0014	0.0117**	0.0013
	(0.0063)	(0.0020)	(0.0067)	(0.0020)
% of Women at Childbearing Age who are Black	-4.9773	0.7442*	-5.0364	0.7086*
	(7.0536)	(0.3507)	(7.0896)	(0.3582)
Ratio of the Elderly to Population	1.4053*	1.2463*	1.3245*	1.1952*
	(0.5967)	(0.4761)	(0.0615)	(0.4914)
<i>Time Trend</i>				
Year 1990	0.0969*	-0.0037	0.0918*	-0.0110
	(0.0461)	(0.0163)	(0.0456)	(0.0161)
Year 1995	0.3219*	0.0173	0.3272*	0.0155
	(0.0936)	(0.0197)	(0.0991)	(0.0218)
Year 2000	0.6340*	0.1210*	0.6420*	0.1205*
	(0.2308)	(0.0303)	(0.2362)	(0.0332)
Year 1990 * rural	-0.0668*		-0.0700*	
	(0.0104)		(0.0109)	
Year 1995 * rural	-0.2637*		-0.2657*	
	(0.0465)		(0.0475)	
Year 2000 * rural	-0.4711*		-0.4729*	
	(0.1689)		(0.1698)	
Number of Observations	12,176	8,912	12,176	8,912
R ²	0.771	0.921	0.771	0.921

Notes:

- 1) Columns (1) and (3) are estimations based on all counties.
- 2) Columns (2) and (4) are estimations based on rural counties only.
- 3) Standard errors are reported in parenthesis below the estimates.
- 4) Standard errors reported assume arbitrary correlations between errors within a state.
- 5) Both models include county fixed effects.
- 6) * and ** denote statistical significance at 5% and 10% level respectively.

Table 13: Effects of state direct tort reforms on the availability of NICU care

<i>Dependant variable: whether or not a county has a NICU</i>				
	Model 2		Model 3	
	(1)	(2)	(3)	(4)
<i>Years with Reform in the 5 Most Recent Years</i>				
Cap on Total Damages	-0.0022 (0.0018)	-0.0003 (0.0010)		
Cap on Non-economic Damages	0.0004 (0.0010)	0.0010 (0.0007)		
Cap on Punitive Damages	0.0019 (0.0012)	0.0003 (0.0009)		
Periodic Payment Arrangements	0.0008 (0.0012)	0.0000 (0.0008)		
Mandatory Offset of Compensation from Collateral Sources	-0.0014 (0.0018)	-0.0005 (0.0010)		
<i>Dummy Variables</i>				
Cap on Total Damages				
Current Year			-0.0034 (0.0092)	0.0043 (0.0068)
Four Years Before			-0.0021 (0.0090)	-0.0015 (0.0057)
Cap on Non-economic Damages				
Current Year			-0.0011 (0.0049)	-0.0006 (0.0036)
Four Years Before			0.0020 (0.0050)	0.0038 (0.0034)
Cap on Punitive Damages				
Current Year			0.0068 (0.0063)	-0.0016 (0.0038)
Four Years Before			0.0005 (0.0060)	0.0003 (0.0045)
Periodic Payment Arrangements				
Current Year			-0.0026 (0.0072)	-0.0040 (0.0041)
Four Years Before			0.0057 (0.0069)	0.0027 (0.0042)
Mandatory Offset of Collateral Sources				
Current Year			-0.0039 (0.0094)	-0.0009 (0.0049)
Four Years Before			-0.0046 (0.0059)	-0.0005 (0.0043)

<i>Dependant variable: whether or not a county has a NICU</i>				
	Model 2		Model 3	
	(1)	(2)	(3)	(4)
<i>County Socioeconomic Characteristics</i>				
Log of Per Capita Income	0.0081 (0.0177)	0.0206** (0.0111)	0.0069 (0.0178)	0.0206 (0.0109)
Wage per Job	0.0103 (0.0227)	-0.0009 (0.0171)	0.0086 (0.0226)	-0.0026 (0.0169)
Unemployment Rate	0.0009 (0.0008)	-0.0001 (0.0006)	0.0009 (0.0008)	0.0000 (0.0006)
% of Women at Childbearing Age who are Black	0.3866* (0.1136)	0.2643* (0.1192)	0.3762* (0.1162)	0.2481* (0.1174)
% of Hospitals Owned by the Government	-0.0011 (0.0060)	0.0012 (0.0029)	-0.0012 (0.0059)	0.0012 (0.0028)
Births per Woman at Childbearing Age	0.0735 (0.0516)	0.1569* (0.0754)	0.0716 (0.0525)	0.1587* (0.0780)
Women Density	0.0000 (0.0002)	0.0025 (0.0020)	0.0000 (0.0002)	0.0027 (0.0020)
Ratio of the Elderly to Population	0.2020 (0.0741)	0.0268 (0.1084)	0.1999 (0.1768)	0.0294 (0.1097)
Population (in 10,000s)	0.0017 (0.0015)	-0.0139 (0.0110)	0.0017 (0.0016)	-0.0144 (0.0123)
<i>Time Trend</i>				
Year 1990	0.0322* (0.0127)	-0.0051* (0.0026)	0.0331* (0.0123)	-0.0034 (0.0030)
Year 1995	0.0432* (0.0150)	0.0036 (0.0039)	0.0441* (0.0141)	0.0046 (0.0043)
Year 2000	0.0463* (0.0169)	0.0006 (0.0054)	0.0489* (0.0176)	0.0007 (0.0054)
Year 1990 * rural	-0.0371* (0.0133)		-0.0374* (0.0124)	
Year 1995 * rural	-0.0414* (0.0155)		-0.0414* (0.0146)	
Year 2000 * rural	-0.0494* (0.0156)		-0.0497* (0.0156)	
Number of Observations	0.860	0.718	0.860	0.718
R ²	0.860	0.718	0.860	0.718

Notes:

- 1) Columns (1) and (3) are estimations based on all counties.
- 2) Columns (2) and (4) are estimations based on rural counties only.
- 3) Standard errors are reported in parenthesis below the estimates.
- 4) Standard errors reported assume arbitrary correlations between errors within a state.
- 5) Both models include county fixed effects.
- 6) * and ** denote statistical significance at 5% and 10% level respectively.

Chapter 7 Conclusions

From the mid-1980s to the year 2000, the proportion of counties in the US that did not have medical care provided by a local hospital increased from 16 percent to 20 percent as a result of a steady decline in the total number of hospitals. Meanwhile, the average number of beds per hospital fell by 17 percent from 200 in 1985 to 166 in 2000. The decline in medical care provided by hospitals has had a more pronounced effect on certain types of services such as obstetrics. From 1985 to 2000, the number of hospitals that provided obstetric services dropped by 23 percent. As a result, more than one-third of counties in the US lacked hospital-based obstetric services in 2000, significantly more than the one-fifth of counties without hospital-based obstetric services in 1985. Health researchers and policy-makers are concerned that the persistent decline in the provision of hospital-based obstetric services may have led to a critical lack of access to obstetric services in some geographic regions, especially rural areas.

While a variety of factors may have played a role in hospitals' decisions concerning whether or not to operate an obstetric facility, in recent years rapid increases in medical malpractice premiums and a reduction in the supply of malpractice insurance underwriting services have received much public attention. Health care providers have often attributed changes in their practice patterns to pressures arising from medical malpractice litigation, which suggests that some providers may practice defensive medicine. In response to rapid premium increases, health care providers have called for tort reforms to mitigate liability pressure.

Our study examined the relationship between state-level medical malpractice reforms and whether a county had hospital-based obstetric services, in order to provide

empirical evidence on 1) whether or not hospitals practiced negative defensive medicine; and 2) whether or not certain types of tort reforms were effective tools in increasing the availability of obstetric services by hospitals. We examined caps on total, non-economic and punitive damages as well as rules requiring the mandatory offset of collateral source and periodic payment arrangements. Our county-level panel data covered four five-year intervals from 1985 to 2000.

After controlling for confounding factors such as time-variant county socioeconomic characteristics, time-invariant county characteristics and time trends that are uniform across all counties, we found limited evidence that some tort reforms may increase the likelihood that women have access to obstetric services provided by hospitals in their home county. The mandatory offset of the collateral source rule (hereafter referred to as the ‘offset rule’) and caps on total damages have the most notable impact on the provision of obstetric services by hospitals in a county; an additional year with the offset rule or a cap on total damages in effect over the five most recent years increases the probability of a county having hospital-based obstetric services by 0.6 and 0.5 percentage points, respectively. Caps on non-economic damages have about half the impact of that of caps on total damages, while caps on punitive damages and periodic payment arrangements appear to have little effect on the probability that a county has hospital-based obstetric services available. If all counties had adopted the rule in 1996 and kept it in place for five years, our model predicts that 60 additional counties would have had at least one hospital that provided obstetric services in 2000. As a result, an additional 1.7 percent of women of childbearing age would have had access to hospital-based obstetric services in their home county. Since fewer counties actually had caps on

total damages in place between 1996 and 2000, the predicted net effect of having had caps on total damages in place in all states would have been greater than that of the mandatory offset rule; 2.3 percent more women would have had access to hospital-based obstetric services in 2000 if all states had imposed caps on total damages from 1996 to 2000. Nationwide caps on non-economic damages over the same five-year period would have increased the fraction of women with access to hospital-based obstetric services in their home county by 0.9 percent.

These results suggest that the effects of direct reforms on access to hospital-based obstetric services are modest. However, direct reforms appear to have a relatively larger impact in rural counties than in non-rural counties. Results from our multivariate analysis limited to rural counties suggest that a rural county in a state that enforced the offset rule, a cap on total damages or a cap on non-economic damages in one of the five most recent years is respectively 0.76, 0.53, and 0.27 percentage points more likely to have at least one hospital that provides obstetric services than an otherwise equivalent rural county in a state that did not impose a reform. Given the percentage of rural counties that did not have hospital-based obstetric services and the number of women of childbearing age in these counties in 2000, the estimated coefficients imply that if all states had imposed the offset rule from 1996 to 2000, the total number of women of childbearing age in rural counties with access to local hospital-based obstetric services would have increased by 2.5 percent; if all states had imposed caps on total damages the number would have increased by 2.4 percent and if all states had imposed caps on non-economic damages the number would have increased by 1.0 percent. However, it should

be noted that the estimated coefficients are not statistically significant at the conventional levels when we adjusted for arbitrary correlation across errors within a state.

Our results on the effects of direct reforms are reasonably robust to different specifications of the reform variables. In an alternative version of our model, we included each reform as two dummy variables, one for whether or not the reform was in effect in the study year and one for whether or not the reform was in effect four years prior to the study year. Results from this model indicate that the effects of direct reforms except caps on punitive damages strengthen with the length of time that they have been in place. A county with a reform for at least five years is more likely to have hospital-based obstetric services than a county with the same reform for at least one year. When we extended the time horizon used to define reform variables in our main model from five years to ten years, we found evidence that the marginal effect of an additional year of caps on total damages and the offset rule may diminish over time after having been in effect for five years. In contrast, caps on non-economic damages appear to continue to increase the probability that a county has hospital-based obstetric services more than five years after they are introduced. When we examined the three types of caps on damages as a group, we found that the marginal effect of having at least one of the caps on damages for an additional year in the five prior years was only about half that of having an offset rule and/or a periodic payment arrangements requirement.

Since hospital-based obstetric facilities are only one of the many providers of obstetric services to women, we also assessed the impact of tort reforms on the supply of office-based obstetric services and the availability of specialized care provided in neonatal intensive care units at the county level. As in the case of the provision of

hospital-based obstetric services, the number of OB/GYNs and family practitioners per woman of childbearing age in a county appears to be positively affected by the presence of offset rules and caps on total damages. For this measure of access to obstetric care, estimated coefficients associated with offset rules and total damage caps were statistically significant at the 5 percent level ($p \leq 0.05$). Our model predicts that if a state imposed the offset rule for five years, counties in the state would see about 1.7 more OB/GYNs or family practitioners per 10,000 women of childbearing age than comparable counties in a state where no mandatory offset of collateral source rule was imposed. If a cap on total damages were imposed counties in the state would see about 1.1 more OB/GYN/s or family practitioners per 10,000 women. Given that the average number of OB/GYNs and family practitioners per 10,000 women of childbearing age per county in 2000 was 15.3, these differences are sizable. Our findings are broadly consistent with those of Encinosa and Hellinger (2005), which provide similar evidence that direct reforms (specifically, caps on non-economic damages) increase the supply of OB/GYNs. However, the effects of caps on non-economic damages in our analysis were only about one-tenth the magnitude of those of caps on total damages and the estimate was not statistically significant at the conventional levels. The difference in the findings concerning the impact of caps on non-economic damages between our study and the Encinosa and Hellinger study provides evidence that omitting caps on total damages in the multivariate analysis in the Encinosa and Hellinger study may have led to bias in their estimates of the effects of caps on non-economic damages.

Our analysis on the provision of NICU care at the county level indicates that the probability that a county has NICU care is most affected by caps on punitive damages

when all counties, both rural and urban, are studied together. When only rural counties are considered, however, caps on total damages appear to have a bigger impact, but the estimated coefficients associated with these reforms are not statistically significant. The magnitudes of the coefficients for direct reforms are small. For example, if a cap on total damages were imposed on a rural county for five years, the probability that at least one hospital in the county would provide NICU care would be increased by only 0.5 percentage points. However, since the fraction of counties having NICUs was low in our study period, especially in rural counties, 0.5 percentage point amounts to 18.5 percent of the probability that a rural county had NICU care in 2000.

We also examined how direct reforms influence the county-level supply of medical care in general. We found that direct reforms have a smaller influence on the ratio of the total number of physicians in active care to residents than on the ratio of OB/GYNs per woman of childbearing age. The estimated coefficients associated with caps on total damages are statistically significant at the 5 percent level both when rural counties were studied separately from or combined with non-rural counties. The estimated coefficients associated with the offset rule are only statistically significant at the 5 percent level when we limit our analysis to rural counties. Our model predicts that having a cap on total damages in place for five years would increase the supply of physicians per 100,000 residents by 6, which is equivalent to 5 percent of the average number of physicians per 100,000 residents in 2000. The difference in the magnitudes of the impact of direct reforms on physicians in general and OB/GYNs and family practitioners is consistent with our hypothesis that if OB/GYNs and family practitioners

are among the hardest hit by medical malpractice pressures, they should expect to benefit more from measures that alleviate liability pressures.

In summary, results from our multivariate analyses provide some evidence that hospitals practiced negative defensive medicine in the provision of obstetric services. Direct reforms, especially the offset rule and caps on total damages, increase the supply of hospital-based as well as office-based obstetric services and their impact is relatively larger in rural areas than in non-rural areas. Since caps on total damages are particularly controversial because they limit economic damages such as medical expenses and lost wages arising from malpractice, the mandatory offset of collateral source rule may serve as a better candidate for tort reforms that aim to improve access to obstetric care. However, there are several reasons for caution in drawing policy conclusions from this analysis.

First, many of the estimated coefficients associated with direct reforms in our multivariate analysis are not statistically significant at conventional confidence levels after adjusting for arbitrary correlations across errors within a state. While the estimated parameters are informative, they lack sufficient precision to imply firm conclusions concerning the effects of tort reforms on the availability of hospital-based obstetric services or NICU care at the county level. In most cases, we cannot reject the hypothesis that reforms had no effect on the measures of access to care examined in our study. Notable exceptions are the coefficients associated with the offset rule and caps on total damages in our analyses of the supply of OB/GYNs and family practitioners and the supply of all physicians.

It is worth noting that if we had not adjusted the standard errors for arbitrary correlation across errors within states, the estimates of the effects of the offset rule and caps on total damages on the likelihood that a county had hospital-based obstetric services would both have been statistically significant at the 5 percent level. This suggests that the Encinosa and Hellinger (2005) study, which is also a county-level study but did not adjust for arbitrary correlation across errors within states, may have understated the standard errors and thus overstated the statistical significance of their estimates.

Second, omitted variables may lead to biased parameters estimators. Although the distribution of power in state legislative and executive bodies between political parties may play a major role in the passage of tort reforms,¹²² it is also possible that lack of access to care may lead to intense lobbying and thus the adoption of tort reforms in a state. To the extent that omitted variables other than time-invariant county characteristics, observable time-varying county characteristics and nationwide time trends affect both access to care and the introduction of tort reforms, our estimators for the effects of tort reforms may be biased.

Third, we focused on whether a county had at least one hospital that provided obstetric services in our study period. This is a narrow measurement of hospital-based obstetric care. Because of poor data quality with respect to the variable measuring the number of obstetric beds in the AHA annual databases, we were not able to examine the effect of tort reforms on hospitals' total capacity for providing obstetric services. Therefore, while our findings indicate that counties in reform states may be more likely to have hospital-based obstetric services available, they do not provide evidence on the

¹²² Kessler and McClellan, *Do Doctors Practice Defensive Medicine?*

difference in the quantity of hospital-based obstetric services between counties in reform and non-reform states.

Our findings point to a number of areas that would benefit from additional research. Finding and making use of more data points would help to improve the precision of the estimates in the multivariate analyses. It would also be useful to examine the impact of tort reforms on a broader set of measures of hospital-based obstetric care, such as the number of beds designated for obstetric services or the level of obstetric procedures provided by a hospital's obstetric unit. Since more complex obstetric procedures are more likely to result in adverse outcomes that could lead to malpractice lawsuits, one would expect that, all else equal, hospitals that provide services for all serious complications and abnormalities related to labor and delivery would behave differently from those that only provide services for uncomplicated maternity and newborn cases. It would therefore be useful to study whether tort reforms affect the provision of complicated obstetric procedures more than that of low-level obstetric procedures.

Counties are relatively arbitrary geographic units, so whether or not a county has hospital-based obstetric services may not be the accurate measure of access to care. Future research, therefore, could improve on this study by employing more direct measurements of access to hospital-based obstetric care, such as the average travel distance to hospital-based obstetric services approximated by the distance between the county population centroid and the nearest hospital that has an obstetric facility. In addition, as by definition, negative defensive medicine exists when liability pressure leads to a reduction or elimination of care that adversely affects health outcomes, future

research could study the effects of direct reforms on health outcomes for women and their babies to examine the existence of negative defensive medicine in the provision of obstetric services more thoroughly. In the case of obstetric care, however, empirical analyses may be unlikely to detect negative defensive medicine even if it does exist, as the frequency of adverse outcomes is very low.

While it is important to examine the impact of tort reforms on access to obstetric care, it will be useful to study the mechanism through which such an impact takes place. Research of the effects of tort reforms on hospitals' decision on entry and exit and the effects of tort reforms on hospitals' decision on whether or not to provide obstetric services conditional on their staying in operation will fill this gap. Such an analysis should jointly model hospital closings and openings and whether or not hospitals provide obstetric services.

One possible reason that we did not find firm evidence on the effectiveness of direct reforms may be that we have not adequately controlled for differences in the characteristics of reforms introduced in different states. For example, caps on non-economic damages range from \$250,000 to \$1 million. It is reasonable to expect that higher caps have less of an impact on liability pressures than do more stringent ones. Some studies have examined the percentage of malpractice verdicts against physicians in California that were reduced in size by various reforms under MICRA.¹²³ However, no research has been done on how malpractice claims against hospitals are affected by different types of tort reforms. Future research in this area will provide valuable insights into why some reforms reduce liability pressures perceived by hospitals while others do

¹²³ Pace, Golinelli and Zakaras, *Capping Non-Economic Awards in Medical Malpractice Trials California Jury Verdicts Under MICRA*, 9-115.; Studdert, Yang and Mello, *Are Damages Caps Regressive? A Study of Malpractice Jury Verdicts in California*, 54-67.

not. Meanwhile, experimenting with categorizing reforms by the likelihood they bind in malpractice claims, such as by grouping caps on damages into those with a limit of \$250,000 and those with a higher limit, may shed light on the potential differential effects of reforms on access to hospital-based obstetric care.

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