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THE EFFECTS OF MALPRACTICE TORT REFORM OF DEFENSIVE MEDICINE

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INTRODUCTION

Medical malpractice crises occur across states to differing degrees, thus the proposed changes in state tort reforms differ accordingly. The primary overt goals of tort reform aim to address: rising medical malpractice insurance rates, increased frequency and severity of awards, and the increased incidence of doctors shuttering offices or fleeing states due to untoward malpractice environments. A secondary goal of tort reform is to reduce health care costs attributed to malpractice costs. Clearly, as malpractice tort reforms are debated in state capitols and reforms take place, the effects of the reforms on the goals above can be examined. However, there is an often ignored implication of reform requiring attention. How do reforms affect doctors' decisions and behaviors in treating patients? Specifically, do doctors change their behavior as the malpractice environment changes, and if so, do these changes affect health care costs? Given the variety of state tort reforms occurring over the last several years, we can examine how each one affects health care costs attributed to changes in physician behavior.

Since the early 1970's economists, lawyers, and many within the medical community have debated the existence of defensive medicine. Using the Office of Technology Assessment the definitions (OTA, 1994), positive defensive medicine occurs when physicians order additional tests or procedures primarily to avoid malpractice liability. Negative defensive medicine occurs when doctors avoid certain patients or treatments chiefly out of concern for malpractice liability. The thrust of this paper deals with positive defensive medicine. Given different malpractice environment across states, we witness variations in positive defensive medicine practices leading to differences in health care expenditures.

The plan of the paper is as follows. First, we note the existence of defensive medicine. Next, we discuss malpractice tort reform across states. Lastly, we show which reforms have demonstrable impacts on defensive medicine and therefore on health care expenditures.

PREVIOUS STUDIES OF DEFENSIVE MEDICINE

There are three methods to assess the existence of defensive medicine, and all three have demonstrated its prevalence. In the first method, physicians are asked to estimate how often they order additional tests and procedures or avoid certain patients. Hickson et al (1998) found 80% of pediatricians surveyed practiced positive defensive medicine. OTA (1994) summarized findings of sixteen surveys and revealed anywhere from 21 to 81 percent

of physicians contended they ordered additional tests out of fear of litigation. Most recently, the Philadelphia Inquirer (2005) reported the Pew Charitable Trust, working on the Project on Medical Liability in Pennsylvania, found 93% of 824 physician respondents in six high risk specialties indicated they practiced positive defensive medicine.

The second method uses physician surveys to assess physician actions given specific hypothetical clinical situations, thus enabling focus on physician specialties and clinical scenarios in which defensive medicine is a concern. In 1993, the OTA conducted clinical surveys of obstetricians, gynecologists and surgeons and revealed the percentage of respondents who chose "malpractice concerns" as the primary reason for administering a clinical action ranged from 4.9% for back pain scenario to 29% for head trauma, with an average of 8% across the study (OTA, 1994). The estimated aggregate cost of defensive Cesarean deliveries was \$8.7 million in 1991, compared to the aggregate cost of defensive diagnostic radiology of the head for American ages 5 to 24 to be \$45 million (OTA, 1994).

The third method, health care utilization studies, mitigates the biases associated with the hypothetical nature of the above physician surveys. Patient hospital records are linked to patient health status, hospital demographics and geographic considerations to assess the utilization and cost of defensive tests. Here, the data are real, not hypothetical, thus avoiding possible bias in the physician responses. Additionally, since information is kept on each patient, the sample size can be extensive and robust. Localio et al (1993) found in the case of Cesarean deliveries, patients in a hospital with high frequency obstetric malpractice claims were 32% more likely to undergo a Cesarean delivery than patients in a hospital with low claim frequency. Kington (1994) and Baldwin et al (1995) also witnessed defensive medicine in obstetrics practices.

LEGISLATURES ENACT TORT REFORM IN RESPONSE TO MALPRACTICE CRISES

Literature on malpractice has identified two periods prior to today in which the malpractice system was in crisis: one in the mid-1970's and one in the 1980's. Both led to significant increases in malpractice premiums and heightened concerns of doctors and hospitals. In response to the crises, some states enacted tort reforms. The goal of reform following the 1970's crisis was threefold. Legislators wanted: to make it more difficult for plaintiffs to bring non-negligent suits to trial; to define standards of care and consent; and, to limit the total costs associated with plaintiff awards for successful suits (Barker, 1992).

Several indirect reforms, those indirectly affecting monetary awards, were enacted. Prior to 1970, most states had statute of limitations with discovery rules, indicating statutes did not begin until after the injury was discovered. By allowing claims to be filed several years after the date of injury, it contributed great uncertainty to malpractice insurance pricing. To reduce uncertainty, 34 states shortened their statute of limitations. Most statute reforms reduced the total limitations period to 2-3 years and decreased the length of time permitted for injury discovery (Barker, 1992.)

Another indirect reform concerned the doctrine known as *res ipsa loquitur*, "the thing speaks for itself." This doctrine originally permitted juries to infer negligence based on the premise the defendant has exclusive control over the instrument causing injury, and that the instrument does not injure when used in a non-negligent manner. Reforms of this doctrine defined circumstances under which the doctrine applied. Similarly, many states defined the standard of care physicians were expected to provide. By defining acceptable standards of care, legislators essentially codified professional standards into a legally binding form rather than an honor code.

There were also several reforms enacted to limit malpractice awards directly. After 1975, nine states enacted reforms capping malpractice awards values; seven of the states capped total

damage awards while two states capped only non-economic damages of pain and suffering (Barker, 1992). Several states created Patient Compensation Funds (PCF). Physicians in these states were responsible for awards up to a certain dollar amount, after which the PCF paid the remainder. Modification of the collateral source rule was another direct reform enacted. Originally, this rule prohibited evidence of collateral award sources to be introduced to the jury. Reform allowed juries to consider, and sometimes mandated, juries to lower awards when plaintiffs had collateral award sources. These collateral sources could include other physicians, hospitals or insurance companies. By enacting such reforms, plaintiffs could no longer receive duplicate malpractice awards from multiple sources.

To reduce costs associated with litigation, three major reforms were enacted. First, some states mandated pretrial screening requiring potential cases screened by a panel before proceeding to trial. Cases deemed unworthy did not reach trial, thus eliminating unnecessary trial expenses. Thirteen states created provisions for arbitration, either voluntary or mandatory, between pretrial discovery and trial to eliminate expenses associated with trial (Barker, 1992). Under mandatory arbitration, third party decisions were binding and could not be appealed. A third reform capped contingency fees for attorney representation, limiting the percentage of the award collected by lawyers following successful trials.

An alternative way of classifying reforms is by the impact they have on physician behavior, either directly and immediately or indirectly over time. The likelihood of a physician making a payment in a case of presumed negligence is the probability of being sued times the magnitude of the award. We categorize reforms reducing the likelihood of being sued, thus the frequency of being sued, as direct impacts since they will immediately alter physician behavior. There are four primary tort reforms that can directly impact behavior: use of arbitration boards, introduction of pre-trial screening, restricted contingency fees and statute of limitations reductions. If physicians believe their actions will be reviewed by objective experts to determine if negligence occurred, they will be less inclined to practice defensive medicine, regardless of the size of the award. Restricting contingency fees will reduce the likelihood of being sued because attorneys will more carefully scrutinize which cases to contest. Reducing the statute of limitations reduces the probability of being sued by limiting cases to timely observable injuries or deaths.

Other reforms reduce the expected awards to claimants or severity of the claim, thus the expected payout by the physicians, and we categorize these as indirect impacts. Since doctors have malpractice insurance, the payout is generally paid by the insurance company leaving small, if any, out-of-pocket expenses by the physicians. This suggests less immediate changes in behavior by doctors due to the third party payment. Though large insurance payouts lead to higher future malpractice premiums for doctors, this out-of-pocket expense is incurred over time and leads to changes in behavior over a longer time period, such as doctors leaving practices or states. Capping damages, instituting collateral source rules, creating PCF's, allowing for periodic, not lump sum, payments and sharing blame through joint and several liability clauses will reduce the severity of the claim's award and alter physician behavior indirectly.

LINKING DEFENSIVE MEDICINE AND TORT REFORM

Kessler and McClellan's (1996) study examined how tort reform and malpractice environments impact defensive medicine. The authors used longitudinal data on Medicare patients from 1984, 1987, and 1990 who were treated for acute myocardial infarction (AMI) and new ischemic heart disease (IHD). They compared hospital expenditures, holding health outcomes constant, across states with tort reform to those without reform. Hospital expenditure growth was 2-6% lower in reform states for AMI with slightly greater differences for IHD. Expenditures in states adopting direct reforms, those designed to reduce awards,

declined 5.3% relative to non-reforming states and expenditures in states with indirect reforms increased 1.8% relative to non-reforming states. Overall, their results show direct reforms reduce expenditure growth without increasing mortality while indirect reforms have no substantial effects on expenditure or mortality.

METHOD

We develop a healthcare utilization multiple regression model to discover how state malpractice environments influence the practice of positive defensive medicine. The scope of the study is limited to patients aged 18-65 with skull fractures, since skull fractures are associated with a high level of risk and uncertainty, making it likely defensive medicine occurs. We contend reductions in state malpractice pressures will diminish the level of defensive medicine associated with these patients and result in substantial cost savings. Unlike Kessler and McClellan's (1996) use of direct or indirect reforms, we study the individual impacts of twelve reforms. We examine how much of an impact the reforms have on defensive medicine according to our taxonomy of direct versus indirect impact on physician behavior.

An interview with surgeon Dr. Stanton Miller (2003) highlights how defensive medicine occurs with head trauma patients. He contends generally the only tests needed to evaluate a patient admitted with a head injury are a comprehensive neurological exam along with a comprehensive examination of the rest of the body. However, due to fear of liability, physicians frequently order additional tests such as Computerized Tomography tests (CT scans) or Magnetic Resonance Imagery (MRI) tests. These tests have an approximate cost of \$400 and \$1,000 to \$1,500, respectively. Physicians may also call neurologists in for consultations, tacking on another \$250 to the bill. Finally, if a physician suspects that a patient has a traumatic head injury, he or she will probably put the patient in the Intensive Care Unit overnight (\$2,000+) so that the patient's neurological conditions can be monitored for internal bleeding and other injuries (Miller). Thus, a patient treated for a head injury may have over \$3,500 in additional charges due to defensive medical practices.

The dependent variable, total patient expenditures, is used as a means of assessing the level of defensive medicine practiced in each state. To distinguish the effect of state malpractice environmental factors from other factors contributing to variations in patients' total expenditures, independent variable vectors accounting for patient and hospital demographics have been included. Dummy variables for various tort reforms serve as identifiable measures of differences in state malpractice environments.

Variables within the patient and hospital demographic vectors can account for differences in patients' hospital expenditures. Though each variable will have its own individual impact on charges, each can be held constant to examine the individual role of tort reform on total charges. For example, patient's length of stay, number of diagnoses, and number of medical procedures positively impact charges, but these can be held constant serving as control variables to assess the tort reform impacts. The other general patient demographics are age, gender, patient income and payment source. The hospital demographic vector includes variables describing hospital control, size, location, and teaching status.

Twelve dummy variables for various tort reforms are used in the model, as shown in Tables I and II. We hypothesize physicians working in states with tort reform that directly or indirectly impacts physician behavior will practice less defensive medicine than their counterparts in non-reform states, leading to less total patient expenditures. Thus, the tort dummy variables are expected to have negative regression coefficients.

DATA

The data come from two sources. Information on total patient expenditures, patient demographics, and hospital demographics, for patients who had primary, secondary, or tertiary diagnoses of skull fractures are derived from the 2000 Nationwide Inpatient Sample, part of the Healthcare Cost and Utilization Project sponsored by the Agency for Healthcare Research and Quality.¹ This data set contains 7,450,992 inpatient hospital stays from 994 hospitals in 28 states. To make patients as similar as possible, several restrictions are placed on the patients considered in this study. Age is restricted to patients 18 to 65 old for two reasons. First, minors are eliminated because they are subject to different malpractice statutes of limitations in many states. Second, the elderly are eliminated because literature on malpractice suits has shown that successful elderly claimants are awarded low dollar amounts due to their lesser life expectancies. We eliminated outliers for length of stay and number of diagnoses; we only chose patients with fewer than eleven days in the hospital and fewer than eleven diagnoses with their hospital encounter. The total charges obtained from the NIS were deflated by regional or state CPIs to account for variations in the price of medical care services.² Due to restrictions and missing data, our sample size is limited to 23 states and approximately 3492 patients.

The second source of data used for state tort laws come from the American Medical Association Advocacy Resource Center's state law charts on liability reform. Dummy variables for the malpractice tort laws listed in Table I are created for each state and are presented in Table II. The statute of limitations variable is the maximum number of years during which a claimant can commence a medical liability action. Due to lagging time effects between when reforms are enacted and when physicians behaviorally respond to these reforms, a two-year window of time is permitted for each reform. Hence, reforms enacted after 1997 are not considered in this analysis of 2000 patient data.

¹ The diagnoses codes for skull fractures are based on the ICD-9CM codes valid for the patient's discharge date and include: 800.00-800.99 (Fracture of skull vault), 801.00-801.99 (Fracture of skull base), and 803.00-803.99 (Other and unqualified skull fractures). Information on ICD-9-CM codes was obtained from a topsSearch ICD-9 Trial on e-mds.com and UMEA University's online directory of ICD-9-CM International Coding Standard.

² Kansas was selected as the base state in this analysis because of its baseline number of malpractice tort reforms. CPI data for the year 2000 were obtained from the Urban Consumer Series "All Items" CPI index available on Bureau of Labor Statistics' website. If data for a metropolitan area within a given state were available or the state was cited as having a CPI value corresponding to a metropolitan area in a nearby state, this CPI value was used. If data for several metropolitan areas within a state or corresponding to a state were available, the average of these values were used. For states in which there were no corresponding metropolitan areas associated, the regional (Northeast, Midwest, South, or West) "All Items" Urban CPI value was used. This method of CPI base lining is the best approximation that can be made, given the limited amount of CPI information available for locations around the nation.

Table I: Malpractice Tort Laws Used in Analysis

Reform	Description of reform
Arbitration (Permitted)	Arbitration is permitted, but not mandated.
Arbitration (Mandatory)	Arbitration is mandated.
Pre-judgment	Claimants need to obtain a certificate of affidavit of merit within a certain amount of time in order to pursue medical liability action.
Contingency Fee Cap	The proportion of an award that an attorney can contractually charge is statutorily capped at a specific level.
Statute of Limitations	The maximum number of years (from incident occurrence, discovery, or the maximum time limit) during which a claimant can commence an action for medical liability
Collateral Source Rule Reform	Damages payable in a malpractice suit are statutorily reduced by all or part of the dollar value of collateral-source payments to the plaintiff.
Damage Caps (noneconomic or total damages)	Either noneconomic, total damages, or both types of damages are capped at a statutorily established dollar amount.
Damage Caps (punitive damages)	Punitive damages are capped at a statutorily established dollar amount.
Joint and Several Liability Rule Reform	The Joint and Several Liability rule is abolished either for noneconomic or total damages in all claims, such that damages payable in a malpractice suit are statutorily allocated in proportion to the tortfeasors' degree of fault.
Periodic Payment of Awards (Permitted)	Part or all of the damages are permitted to be disbursed in the form of an annuity that pays out over time.
Periodic Payment of Awards (Mandatory)	Part or all of the damages must to be disbursed in the form of an annuity that pays out over time.
Physician Compensation Fund	A state-administered excess malpractice liability insurance program exists for physicians.

Table II: State Tort Coding Matrix as of 2000

State	Arbit	PreJudge	ContFeeCap	StatLim	CollSoRef	DamCap	JntSevL	PeriodPay	PCF
AZ	0	0	0	2	1	0	1	0	0
CA	1	0	1	3	1	1	0	1	0
CO	1	1	0	3	1	1	1	2	0
CT	1	0	1	3	1	0	1	1	0
FL	1	1	0	4	0	0	1	1	1
IL	0	1	1	4	1	0	0	1	0
KS	1	1	0	4	0	1	1	1	0
KY	0	0	0	1	0	0	1	1	0
MA	0	0	1	7	1	1	0	0	0
MD	2	1	0	5	0	1	0	1	0
MO	0	1	0	10	0	1	0	1	0
NC	2	0	0	4	0	0	0	0	0
NJ	0	1	1	2	1	2	1	0	0
NY	1	1	1	2.5	1	0	1	2	0
OR	0	0	1	5	0	0	0	0	0
PA	1	0	0	7	0	2	0	1	1
SC	1	0	0	6	0	0	0	0	1
TN	1	0	0	3	1	0	1	0	0
TX	1	1	0	2	0	2	1	0	0
VA	2	0	0	2	0	1	0	1	0
WA	2	0	0	8	1	0	0	1	0
WI	1	0	1	5	1	1	1	1	1
GA	1	1	0	5	0	2	0	0	0

STATE TORT CODING KEY *

*All reforms took effect in prior to 1998 in order to allow for lag time between tort reform enactment and physician behavior change.

Arbitration:

Arbit= 0 if there are no provisions for arbitration.

Arbit= 1 if there arbitration is permitted (voluntary) .

(In regression analysis transformed to: ArbitVol= 1.)

Arbit= 2 if their arbitration is mandatory .

(In regression analysis transformed to: ArbitMand= 1.)

Pre-judgment measures:

PreJudge= 0 if claimants do not need to obtain a certificate/affidavit of merit within a certain amount of time in order to pursue a medical liability action .

PreJudge= 1 if claimants must (mandated) file a certificate/affidavit of merit within a certain amount of time in order to pursue a medical liability action .

Contingency Fee Caps:

ContFeeCap= 0 if contingency fees are not capped (This includes HI, IA, and WA where courts must approve/determine reasonable contingency fees.)

ContFeeCap= 1 if contingency fees are capped.

Statute of Limitations:

StatLim= #. This number is the maximum number of years (from incident occurrence or discovery) during which a claimant can commence an action for medical liability. In cases where there were different time limits for occurrence, discovery, or a maximum statute of limitations I have used the maximum time limit.

Collateral Source Rule:

CollSoRef= 0 if the collateral source rule is in effect (juries cannot consider claimants' external compensation sources).

CollSoRef= 1 if the collateral source rule has been reformed such that juries are permitted to consider claimants' external compensation sources.

Damage Caps:

DamCap= 0 if there are no caps on any type of damage award .

DamCap= 1 if there are caps on noneconomic/total damages. (In regression analysis transformed to: DamCapNT= 1.)

DamCap= 2 if there are caps on punitive damages only (In regression analysis transformed to: DamCapPun= 1.)

Joint and Several Liability Rule:

JntSevL= 0 if joint and several liability is in effect (joint tortfeasors are each responsible for the entire judgment)

JntSevL= 1 if joint and several liability has been reformed such that damages are allocated in proportion to tortfeasors' degree of fault)

Periodic Payment of damages:

PeriodPay= 0 if there are no provisions for periodic payments of damages

PeriodPay= 1 if periodic payment of damages is permitted, but mandated (In regression analysis transformed to: PerPayPerm = 1.)

PeriodPay= 2 if periodic payment of damages is mandated (In regression analysis transformed to: PerPayMand = 1.)

Physician Compensation Funds:

PCF= 0 if the state did not have a patient compensation fund in 2000.

PCF= 1 if the state had a patient compensation fund in 2000.

RESULTS

Ordinary least squares regression results correcting for heteroskedasticity using White's test are reported in Table III. The mean total charge for patients with skull fractures was \$21,127, in 2000 dollars, with an adjusted R-square of .49. Since the purpose of the paper is to evaluate the reform impacts, discussions of the numerous statistically significant control variables are not included.³ All but one tort reform, voluntary arbitration, have a significant impact on the practice of defensive medicine, though not all variables yield the expected signs on their coefficients.

Three of the four direct impacts indicate significant savings from tort reform. The reform with the largest negative coefficient, indicating the most important reform in terms of savings from reduced defensive medicine, is mandatory arbitration. Having a provision for mandatory arbitration reduces total skull fracture charges by \$12,177, a significant amount compared to the mean of \$21,127. This result supports the theory that physicians fear malpractice suits going to court and practice less defensive medicine when suits must first be assessed by an arbitration board. Interestingly, having a voluntary arbitration policy has no impact, implying the policy needs to have teeth to be effective. Similar to mandatory arbitration, pre-judgment measures reduce charges by \$5,174.99, implying physicians will practice less defensive medicine if states screen claims before they can proceed to court. It appears doctors practice significantly less defensive medicine knowing arbitration or screening boards cull through cases first. Lastly, enacting contingency fee caps, which presumably reduce the frequency of claims, reduce charges by \$4,534.50.

Three of the indirect impacts also reduce patient expenditures. Mandatory periodic payments reduce charges by \$7,842.91 suggesting physicians feel less threatened when payments are disbursed over time rather than a lump sum. The magnitude of this coefficient indicates it is the second most cost saving reform. Having physicians responsible for the same proportion of damages as their actions contribute in a medical liability case using joint and several liability rules significantly reduces charges by \$2,474.77. The existence of state PCF's reduces defensive medical care by \$1,856.49. These latter two reforms have less bang-per-buck as the direct impacts above.

Statute of limitation reforms have a significant, but unexpected, effect on total charges. For each additional year a patient is able to take medical liability action, there is a \$1,504.69 decrease in total charges for skull fracture patients. Theory predicts that allowing patients an additional year to take action will increase the volume of malpractice claims filed, thus cause physicians to practice more defensive medicine; if a physician knows that a patient has more years in which he or she can file a malpractice suit, then perhaps the physician orders more tests to protect from a suit claiming the proper standard of care was not met. Thus, although the length of time to bring a suit is significant, the real issue is the physician's risk of being sued. It is possible that a risk plateau or peak exists for statutes of limitations such that after a certain number of years, the probability of a malpractice claim being filed either plateaus or drops drastically. More research on the relationship between defensive medicine and statute of limitations reductions is needed before firm conclusions can be drawn.

Four indirect impact reforms show results in contrast with expectations. The collateral source rule, periodic payments, and damage cap reforms significantly increase total charges, suggesting more defensive medicine. Having a collateral source reform increases skull fracture

³ For example, Table III indicates for each additional day of hospitalization, total charges increase \$3,191.70, *ceteris paribus*. Similarly, each additional procedure increases total charges by \$3,716.70, whereas an additional diagnosis raises patient charges by \$191.68.

Table III: Regression Results (t-values in parentheses)^a

Variables	Coefficient Estimates ^b	Variables	Coefficient Estimates ^b
Intercept	-\$130.98 (-0.06)		
Patient Demographics		Malpractice Tort Law Reforms	
(AGE): Age	-\$130.98 (-0.83)	(ARBITVOL): Arbitration-Voluntary	\$686.81 (0.67)
(FEMALE): Gender	-\$17.34** (-2.71)	(ARBITMAND): Arbitration-Mandatory	-\$12,177.00*** (-10.40)
(MEDICAID): Medicaid Insurance	\$3,596.63** (2.85)	(PREJUDGE): Pre-judgment	-5,174.99*** (-6.18)
(PRIVATE): Private Insurance	\$30.30 (0.06)	(CONFEECAP): Contingency Fee Cap	-4,534.50*** (-5.27)
(TWENTYFIVE): Income \$25,000-34,999	-\$1,535.95 (-1.54)	(STATLIM): Statute of Limitations	-1,504.69*** (-8.98)
(THIRTYFIVE): Income \$35,000-44,999	-\$1,410.69 (-1.50)	(COLLSOREF): Collateral Source Rule	\$3,866.88*** (4.73)
(FORTYFIVE): Income \$45,000 +	\$1,841.90 (1.90)*	(DAMCAPNT): Damage Caps-Noneconomic/Total	\$2,584.30*** (3.97)
Patient Hospital Stay Demographics		(DAMCAPPUN): Damage Caps-Punitive	\$2,226.01** (2.01)
(LOS): Length of Stay	\$3,191.70*** (25.59)	(JNTSEVL): Joint and Several Liability	-\$2,474.77** (-2.69)
(NDX): Number of Diagnoses	\$191.68 (1.59)	(PERPAYPERM): Periodic Payment- Permitted	\$2,775.17*** (3.48)
(NPR): Number of Procedures	\$3,716.70*** (15.88)	(PERPAYMAND): Periodic Payment- Mandatory	-7,842.91*** (-5.32)
Hospital Demographics		(PCF): Physician Compensation Fund	-\$1,856.49** (-2.03)
(TEACH): Teaching facility	\$654.39 (0.64)	Adjusted R ² = 0.4862 Condition Index = 35.91244 Dependent Mean (total charges) = \$21,127	
(URBAN): Urban location	\$7,063.70*** (8.29)		
(URBAN): Large size	\$3,954.61*** (7.22)		
(PUBLIC): Public facility	\$2,686.13** (2.29)		
(VOLUNTARY): Non-profit facility	\$2,714.92** (2.00)		

Notes:

^a t-values were produced using White's consistent estimators of the variance.^b All coefficient estimates use 2000 dollars.

* Significance at the 10% confidence level; ** at the 5% level, *** at the 1% level

patient charges by \$3,866.88. Caps on non-economic or total awards increase charges by \$2,584.30, while caps on punitive damages increase charges by \$2,226.01. Permitting periodic payments increase total charges by \$2,775.17. A possible explanation for these results is they result from an endogenous relationship between tort reforms and the degree of state malpractice crises. Tort reforms are often enacted in states in reaction to a malpractice crisis occurring. These crises, often manifested through large annual physician malpractice premium increases that can lead to declines in practicing physicians, lead to reforms concerned with reducing the economic impact on physicians. All four indirect impacts noted above attempt to reduce doctor outlays. Thus, the significantly positive coefficients on these four variables may reflect this endogenous relationship between states in malpractice crises and the reforms they enact, and the fact that it takes time for the reforms to become effective. For example, as of 2000, Pennsylvania, New Jersey, Texas and Georgia, for states deemed in crisis by the American Medical Association, allowed caps on punitive damages only (American Medical Association, 2005). Additionally, total charges in these states are higher than average. The positive coefficients may reflect lingering crises effects that the reforms have not yet fixed.

CONCLUSIONS

There is strong evidence that variations in state malpractice environments significantly influence the level of defensive medicine practiced by physicians on skull fracture patients. Specifically, states enacting reforms directly impacting doctors' behavior witness reductions in patient expenditures on skull fractures. States requiring mandatory arbitration reduce charges on average by \$12,177, over half the mean hospital charge for skull fracture patients. Pre-judgment measures save \$5,175 on average. We contend these reforms most directly affect doctors' behaviors since doctors have more confidence in a system that eschews frivolous or unwarranted cases. Capping attorney fees save \$4,534 per skull fracture patient presumably by reducing the expected number of suits filed. Additionally, states mandating periodic payment of awards witness significantly reduced charges of \$7,843 per skull fracture patient, though we posit this indirectly, or less immediately, alters physician behavior. In contrast, damage caps and collateral-source rule reforms, designed to reduce out-of-pocket costs to physicians, do not reduce defensive medicine costs.

The results are consistent with some of Kessler and McClellan's (1996) findings, though contrary to others. Both studies find that joint and several liability rules and mandatory periodic payments reduce patient expenditures. Kessler and McClellan's (1996) results, however, show damage caps reduce expenditures, contrary to findings here. Danzon (1986) finds damage caps decrease claims severity, but not their frequency. If this is the case, then physicians do not perceive a reduced likelihood of being sued with damage caps in place and thus do not practice less defensive medicine, which would contradict Kessler and McClellan's findings. The positive coefficient on damage caps here is not inconsistent with Danzon, and as mentioned previously, the endogeneity between higher medical costs malpractice crises may best explain it.

Kraus (1996) estimates approximately 2 million head injuries occur each year. If only half are skull fractures for people aged 18-65 enacting mandatory arbitration could save over \$12 billion in skull fracture defensive medical practices. Considering this estimate represents savings from less than one percent of the total patient population, total defensive medicine costs across numerous injuries and illnesses are potentially tremendous.

Policy makers should seriously consider the impact of state malpractice tort reforms on the practice of positive defensive medicine to reduce health care expenditures. Those reforms directly impacting physician behavior offer enormous savings in skull fracture diagnoses. Given previous studies in obstetrics noting the existence of positive defensive medicine, it is likely a study such as

ours using obstetrics data would also find significant savings. Reforms designed to reduce the frequency or likelihood of frivolous lawsuits offer the greatest savings. Some reforms attempting to reduce the severity of awards, such as joint and several liability rules, mandated periodic payments and PCF's, offer lesser savings on average. Damage caps and collateral source rules do not appear to reduce positive defensive medicine, though they may impact physicians moving practices or avoiding certain types of practices.

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