The Relationship of Rates of Medical Diagnostic Imaging for Head Trauma as a Function of the Hostility of Medical Malpractice Environment

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CHAPTER 1 –

INTRODUCTION:

Health care expenditures in the United States have been steadily rising over the last half-century and an increasing percentage of the US GDP is being spent on the health care sector. Public sector and academic research interest has increased in hopes of elucidating the reasons behind the increased costs of care. One component of the growing health care bill maybe the cost of superfluous medical procedures spurred on by physicians' fears of malpractice litigation.

The issue of medical malpractice and the reform thereof has been brought to the forefront of national attention, as evidenced by cover stories in two prominent newsmagazines: Newsweek – Lawsuit Hell: How Fear of Litigation is Paralyzing Our Professionals[1] and Time – The Doctor is Out[2]. The American Medical Association has declared tort reform its number one legislative priority, and President Bush has made it a leading policy concern. Because so much of this topic is marred with political motivations, it is important for research to provide empirical evidence of the impact of the medical malpractice environment on the health care system.

Health care providers describe a system disfigured with unaffordable malpractice insurance premiums, unpredictable court trials, and further detrimental implications to the public health. Jury awards have risen dramatically. The median medical liability award grew 11% from 1996 to 2002, topping $1 million; the average award in 2001 was $3.9 million and a year later, in 2002, it had risen to $6.2 million dollars.[3] The US Government Accountability Office (GAO), a non-partisan Congressional office, has identified the increased payouts in medical malpractice claims as the primary driver for malpractice insurance premium increases.[4] Nationally, emergency physicians have seen their liability insurance rates increase 56.2% from 2002 to 2003, neurosurgeons a

35.6% increase from 2001 to 2002, and general surgeons a 25% increase from 2001 to 2002.[5] Particular regions of the country have experienced more dramatic increases in premiums than others. General surgeons in Dade County, Florida saw their premium rates increase by 175% from 1999-2002, to nearly $175,000 per year;[6] 2004 premiums are over $277,000 for these same practitioners.[7] This suggests an irrationality of the system; such large increases in awards and premiums are not reflective of changes in physician competence and quality of care over the span over a year. The perversions of such a system can lead to decreased access to care and increased costs of medical care, which will be addressed in following sections.

Widespread debate has been held to address these concerns and the political battles can be as interesting as the policies themselves. This paper will just touch on the politics to provide the reader a glimpse into the political climate surrounding this debate. Having a taste for the political environment can help the reader to understand these policy proposals in a relevant context.

Various states have attempted tort reforms; some attempts have been more successful than others. For example in 1975, California instituted its Medical Injury Compensation Reform Act (MICRA) law, which has remained on the legal statute since. In 1987, Oregon passed its own set of tort reforms but in 1999 had them struck down as unconstitutional by the Oregon Supreme Court.[8] In 1977, Texas' legislature approved tort reform, which later the Texas Supreme Court deemed unconstitutional. In 2003, Texas attempted tort reform again, but Texas voters preemptively avoided judicial strike down of the law by passing Proposition 12 ratifying an amendment allowing such restrictions on lawsuits.[9] The current patchwork of tort reforms and inconsistencies of policy by state has led Congress to consider standardized federal legislation.

The most recent political consideration of tort reform occurred in the 108th Congress. MICRA-like reforms have been proposed, passed through the House of Representatives thrice, with the promise of Presidential approval. The Senate has killed consideration of this issue by failure to approve cloture, despite an indicated 49-48 vote in favor of adoption.[10] Even the liberal Senator Feinstein of California has attempted to cross the aisle to work with the conservative Senator Frist of Tennessee for a bipartisan version of tort reform, only to be vilified and lobbied against by both the trial lawyers' and physicians' interest groups.

Support and opposition for tort reforms generally parallel party lines. Democrats side with trial lawyers, who for reasons of economic self-interest are anti-tort reform. Rather Democrats blame insurance companies, i.e. big business, for the problems of today's malpractice system. Some cite incompetent doctors, and a few "bad apples" that other competent doctors end up propping up. However, most have faith in the profession, or at least see it as politically imprudent to attack it, and avoid such lines of argument. Ideologically, Democrats cite infringement on access to courts and claim that tort reform policies hurts those of vulnerable populations, who only have the court systems to fight political juggernauts and economic behemoths. Republicans side with doctors and insurance companies. The GOP believes trial lawyers are self-interested and in the process increase the costs of doing business and practicing medicine. Generally, Republicans side with insurance companies, who are large businesses, because of their strong ideological support for free and efficient markets. It is not clear if doctors are allied with Republicans in this battle because of mutually shared values, or whether it is coincidental that their incentives are aligned with the insurance companies and hence with Republicans. Are doctors merely caught in this political crossfire?

The public at-large has, too, been tuned into this battle and has formed its own opinions on the topic. A public opinion poll conducted by the Kaiser Healthcare Foundation and the Gallup Organization found that three-quarters of Americans surveyed believe that the medical malpractice issue was at least a major problem. The survey further found out that more than 7 out of 10 Americans supported proposed tort reforms, and 6 in 10 think that too many patients bring lawsuits against their doctors.[11]

The following is a review of the literature beginning with a discussion of the theory and intent behind the current system, its shortcomings, the consequences and implications of these failures, empirical evidence of such claims, and proposed solutions to the US medical malpractice liability system.

THE CURRENT TORT SYSTEM AND ITS LIABILITIES:

The American medical malpractice legal system is a specialized branch of tort law. A tort is a civil and non-contractual wrong done to another person or group of persons. That is, an aggressor in a bar fight and a negligent physician when prosecuted are tried under similar lines of argument. As with all civil suits, the liable compensates the injured monetarily.

There are four elements that must be proven to establish tort infractions: duty, breach, causation and injury.[12] Duty is the presence of an obligation to protect another person against unreasonable risk of harm; this always exists between a doctor and patient when a relationship has been established. For the general public, this implies a standard of care of a reasonable, prudent person; physicians, however, are held to a higher standard of care, a standard on par with other physicians of their specialty. Breach occurs when the individual fails to fulfill the duty, through negligence or malicious intent. Causation connects the negligent conduct as the cause of the injury and must be proven. Lastly, an injury must have occurred in order for a tort to have taken place; an injury can be physical, emotional, property or monetary.

Theoretically, the medical malpractice system is intended to hold the medical profession to a basic standard level of quality of care by deterring negligent practices. Additionally, the system provides for mechanisms of compensation, and exacts corrective justice to irresponsible physicians.[13] This inherently means that a malpractice system must provide physicians with information as to what standard level of care is acceptable. Some believe that the problem with this theoretically well-intended system is the unpredictable standards by which decisions and awards are made.

Before considering the inaccuracies of the tort system, it is important for us to have a gauge of the extent of negligence and to describe how malpractice

cases stack up to other tort cases. Iatrogenic injury in medicine is prevalent. An Institute of Medicine report estimates that medical errors are the 8th leading cause of death in the US.[14] Several studies have sought to determine the prevalence of negligent errors, i.e. true medical malpractice. A study in New York State found that the incidence of adverse events suffered by hospitalized patients was 3.7%; of these, 27.6% were due to negligence. That is, about 1% of all patients hospitalized suffered a negligent medical injury.[15] A California study found similar figures with 4.6% iatrogenic injury, and 0.8% overall due to negligent medical care.[16] Disproportionate numbers of negligent injuries are inflicted on the elderly and uninsured patients. Unfortunately, these are the victims that are least able to assert meaningful tort claims.[17] Compared to other tort cases, medical malpractice cases have the highest proportion of going to trial (6.9% v. 2.9%), a lower than average win rate for the plaintiff (30.3% v. 51.8%), and the median amount of award is much larger than for other civil torts ($201,000 v. $51,000 in 1992 dollars).[18]

The deviations of the medical malpractice system from its theoretical intents lead to concerns over its effectiveness as an effective liability system. Evidence suggests that the sensitivity and specificity of malpractice cases is poor. That is, injuries that truly stem from negligence rarely go to trial or win, whereas, frivolous claims are allowed hearings and granted unwarranted compensation. One study found that for every ten negligent adverse events, only one malpractice claim was filed. And only 40% of these ever received any payment at all. The authors concluded that there were actually too few tort claims in truly negligent cases.[19] A Harvard study showed no relationship between malpractice claim activity and the rate of negligent injury. The study found that of a cohort of medical malpractice claims, 17% of injuries were truly due to negligent

actions, 21.3% were due to bad outcomes, 6.4% were borderline/indeterminate cases, and 55.3% of cases did not even exhibit any injury.[20]

The unreliability and unpredictability of such a system presents as a worry to those who are subject to it, such as health care providers. Being unable to discern when a patient might present a malpractice risk forces doctors to act defensively at all time. Studies show that an overwhelming majority of physicians have little faith in the malpractice system, and believe that most malpractice claims are unwarranted and that the system for such resolutions is unfair.[21,22]

Other complaints about the system include its inefficiencies and inadequacies with regard to its intended purposes. The court system can be quite sluggish; average time to trial exceeds 5 years from the date a claim is filed.[23] Often injured patients do not collect even the majority of their compensation. Net compensation for plaintiffs is 40-45% of full system cost.[24] For every $1 won in medical malpractice suits, 60 cents is paid to the attorney and only 40 cents are ultimately awarded to the patient. The intent of this liability system is to prevent capricious provider behavior and decrease the number of medical errors committed. Ironically, the set of incentives currently in place can encourage too much caution and defensive medicine, which may lead to increased costs and decreased access to care.

The resulting problems of the current liability system are of concern to physicians and patients because of its direct costs, and perhaps more disturbing for some of the incentives and alterations to physician behavior that result from fear of suit. Increasingly, costly physician liability insurance premiums are added to the cost of care and are encompassed in office overhead. Inevitably, these costs are passed on to the payers of health care costs. In 2000-2001, doctors spent $6.3 billion on malpractice insurance.[25] Additionally, costs involved with

defending and winning malpractice suits in court are estimated at $87,720 per physician.[26] These costs are low in comparison to the overall health care cost structure, but perhaps more problematic are the effects that fear of malpractice has on physicians.

The indirect costs of our current medical liability system not only affect the cost of health care but also how the health care system functions and operates. A fear of liability exposure from reporting errors leads to a reluctance by providers to admit, discuss and disclose medical errors. As noted in the IOM's recent medical errors report, "[p]atient safety is also hindered through the liability system and the threat of malpractice, which discourages the disclosure of errors. The discoverability of data under legal proceedings encourages silence about errors committed or observed. Most errors and safety issues go undetected and unreported, both externally and within health care organizations."[27] The stifled communication of medical errors with colleagues and patients prevents system-wide reforms and studies of errors that allow us to push forth with better, safer patient care.

This reluctance to disclose information creates a strain on the doctor-patient relationship. The physician is afraid that full disclosure might lead to a suit, and patients can be skeptical about their doctor not providing the full truth. But perhaps the most troubling side effect of medical liability threat is the notion of defensive medicine. Patients trust their physician to have their well-being as their paramount concern; however, if patients are uncertain about their doctor's motivations to order tests and procedures and presume that they may be done with the physician's litigation exposure as the supreme concern, then trust is much more difficult to create and sustain. The wider social implications of medical care costs and access due to defensive medicine will be the primary topic of my exposition and will be more clearly defined and estimated as follows.

DEFINITION OF DEFENSIVE MEDICINE:

Defensive medicine occurs when doctors order tests, procedures, or visits, or avoid certain high-risk patients or procedures, primarily because of concern over malpractice liability.[28] Others have more crudely described it as "cover-your-ass medicine," which while albeit is more political rhetoric, describes the notion quite viscerally and succinctly. Doctors provide extra services to ensure "proper" documentation of a thorough work-up so that they feel invulnerable to accusations that they did not react appropriately to a patient's symptoms. Even unconscious motivations to perform extra diagnostics or limit certain liability exposures can be considered defensive because regardless of intent, the consequences of such behavior still occur.

Defensive medicine can be divided into two different entities: positive and negative defensive medicine. Positive defensive medicine occurs when too much of something is being done, such as diagnostic testing; negative defensive medicine occurs when services are cut, such as curtailing high-risk procedures.

Positive defensive is more common and occurs when tests and procedures are ordered to minimize the risk of missing a diagnosis, even if the patient is minimally at risk, particularly when the consequences of being wrong are severe. For example, in a case where the patient presents to the emergency department with a non-specific, non-traumatic headache, it most likely is due to a relatively benign migraine or tension headache. However, the consequences of the ED physician being wrong and missing a subarachnoid hemorrhage, ruptured berry aneurysm, or brain tumor are severe for patient and the doctor, despite the likelihood of such a diagnosis being slim. This leads the physician to order expensive diagnostic tests, or even to admit the patient to the hospital to rule out a remote but possibly very serious pathology. "Defensive medicine will tend to be more frequent in the following instances: when the disease or condition to

be detected or prevented is life-threatening or disabling; when timely detection of a disease or condition changes therapy; when the change in therapy can be expected to make a real difference to the patient's ultimate state of health; and when the diagnostic test or treatment alternative is readily available and low-risk."[29] Defensive practices can even be so systematically indoctrinated because of a medical community's consolidated fears that common practices, i.e. standards of care, are strewn with defensive measures. This phenomenon creates an interesting positive feedback loop, wherein to protect against malpractice suits physicians must continue to meet or surpass the "standards of care," which as a community standard will continue to rise.

Certainly, increasing diagnostic testing is bound to find pathologies that otherwise might not have been picked up and help patients. Therefore, we cannot argue that such practices are necessarily of zero benefit. However, malpractice fears push the tolerance for uncertainty to very low levels. Economically speaking, the marginal benefit may be positive to the patient but will be less than the marginal costs incurred to society and a suboptimal social outcome will prevail. This is because the possibility of a morbid diagnosis is remote as compared to the certain cost of obtaining the extra test. While the patient may appreciate the marginal benefit because a third-party payer has paid the marginal cost, society as a whole will have expended resources inefficiently; those lost resources, if expended on a patient with a medically indicated need, would have resulted in higher social welfare. Therefore, the primary concern with positive defensive medicine is the disproportionate increase in costs for a relatively minor increase in quality of care. In a purely fee-for-service doctor-patient payment scheme, this might not pose to a problem because the benefit and costs are borne by the same individual; however, because today's health care

dollars are primarily paid for by a third-party, whether it is an insurance company or the government, society at-large must bear these costs.

Additional concerns include increased exposure to risk because of increased testing, as all tests carry their own inherent risks. And while it may appear to be irrational to expose a patient to more risk of injury as a defensive measure, it can be explained that many physicians believe that they are more likely to be sued for not doing enough than for doing too much. Also, no test is 100% accurate, so increased testing will likely present with increased numbers of false positives. This may lead to increased moot workups and undue patient stress and worry.

Negative defensive medicine occurs when physicians stop performing certain high-risk procedures or modalities of practice, quit their practices, or move practices to decrease their malpractice exposure or premiums. The most cited example is when family practitioners, the jack-of-all-trades of the medicine business, stop performing surgeries or delivering babies. Physicians may move across state lines to venues with lower malpractice rates or to locales with better perceived liability exposure. While in a perfect market such free movement of labor according to costs of business enhances efficiency, there is reason to believe that the physician labor market is not a truly free market due to barriers to entry and rigid payment structure. Therefore, unlike positive defensive practices, these actions have no perceived benefits. The results are decreased access to care due to decreased services provided by physicians and decreased numbers of physicians to perform any given practice, in particular, higher risk specialties. Pro bono work for the poor, who are otherwise without regular medical care, may be reduced with negative defensive medicine.

Ultimately, patients are worse off due to defensive medical practices because of increased costs of care and decreased access to care. In the following sections, I will address the theory behind these practices, to cite empirical evidence of the existence and extent of such defensive measures, and end by presenting different models of reform. Given that more is understood about positive defensive medicine, this paper will focus on this topic; however, negative defensive medicine will also be addressed.

ECONOMIC THEORY OF DEFENSIVE MEDICINE:

Economic theory provides a convincing explanation for why the phenomenon of defensive medicine occurs. Such behavior can be predicted and explained by economic theories borrowed from other more traditional business models. Agency theory, usually used to describe business owner and worker relationships, can be used to describe the existence of defensive practices. Risk-based utility functions, usually used to explain investor behavior, can be used to predict the amount of defensive medicine prescribed.

The physician's role is different from that of the traditional seller of goods, in that an agency relationship exists. Such a relationship exists whenever one entity's utility is dependent on what another entity decides to do. In the case of the doctor-patient relationship, the agency role exists because of asymmetric information. The doctor has much greater medical expertise and is, therefore, entrusted to act on the behalf of the patient. In economic theory, the perfect agent is one that seeks to maximize the utility of the principal and is motivated solely by the resulting utility of the principal. There are numerous reasons to believe that doctors are not perfect agents. All agents are self-interested individuals who are seeking to maximize their own utility functions. While the welfare and utility of their patients are a major factor to a physician's utility, there may still be other variables that are contributors to physician behavior.

The principal-agent problem states that given asymmetric information, the doctor (agent) who is acting on the behalf of patients (principal) can misbehave.[30] The physician can use his superior medical expertise to dupe the patient into believing that everything the doctor orders is medically indicated and will provide some clinical benefit that outweighs the costs involved, i.e. unnecessary medical procedures.

A problem with the principal-agent relationship arises when agents pursue their own goals even at the expense of the principal. A check to this system occurs when the patient can refuse treatment because he/she believes it has reached a point of excess. However, this check is largely non-existent in today's health care financing scheme because third-party payers remove the price-sensitivity of the patient to the extra care. This model also implies the plausibility of physicians' inducing demand out of economic self-interest. For example, if a physician owns an X-ray machine, he may be more inclined to order imaging of his patients, for economic self-interest. A physician's medical expertise sets up an asymmetric relationship of medical knowledge, and thus a power structure that can allow the doctor to extract utility and welfare from the patient by ordering defensive procedures. The increasing payment of medical costs by third-party payers decreases patient incentives to stop the practice of defensive medicine and leads to the imposition of these inefficient costs on society at-large.

How much defensive medicine is practiced is strongly dependent upon the physician's estimate of risk of facing a malpractice suit and the losses that the doctor will suffer as a result. Assuming a risk-averse physician and a standard expected utility model, if the physician accurately estimates his risk of malpractice liability the correct amount of defensive practices will be performed to the doctor's benefit. The expected utility model is one that is often used to describe gambling situations or investment portfolio analyses; basically, the greater the probability of loss, the more the actor will pay/act to insure himself from such losses.[31] In this model, the higher the risk of malpractice suit, the greater the probability of physician losing the suit, and the greater that will be the predicted amount of loss, the greater the amount of defensive medicine

practiced. This is perfectly rational behavior from the perspective of the physician. This amount will most likely still be more than the social optimum because the amount of defensive medicine equals the physician's personal well-being rather than the social optimum in question. Fair or not, this can be considered the risk premium that is carried by society on the behalf of the patient.

Unfortunately, the true risk of liability is much less than physicians speculate it to be. Physicians, across all specialties, are overly conscious of being sued and tend to overestimate risk. Among all specialties, the average physician overestimates by 300% his/her risk of being sued in the following year. Low-risk specialties tend to overestimate their risk compared to that of the higher risk colleagues.[32] This leads us to conclude that more defensive medicine is practiced than is economically logical. While the discussion of theory is helpful to our understanding, it is just as important to evaluate the empirical evidence supporting or refuting our theory.

EMPIRICAL EVIDENCE:

The following section will consider the empirical evidence of the extent of defensive medicine. Before such considerations, general biases of various methodologies of research will be discussed.

BIASES OF METHODOLOGY:

Empirical studies of defensive medical practices have been attempted. However, investigators always return to the difficulty of its estimation. Generally, as with all social research, the foundation of these studies is based on simple assumptions made by the authors; the fragility of these studies lies therein. Political disagreements about the results of such studies tend to always attack the suppositions as biased or inaccurate.

By and large, three methods of empirical study have been employed to estimate amounts of defensive medicine and extrapolations of costs therefrom: individual physician-based surveys, further subdivided into physician reporting of past behavior and hypothetical clinical situations and responses thereto, and larger-scale statistical investigations of clinical utilization rates. All methods of study have inherent prejudices and limitations that are important to recognize while interpreting such analyses. This section will address these biases. Additional methodologies, such as medical file reviews or case studies, may be interesting as none of these were employed in studies reviewed. Certainly, these protocols have their own flaws and limitations.

Several studies have been performed asking physicians to provide generalized answers about their style of practice and how fear of malpractice has altered their behaviors. Other physician surveys present them with clinical scenarios in which they are to provide their medical knowledge and clinical judgment on the given patient. In any instance where the provider is asked to

provide the answers directly there can be significant amounts of bias. Social desirability bias may lead physicians to provide responses that they think are the socially appropriate ones, such as answering as if everything was completely clinically based but not what the physician would do in reality, thus underestimating defensive practices. If physicians are aware of the intent of the study to show defensive medical practices, political motivations can bias answers and skew responses toward overrepresentation of defensive measures. One particular bias that exists in surveys reporting past practices but not with fictitious scenarios is recall bias, which lead to more inaccuracies rather than a positive or negative skew of data.

Larger analyses of utilization rates of medical procedures provide statistical significance and wider generalizability, assuming valid and sufficient data. This form of study is a widely accepted and employed method of study for estimating defensive practices. Its limitations are noteworthy, however. Aside from limitations that are present in individual datasets, only incremental amounts of defensive medicine can be estimated. That is, it is not possible to use these datasets to estimate baseline levels of defensive medicine but rather only differences in utilization rates based on some variable. To make the point more lucid, let us consider a study investigating the medical utilization of radiographic procedures in the elderly for headache. The study can only estimate that more procedures are done for patient X versus patient Y, with the two patients varying by one variable, for example types of tort laws by the in states in which they reside. This amount, assuming appropriate controls, should tell you that there is more defensive medicine practiced in state X versus state Y. It cannot estimate how much defensive medicine occurs, in general, amongst the population as a whole. It is also difficult to estimate the total cost of defensive medicine, however, several studies have made valiant attempts.

ESTIMATED COSTS:

The most problematic result of positive defensive medicine is the increase to medical costs. Estimates of the cost of defensive practices, as with all empirical estimates of this subject as aforementioned, are difficult to obtain and subject to biases and misestimates. The range of estimates tends to be varied, with upwards of a ten-fold difference amongst varying studies.

Reynolds *et al* published one of the first credible estimates in JAMA in 1987. The group estimated that total costs of the malpractice system for physician services in 1984 were between $12.1 and $13.7 billion.[33] These estimates include practices of defensive medicine, and also the direct costs of litigation such as malpractice premiums and the cost of defending claims. Put in perspective this represented 15% of total expenditures on physician services in 1984. A further study expanded on Reynolds' work by including the role and costs of hospitals in the malpractice system. This more comprehensive figure, after adjusting for inflation, came to an estimate of $24.9 billion in liability system costs in 1991.[34] The same group estimated savings with liability reform due to decreased defensive medicine with varying assumptions to arrive at a range of estimates. They announced potential savings of $4.3 billion in 1994 for curtailing defensive medicine, as a mid-range estimate; and over the course of 5-years $35.8 billion, also using mid-range assumptions. Their overall savings for 5-years ranged from a conservative $7.5 billion to a liberal $76.2 billion.[35]

Several studies estimated the costs of defensive medicine with a more parochial concentration on a single set of diagnoses or medical specialty. In the early 1990s, Congress commissioned the Office of Technology Assessment (OTA) to report on defensive medicine. In addition to a literature search, they produced their own studies. The OTA predicted the annual national cost of defensive Cesarean section deliveries in cases of prolonged or dysfunctional labor in

women between ages 30-39 at approximately $8.7 million (in 1992 dollars).[36] They also estimated that the annual national cost of defensive radiological procedures in children between ages 5-24 arriving in the emergency department with apparently minor head injuries is roughly $45 million (in 1992 dollars).[37] More recent studies have approximated a reduction in total obstetrical charges of $73.3 million (in 1996 dollars) per annum nationally if defensive medicine were eliminated.[38] A study based on Medicare data concluded that given significant MICRA-type tort reforms, expenditures on cardiac disease would be $450 million per year lower for the first two years, and $600 million per year lower for the next three years. They estimated that direct reforms could lead to expenditure reductions of well over $50 billion per year without adverse consequences in health outcomes.[39]

A recent study on this topic states that every one dollar in medical liability litigation costs corresponds to more than four dollars of unnecessary hospital costs related to defensive medicine.[40] If we were to eliminate this source of inefficient care and to apply such resources to areas of greater health return such as the uninsured and indigent populations, we could potentially make better use of scare health care dollars. Put in perspective, California's 2005-2006 Medi-Cal budget is approximately $34 billion.[41] The complete elimination of defensive medicine would be able provide national savings of the same magnitude, and if reallocated for such uses could provide health care to those who otherwise have very limited access to care. The reallocation of resources from too much care to those who are cared for too little is an enticing goal. Realistically, however, reforms to the system can only seek to mitigate and undercut some of the practice of defensive medicine. Complete elimination thereof is impossible as long as there is provider accountability to the patient. Needless to say, it would be foolish to invent a system in which there is no accountability on the

provider. Therefore, reforms cannot be expected to recoup the full amount of such estimated costs, and the effectiveness of such reforms will determine to what degree such savings can be realized. It also remains to be seen whether such savings will be reinvested into the health care system.

EVIDENCE OF POSITIVE DEFENSIVE PRACTICES:

Discussing the evidence of the practice of defensive medicine fundamentally assumes that defensive medicine exists in practice and not just in theory. Given the evidence cited below, this does not appear to be a far-fetched presumption. The following section will present the substantiation of facts from studies by the type of defensive medicine, i.e. positive or negative, and by study methodology type, i.e. direct surveys, clinical scenario surveys, or utilization analyses.

Several direct physician surveys provide overwhelming suggestion that doctors change their practices according to liability risk. The American Medical Association's (AMA) Socioeconomic Monitoring Survey on practice changes reported that 43% of respondents prescribed more tests and procedures in response to increasing professional liability risk.[42] In the same year as the AMA study, the American College of Obstetricians and Gynecologists (ACOG) performed a national survey of ob/gyn specialists and found over 76% admitted to increased testing and diagnostic procedures as a result of their professional liability claim experiences.[43] Two years following, ACOG reproduced the same survey and found that nearly 68% had practiced defensive medicine.[44] A national survey put out by the American College of Surgeons illustrated that 60% of its surgeons had increased their diagnostic testing as a result of the national rise in malpractice suits.[45]

Bias is apparent when surveys only ask about defensive medicine as a reason for medically non-indicated orders. When surveys looked to other reasons for test-ordering behavior, the overstatement of defensive practices from the above surveys was clear. On one questionnaire about the ordering of urinalyses and EKGs for the management of hypertension (aimed at relatively

low risk diagnoses) that gave a list of reasons to rank, minimizing risk of a malpractice suit was a relatively low ranked reason for test-ordering behavior.[46] Another study focused on lab testing orders structured in a similar format as the above study found that medico-legal concerns were near the bottom of the rank list.[47]

Using physician responses to clinical scenarios reduces some of the problems associated with response bias, although it does not completely abolish all such issues. The advantage of clinical scenarios is that the hypothetical paper-patient presented presents as a real clinical case, as opposed to an abstract "do you do this or not?" type of response. This allows the investigator to look at behavior in well-defined situations rather than in broad-stroke classes of behavior.

Two studies investigating clinician behavior using clinical scenarios found that there seemed to be a clear sign that defensive medicine is practiced, albeit at to a lesser extent than in self-reported surveys. In a clinical scenarios study between 5-29% of all responding physicians cited malpractice concerns as the primary reason for choosing at least one clinical action. The authors estimated overall that about 8% of diagnostic procedures ordered are likely to be from a conscious concern over malpractice. The clinical scenario providing the greatest extent of defensive medicine was a case of a 15 year-old boy with a minor head injury from a skateboarding accident. Almost half of respondents would order a head CT, and of those 45% would order it because of concern for malpractice.[48] Interestingly, another study employing clinical scenarios failed to find a significant relationship between physicians' personal malpractice suit history and their use of services as reported in their responses to hypothetical scenarios. The same study finds, however, defensive responses as the paramount reason for their clinical action in 24-42% of respondents.[49] This suggests that a culture or

professional norm of defensive-minded behavior is more likely than personal experience to affect physician ordering behavior.

The above techniques of measurement are subject to respondent bias, and the appeal in analyzing actual practice resides in the lack of such prejudices. Utilization studies look at actual orders made in true clinical situations, where the physician is not prompted or interfered with in his/her clinical decisions. The implications of these studies therefore are more generalizable and credible. The most studied instance of defensive practices via utilization studies is the use of Caesarian section deliveries. Several studies scrutinized reasons for performing these procedures, and all were conclusive in linking such behavior with malpractice fears.

A study by Localio and colleagues discovered that New York State obstetricians who practice in hospitals and areas with high malpractice claim frequency and premiums perform more Caesarian deliveries than similar doctors practicing in hospitals and areas with low malpractice claim frequency and premiums. The odds of a C-section in a hospital with the highest frequency of malpractice claims were 32% higher than the odds of a C-section in a hospital/area with the lowest frequency of malpractice claims. The authors conclude that liability risk had the largest influence on births with moderate clinical risk.[50]

Similar to the clinical scenario study investigating personal malpractice experiences and defensive practices, the Localio study concluded there was no association between a physician's individual malpractice claim experience and his/her Caesarian section rate.[51] Baldwin *et al's* study of low-risk pregnancies in Washington State also failed to find a relationship between either physicians' personal malpractice suit history or the malpractice claims rate in the county

and the use of selected services, such as diagnostic ultrasound early in pregnancy, referrals to specialists, and Caesarian delivery.[52]

Tussing and colleagues estimated that of an overall C-section rate of 27.6% in upstate New York, 6.6% was due to malpractice concerns (i.e. 23.9% of all C-sections). This number was further divided into subsets of cause: 4.4% was due to a direct effect, i.e. the decision to cut, and 2.2% was due to an indirect effect, i.e. the decision to cut due to increased use of electronic fetal monitoring systems.[53]

Using national birth certificate data, Dubay *et al* found that obstetricians responded to malpractice claims risk by performing more C-sections and that this response was greater for mothers of lower socioeconomic status and showed decreasing correlation as they traversed up socioeconomic classes. There was no evidence of malpractice claims risk having any beneficial effect on infant health outcomes suggesting that such orders were superfluous and extraneous.[54] This ultimately implies that liability pressure produces a level of precaution that is higher than medically necessary.

A 1996 study of Medicare data investigating the medical management of acute myocardial infarction and coronary artery disease found that states with direct liability limits reduced hospital expenditures by 5-9% within 3-5 years of adoption, with the full effects of reforms requiring several years to appear and no significant increase in patient morbidity or mortality.[55] This strongly implies that defensive medicine is at play.

All three types of studies on positive defensive medicine concluded that procedures and tests were indeed ordered for fear of suit. Variations in the estimated effect size were associated with the type of methodology employed and the particular type bias inherent therein. That is, surveys reported greater

defensive practices, especially when asked specifically about it; utilization studies showed the practice of defensive medicine but the effect size was attenuated. The amount of positive defensive medicine practiced on patients was greatest in the lowest socioeconomic echelons, and diagnoses that were unlikely but had potentially severe consequences were most likely to prompt extraneous ordering. Physician who have been sued do not act more defensively than their non-sued counterparts. However, communities with higher rates of being sued exhibited higher rates of defensive practices.

EVIDENCE OF NEGATIVE DEFENSIVE PRACTICES:

There have been far fewer studies done on negative defensive practices. There are two methodologies by which to investigate this practice: direct physician surveys and utilization studies; clinical scenarios as discussed above are no longer relevant in these studies because we are not investigating individual clinical cases and physician behavior thereto. For the reasons described in the former section, direct surveys tend to overstate the amount of negative practices due to respondent biases.

Direct surveys all report that negative defensive practices occur. The Physicians' Practice Costs and Income Survey, a national survey of all medical specialties, reported that 20% of responding physicians stopped treating certain cases over the past year due to malpractice insurance costs.[56] The American Association of Family Practitioners determined that 27.5% of its respondents had discontinued or decreased obstetric services due to the cost or unavailability of liability insurance. And a national survey of surgeons by the American College of Surgeons found that 24.6% of respondents limited their practice by dropping certain types of operations due to malpractice risk.[57]

Utilization studies all cite the specialty of obstetrician/gynecologist because of the duality of their practices, which include the riskier obstetrics service versus the less risky gynecology service. Their training provides for expertise in both modalities and the study of negative defensive medicine notes changes away from riskier aspects of the specialty toward less risk. The results here are less clear and do not clearly delineate the existence of such practices of negative defensive medicine.

One study found that doctors active in obstetrics who experienced rapid increases in malpractice insurance premiums were not more likely than

physicians with lower premium increases to withdraw from obstetrics.[58] A recent GAO study found insufficient evidence to conclude that increased medical malpractice premiums have had a discernable effect on access to care.[59] On the contrary, another study found that ob/gyns in states with greater liability threats and who reported higher personal malpractice claims exposure were actually more likely to be practicing obstetrics and had higher volumes of obstetrics care than their counterparts. While this may appear at face value to be counter-intuitive, this result was used by the author to support the hypothesis that a worse liability climate leads other practitioners of obstetrics, such as nurse-midwives and family practitioners, in addition to some other ob/gyns to practice only gynecology, to quit, or leave the market, leaving those who remain greater volumes of business.[60]

The evidence for negative defensive medicine is present when reported in physician surveys. However, utilization studies present with less clear-cut evidence this phenomenon occurs. More studies need to be conducted in this area because claims of decreased practitioners due to malpractice exposure are disconcerting to the public health. The evidence of both positive and negative defensive medicine allude to the next logical step of considering reforms.

PROPOSED SOLUTIONS:

Many divergent solutions have been proposed by reformers, some as simple as restricting suits to others as radical scrapping the whole system in lieu of another paradigm. Discussion below is not meant to be comprehensive with regard to proposals, but will focus on those presented by the most vocal proponents of reform. These reform proposals will be presented from least to most radical. For each, the proposal's features, examples of where it has been attempted, whether it has succeeded, and what the pros and cons of each system are will be presented. I will begin with the current standard of tort reform (and currently the most politically feasible), the California-style MICRA laws. This will be followed by discussion of the British "winner-take-all" system, full incorporation rights for physicians, mediation alternatives, a medical court system, and finally a no-fault compensation system.

MICRA-TYPE REFORMS: The standard tort reforms currently touted across the country and in Congress are those based on California's Medical Injury Compensation Reform Act (MICRA) laws.[61] These laws are generally intended to limit the ability and desirability of bringing cases to court. Provisions of these reforms include: a cap on the awards for non-economic damages, limitations to attorney contingency fees, payment of future damages in installations, statutes of limitations, disclosure of collateral source payments, and pretrial screening panels. Caps on damages limit the total amount a jury can award for paid and suffering. However, there usually is no limit on economic damages, such as lost future wages and medical bills. Limitations to attorney contingency fees place a percentage limit on how much the plaintiff's attorney

can collect from the award. Periodic payment of future damages allows the defendant to pay the award over a number of years rather than in one large sum; interest is calculated into the installment plan. Statutes of limitations place a time window in which a case can be filed. Disclosure of collateral source payments allows for the award amount to deduct other sources of payment to the plaintiff. An example of this would be in the case of a wrongful death that the physician loses. If the victim has a life insurance policy, the total malpractice case award would be what the jury awarded minus the amount of the insurance policy. Pretrial screening panels involve a committee of adjudicators who decide the validity of a case and give the approval or denial of consideration in court.

Proponents of these reforms claim that excessive awards are prevented, incentives to bring frivolous lawsuits are reduced, and malpractice premiums are stabilized because insurance providers face a more stable, predictable system. Opponents to such reforms believe that such changes hurt the most vulnerable in society, i.e. women, children, seniors, and minorities, by limiting their access to the court system and do not appropriately compensate them. Additionally, those with the most egregious forms of medical injury or death are the least adequately compensated for their damages.

Because this form of tort reform is the only significant form adopted by US state governments, it is the only model for which studies have been able to discern effectiveness. Several studies concluded that such reforms do have an effect on malpractice costs. The OTA concluded that caps on damages consistently reduced direct malpractice cost indicators, collateral source payments almost always reduced malpractice costs, pretrial screening panels and statute of limitations sometimes reduced costs, and restricted contingency fees

never reduce costs.[62]

Two Stanford researchers found that states with direct liability limits, i.e. caps on damage awards, abolition of punitive damages, and collateral-source-rule reforms, reduced overall hospital expenditures, which included both direct and indirect costs such as defensive medicine, by 5-9% within 3-5 years of adoption, with the full effects of reforms requiring several years to appear and no significant increase in patient morbidity or mortality. In contrast, reforms that limit liability only indirectly, i.e. caps on contingency fees, mandatory periodic payments, are not associated with substantial effects on either expenditures or outcomes.[63]

The RAND Corporation recently published a more comprehensive analysis investigating the economic effects similar to the above studies and also looked at who these laws affected the most.[64] Their study concluded that California's MICRA laws do indeed limit losing defendants' expenditures into the medical malpractice system. The study confirms critics' concerns by demonstrating that those that most often had their damage awards reduced and by the greatest amount were patients with the most severe injuries, such as brain damage or paralysis or death, and infants. Total awards were estimated to be 30% less than had there been no cap. However because of attorney contingency fee limitations, patient recoveries were reduced to only 15% less than had there been no cap. This latter finding supports proponents of these reforms who cite profit-seeking attorneys as a large factor in the malpractice problem.

"WINNER-TAKE-ALL" SYSTEM: The British court system, on which the American system is historically based, has one component that some reformists advocate adopting as a minor but effective change to our tort system. Often

referred to as the "winner-take-all" system, the loser in these court cases pay the costs of litigation, i.e. court and attorney fees, for both sides. Proponents believe that such disincentives to bring frivolous cases to trial will be an effective gatekeeper to the courts. This presumes an increased percentage of cases will be valid cases, and physicians and their insurers would not be forced to spend superfluous resources on defending cases without merit. Critics believe that too few malpractice cases go to trial as is, and that such a policy would further exacerbate this situation. Furthermore, those least able to pay for court access would be most likely deterred from bring cases to trial for fear of further incurring economic losses.

ENTERPRISE LIABILITY REFORM: Currently physicians cannot incorporate as full corporate enterprises, but can only exist as professional corporations. Incorporating allows the owners of an enterprise to avoid personal liability. That is, if a corporation is sued for liability of product or service and loses, the most the owner stands to lose is the amount invested in the firm. Personal assets and otherwise non-invested holdings of the owner are not subject to loss in court. Medical and legal practices, however, can do no such thing. Therefore, doctors when sued risk losing not only the full asset value of their practice, but also all of their personal assets and family holdings. Proposed enterprise liability reforms seek to establish parity between the learned professions and all other forms of enterprise. Liability would be transferred from individual to institution.[65]

The benefits of this system include increased protection to individual physicians, which might decrease the amount of defensive medicine practiced. Hospitals or health plans, which would be the liability holder, would take a

greater role in ensuring quality of care. Detractors from such proposals fear that physician autonomy would be undermined, as hospitals would monitor defensively to ensure that their physician members practice in line with risk management's assessment of a case. Others believe that lack of enough liability incentive will create careless physicians, evoking images of Enron-type executives and their corporate shields.

Such systems are most often seen in academic health centers such as the the University of California medical centers. The United Kingdom switched to this form of a system in 1990.[66] These physician shields are sparse in other aspects of the US health care system.

ALTERNATIVE DISPUTE RESOLUTION SYSTEM: Alternative dispute resolution systems have been proposed as a means to remove medical malpractice cases from the judicial system into another venue with its own third-party, unbiased arbiter. These types of proposals include settling tort claims in arenas such as arbitration, mediation, neutral evaluation, and summary trials.[67] Herein both parties are brought to the table to make their arguments to a neutral third-party agreed upon by both sides. This arbiter hears each perspective and arrives at some decision. Room for negotiations is also allowable under these circumstances.

Proponents of such systems insist that such proceedings are less formal, cheaper, speedier, and can produce a more rational decision than juries. Opponents challenge the neutrality of the magistrate, and believe the provider will be left with the upper hand. Nay-sayers also state that to make such systems mandatory and binding would be to force individuals to give up their Constitutional right to a trial, which is unlikely to pass any Supreme Court

scrutiny. Therefore, non-binding arbitration might not only be a moot point, but could also serve to increase time to trial and increase costs of considering such suits. If non-binding, a plaintiff who is ultimately unhappy with the results of arbitration can just return to the courts to hear out the case.

President Clinton proposed such a system in his health care reform package HR 3600 in the 103rd Congress, which ultimately had little political viability. His plan was mandatory but non-binding, meaning arbitration would be the first line of recourse for malpractice tort claims but that if terms were unsatisfactory to either party, then judicial relief could be sought thereafter. Currently, Kaiser Permanente and some other HMOs include such systems as a mandatory component of a patient's terms of contract when signing up for health care services. They are therefore both mandatory and binding, because patients agree to them in their contract prior to treatment. It remains to be seen if such schemes are constitutional.

MEDICAL COURT SYSTEM: A medical court system is a relatively new concept proposed by reformers as analogous to other specialty courts, such as the Customs Court, Court of Appeals for Veterans Claims, Tax Court, Court of International Trade and Court of Appeals for the Armed Services.[68] These Congressionally-created courts were formed under the basic premise that certain types of cases are too specialized, convoluted and esoteric for a jury of laymen to decide. A slight variation to the same premise is to set up administrative tribunals, which is a fault-based, non-jury administrative adjudicator of claims of medical malpractice.

Champions of this system believe that medicine itself is complicated enough that only individuals armed with such specific knowledge can truly

make fair, just decisions detached from the emotion which often unduly influences juries. Challengers to this system argue that those who would be best equipped to be judges in this type of court would be physicians themselves. This would lead to a sense of professional courtesy that would consistently bias in favor of the defendant, i.e. the physician.

NO-FAULT COMPENSATION SYSTEM: A no-fault compensation system for medical injury is the most radical of the proposals put forth. An injured patient would fill out paperwork to be submitted to an adjustor who draws from a community fund and compensates as fit after mere proof of injury.

The benefits of this system are many. Most injured patients with non-catastrophic type injuries are not appropriately compensated under the current system. A no-fault system would compensate injuries large and small. Physicians and patients would be able to cooperatively ensure compensation to the injured, and the current adversarial strain on the doctor-patient relationship would be improved. Such a system would be more predictable and reliable than a jury-driven court case, and its costs should be significantly less.

On the other hand, this would possibly create a new bureaucracy that may be just as inefficient as many of the governmental bodies we are familiar with. Setting up standardized compensation charts and matrices identifying which injuries are compensated and by how much may be unjust to some victims if not done sufficiently well. Theory states that physician incentives to be careful and diligent would be decreased and quality of care may suffer. However, perhaps the biggest problem concerns the financing of this fund. Questions such as, "who will provider the funds: physicians, health institutions, or the public?" and

"how will we ensure adequate funding given the certain increase in the number of claims?" must be sufficiently addressed before such a proposal can proceed.

This system has been employed in certain categories of injury such as motor vehicle accidents and worker's compensation claims. In the 1990s, Virginia and Florida set up no-fault systems for the particular delivery-related cases of neonatal injuries.[69] The common result in all of these situations was that the system was inadequately funded. Countries such as Sweden, Finland, and New Zealand also have no-fault systems for medical injury compensation. However, due to differences in social ethos, culture, health care system structure, and citizen demographics, such systems have been more successful than the US's experiences therewith. It is, therefore, unclear whether the US could adopt a comprehensive, national no-fault system and compensation fund that would operate well.

The primary mode of tort reform in the US has been legislation altering the parameters and limits of the existing medical malpractice system, but generally leaving the overall model itself intact. However, as per the discussion above there are numerous other alternative reforms that should be considered. The national debate on the establishment of tort reforms has been heated, with proponents arguing MICRA's effectiveness and opponents disagreeing. A study investigating the relationship of medical malpractice environments, tort reforms and defensive practices will help to elucidate the efficacy of such legislation. An empirical study examining such associations follows.

CHAPTER 2 –
BACKGROUND:

The use of diagnostic imaging has increased significantly over the last two decades and is a significant component of the ongoing increase in the costs of medical care.[70] While some of the increase in imaging can be explained by improvements in technology and greater availability of CT and MRI scanners, some of this increase may be due to the use of imaging driven by physicians' fears of malpractice lawsuits.

Physicians' fears of being sued may lead to defensive medical practices, such as ordering non-indicated medical imaging.[71,72] Whereas direct malpractice costs represent only 1% of dollars spent on the health care system;[73] indirect costs, such as those that result from defensive medical practices, are estimated to comprise a much higher percentage, and have been estimated to account for $5-$50 billion in health care dollars annually.[74,75] For example, Congress' Office of Technology Assessment estimated that the annual national cost of defensive radiological procedures in children between ages 5-24 arriving in the emergency department with apparently minor head injuries is approximately $45 million in 1992 dollars.[76]

The US medical liability system may be considered crude. There is only a weak association between actual medical negligence and the likelihood that a given case will go to trial. Ironically, many cases that exhibit clear medical malpractice are never brought to trial, whereas cases that have bad outcomes unrelated to medical negligence are often brought to trial.[77] The uncertainty of this system has led many parties to push for tort reform in an effort to curb the escalating costs associated with this system. Studies show medical malpractice reforms have been effective at containing the direct costs of the malpractice system.[78] The most consistent impact has been found from laws that directly

limit the amount that can be paid.[79] For example, caps on damages have consistently had a strong effect on containing direct malpractice costs, based on such indicators as claim frequency, payment per claim, and malpractice insurance premiums paid by physicians. Amending collateral source rules, which reduces a court award if there are other sources of payment to the plaintiff, such as life insurance policies, have also been found to limit direct costs. Other tort reforms, such as limitations to attorney contingency fees, which set a cap on how much the representing attorney can collect in fees as a percentage of the winnings, and periodic payments of awards, which allow for an installment payment plan for the losing defendant, have not been shown to reduce direct malpractice costs.[80]

There has been limited study of the association of medical malpractice environment and the use of defensive medical imaging. Additionally, there have been few studies on the impact of specific tort reform laws and indirect costs, such as those that result from defensive medical practices. Our study investigates the association between a state's medical malpractice environment, including tort reform measures enacted, and imaging rates for patients seen in the emergency department (ED), to assess the effect of malpractice fears on excessive testing. In order to separate indicated testing from non-indicated testing, we chose a medical condition (head trauma) where guidelines suggest imaging is indicated in one situation (when there is trauma associated with loss of consciousness), whereas imaging is not indicated and discretionary in another situation (when there is trauma associated without loss of consciousness).[81] We hypothesized that even after accounting for patient and community factors, imaging rates would vary by underlying medical malpractice environment and that imaging would vary to a larger extent when imaging was discretionary.

METHODS:

DATA SOURCES: The majority (>95%) of adults age 65 and older in the US have health insurance through Medicare. Medical billing claims collected by Medicare thus provide a convenient source of information to evaluate the use of neurological imaging among elderly adults. A representative 5%-sample of Medicare-eligible adults age 65 and above living in ten US States, representing approximately 14% of the US population, was constructed using 1992-2001 denominator and claims information (SUMDENOM/PEDSP). The data included Medicare claims/enrollment information (Physician/Supplier Part B) and Outpatient File. These data were originally obtained for an unrelated project evaluating breast cancer screening practices, thus limiting the dataset to female Medicare beneficiaries, and states that contribute data to the national cancer registry through the Surveillance, Epidemiology and End Results (SEER) program. The project was approved by the Centers for Medicare and Medicaid Services, Division of Privacy Compliance Data Development, the University of California, Berkeley Committee for the Protection of Human Subjects and the University of California, San Francisco Institutional Review Board.

SUBJECTS: The study subjects were female Medicare beneficiaries, 65 years of age or older, who presented to an ED with head trauma between January 1, 1992 and December 31, 2001. Head trauma was defined by primary or secondary ICD-9 diagnostic codes: 800 series – fracture of vault of skull, 801 series – fracture of base of skull, 850 series – concussion, 851 series – cerebral laceration and contusion, and 852 series – intracranial hemorrhage. We eliminated from the sample women who presented more than three times with trauma to the ED. As part of Medicare, beneficiaries may be enrolled in risk-based HMO plans. Since Medicare does not receive billing claims for physician services for these

women, neurological imaging cannot be assessed. We, therefore, excluded ED visits during months when women had HMO coverage. Additionally, as Medicare does not receive billing claims during periods where a woman is not Part B eligible, we excluded ED visits that occurred during months where the woman was not Part B eligible.

The dataset was stratified into head trauma patients who exhibited loss of consciousness (LOC) versus those with no loss of consciousness by ICD-9 fifth-digit modifier codes. This presentation was selected because patients with head trauma and LOC are more likely to be considered to require imaging, whereas imaging is considered more discretionary for those who do not exhibit LOC, as determined by the American College of Emergency Physician's (ACEP) practice guidelines.[82] We expected greater variation in imaging rates among patients without LOC, and higher and less variable imaging rates in patients with LOC.

VARIABLES: Predictive variables of imaging were considered at the individual, community, and statewide level. Continuous variables were collapsed into categorical variables for ease of reference. Age was categorized as 65-74, 75-84, and ≥85. Race and ethnicity categories were non-Hispanic White, non-Hispanic African-American, Hispanic, Asian, and all others. The mean household income level of the zip code in which the beneficiary resided was used as proxy for estimated individual household income, categorized as <$40,000, $40,000-$70,000, >$70,000 per annum. Cancer co-morbidity was established through the SEER-Medicare registry dataset. This co-morbidity was selected because of increased imaging rates expected with cancer patients due to concern of concurrent metastasis to the brain. Cancer co-morbidity was defined as a diagnosis of cancer between 6 months and 3 years prior to ED presentation for

head trauma. ED visits within the first 6 months of a cancer diagnosis were excluded.

Community level variables were obtained from the February 2003 release of the Area Resource File[83] (ARF), a county-specific health resources information file. Linkage of the ARF files into our dataset was done by matching zip codes of place of service to associated ARF variables. County variables included the density of radiologists, amount of HMO penetration, and the rural/urban setting of service.

In general, the higher the number of physicians in a community, the higher the associated utilization of medical services.[84,85] To adjust for the number of radiologists in a given area, we estimated the density of radiologists at the county level, using the ARF data, as the ratio of diagnostic radiologists involved in patient care to the total population; this was expressed as a rate per 100,000 population and then categorized by quartiles (>0-≤5.92 = Least, >5.92-≤6.66 = Less, >6.66-≤9.59 = More, and >9.59 = Most). Because information on number of radiologists was available only for the years 1995, 2000 and 2001, we used the density estimate closest to ED presentation date.

HMO penetration was used as a predictor for physician behavior because we speculated that the greater the HMO influence on patient care, the less likely discretionary utilization would occur. The patients included were not enrolled in an HMO during the years they were included in the cohort. However, some speculate that HMO penetration may affect overall physician behavior by changing medical culture toward less superfluous testing.[86] HMO penetration was estimated in each county by calculating the HMO enrollment in 1998 divided by the total population expressed as per 100,000 persons. This was categorized into quartiles (>0-<.26 = Least, ≥.26-<.36 = Less, ≥.36-<.46 = More, ≥.46 = Most).

Urban influence codes describe county type and size; these are used as a proxy for county resource levels. Facilities and areas with higher resource availability have higher rates of resource utilization, e.g. medical imaging.[87] We estimated county resource levels using the ARF urban influence codes, most recently adjusted in 1996, which describe county type and size. We categorized the nine codes as: metropolitan (1), urban (2-3), suburban (4-5), and rural (6-9).

Statewide medical malpractice measures were obtained from two sources. The AMA's rating of states' medical liability situations range from "stable," to "problematic," to "in crisis."[88] The ten states in our study were classified according to the AMA's July 2003 rating scheme: stable – CA, NM; problematic – AZ, HI, IA, MI, UT; in crisis – CT, GA, WA. These ratings were based on a variety of socio-politico-economic measures of malpractice and describe an overall hostility of malpractice environment to health care providers.

The second set of malpractice environment measures was the existence of various tort reform policies as recommended by the American Tort Reform Association (ATRA). These include: caps on damages, limits to attorney contingency fees, periodic payment of awards, and amendments to the collateral source rule. Existence of policy was extracted from ATRA sources.[89] States that had mandatory enforcement of such laws were considered to have the statute in place. For each statute, we established a binary variable representative of whether or not a state had such mandatory tort reforms. All ten states included in our study had tort reforms enacted prior to 1992, thereby excluding effects of intra-study policy enactments.

Studies show that overall imaging has been increasing over time.[90] Therefore, our study adjusts time trends by controlling for year of presentation.

For each ED visit, the outcome was whether neurological imaging was

obtained within 7 days of presentation. Neurological imaging was defined by the ICD-9 procedure codes and CPT codes for head CT or brain MRI.

STATISTICAL ANALYSIS: We calculated the proportion of women with head trauma who underwent neurological imaging by year, stratified by whether there was loss of consciousness and adjusted to a single distribution of age across all years of the study. Multivariable logistic regression was used to identify predictors of receipt of neurological imaging associated with each ED visit, done separately for patients with loss of consciousness and without loss of consciousness. All models were adjusted for age, race and ethnicity, income, cancer diagnosis, year of presentation, density of radiologists, HMO penetration, and locale. Because of co-linearity of the two measures of state malpractice environment (overall AMA rating and existence of specific laws), separate models were run including either the AMA's assessment of malpractice environment or the presence of specific tort reform laws enacted to limit medical malpractice costs.

RESULTS:

Among the 274,590 unique women in the cohort, 8,806 women who were seen in the emergency room between 1992-2001 with head trauma, of which 2,594 (29.5%) had associated loss of consciousness (Table 1). Over 90% of the women had a single ED visit for head trauma, and the majority of women were non-Hispanic white. ED visits occurred roughly evenly split in stable, problematic, and crisis states with respect to the overall malpractice environment as assessed by the AMA. Overall, 5,220 (59.3%) underwent neurological imaging with CT or MRI.

The overall proportion of women who underwent neurological imaging increased from 44.74% in 1992 to 72.68% in 2001 (Figure 1). Imaging rates increased for all groups, and remained significantly higher among patients with loss of consciousness, however, the increase in imaging rates was greatest when imaging was discretionary. By the end of the decade studied, imaging rates had converged and were very similar whether or not imaging was discretionary. Using a quadratic best fit line, we estimated that the proportion of patients who underwent imaging increased from 44.9% in 1992 to 63.7% in 2001 among patients with loss of consciousness (average 1.9% increase per year) and from 35.9% in 1992 to 60.1% in 2001 among patients with no loss of consciousness (average 2.4% increase per year). Adjusting for all factors, the odds of being imaged in 2001 were 3.5 (95% CI 2.6, 4.8) times greater than that in 1992 among patients without loss of consciousness, and 2.5 (95% CI 1.6, 3.8) times greater in 2001 than in 1992 among patients with loss of consciousness.

In the multivariate models, imaging varied very little by patient age or income. There were no significant racial or ethnic differences in the odds imaging when trauma was associated with loss of consciousness (imaging indicated). On the other hand, ethnic and racial minorities were significantly

more likely to undergo imaging (OR 1.3-1.9) when imaging was discretionary (trauma with loss of consciousness). Patients with cancer were more likely to undergo imaging (OR 1.2-1.3).

There was greater variation in the use of imaging by community location when imaging is discretionary. For example, in comparison to rural areas, there were significantly higher imaging rates in suburban, metropolitan, and urban areas for discretionary cases (OR 2.6-3.9). The odds of imaging were also increased in suburban, urban and metropolitan areas when imaging was indicated, but this at best only bordered on statistical significance and the magnitude was attenuated.

In general, areas with the highest density of radiologists in a community had more imaging. A pattern of increasing imaging with increasing radiologist density was seen for discretionary imaging. There was an interesting association between imaging rates and HMO penetration in each community. When imaging was indicated, areas with higher HMO penetration had higher rates of imaging (OR 1.5-1.8), whereas when imaging was discretionary, areas with a higher HMO penetration had slightly less imaging.

States assessed by the AMA as in crisis or problematic with regard to the medical malpractice environment had higher imaging rates than states assessed as stable. This increase was particularly strong with discretionary imaging. For discretionary cases, the odds of imaging were 2-3 times higher in problematic and crisis states as compared with stable states. Imaging was also increased in problematic and crisis states even with indicated imaging, although the increase was attenuated.

With discretionary imaging, the multivariate model that examined specific tort reform laws produced mixed results; two laws were associated with lower imaging rates, and two with higher imaging rates. Among patients where

imaging was discretionary, state laws that imposed a cap on award settlements were associated with approximately 50% lower odds of imaging, and state laws mandating period payments of awards were associated with approximately 40% lower odds of imaging. On the other hand, laws limiting attorney contingency fees and collateral source payment of awards were associated with increased odds of imaging. Among patient with loss of consciousness and where imaging was indicated, there was no significant association between imaging rates and caps on damages and attorney fees, whereas periodic payments and collateral payments had the same pattern of association with imaging seen with discretionary imaging. (Table 2)

DISCUSSION:

The use of neurological imaging for patients seen in the emergency department with head trauma has increased dramatically over the past decade. While imaging rates remain higher when imaging is strongly indicated (i.e. in cases of head trauma with loss of consciousness), imaging rates even among patient without loss of consciousness have risen dramatically and rates of both groups are becoming nearly identical.

There are several possible reasons to explain this trend. First, MRI and CT scanners have become more widespread, and imaging has become more accessible. Patients may have become more sophisticated over the years, such that patient-induced demand may have risen. Decreasing tolerance for uncertainty also might explain some of the increase in imaging. Such decreasing tolerance may stem from increasing fear of malpractice lawsuits which compels physicians to order more procedures than medically indicated. Such trends are worrisome in the face of attempts at health care cost containment and for appropriate health care delivery.

States that have been assessed as having a more hostile medical malpractice environment exhibit greater rates of imaging for both necessary and discretionary indications; however, the increase was particularly striking when imaging is generally considered for discretionary imaging. The magnitude of the increase was substantial; there was more than a two-fold difference in rates of imaging that could be attributable to the medical malpractice environment. While causality cannot be determined from this observational study, the association raises the possibility of the practice of defensive medicine. The increased variability found in discretionary cases suggests that physicians' judgments on test ordering may be influenced by non-medical factors, in particular, malpractice environments.

States with laws that have caps on damages and mandated periodic payments of awards demonstrate lower rates of imaging than those without such laws for discretionary cases. Only periodic payments remained significantly associated with imaging for indicated cases. This is not an expected association. The attenuated value for laws capping damages in indicated cases is the only law to follow an expected association. The other laws studied did not provide results as hypothesized. Policies limiting attorney contingency fees and mandating collateral payments from alternative sources were associated with an increase in imaging. It is not known why these results were in the opposite direction.

Caps on awards may be effective not for their direct effects on court costs and settlements, but perhaps they affect a malpractice hostility signal to physicians. Such policies are often the headline policy touted and the only one understood well by physicians and the public. It could be that such policies do not affect physicians directly, but rather their malpractice insurance providers. Therefore, the existence of tort reforms that are well-publicized and well-understood may signal directly to physicians the level of malpractice hostility and the physician's perception of liability exposure, which then may be then be a factor in physician's test ordering behavior.

If one could estimate causality, laws capping awards and setting mandatory periodic payment schemes would be recommended as a means to decrease defensive practices. However, the variable nature of our results for the set of laws lead us to speculate that such policies may be insufficient for preventing the escalation of imaging and of defensive practices of diagnostic imaging. We infer that improved overall medical malpractice environments, which include reform policies, may mitigate defensive ordering of diagnostic imaging.

The results of our community variables proved interesting as well. Even after controlling for the density of radiologists and patient household income, lower imaging rates were observed in rural communities. We found a positive correlation between density of radiologists and imaging rates, though it is uncertain whether it is because increased demand for imaging generates greater demand for radiologists, or vice-versa. The HMO penetration results were particularly interesting in that increased HMO penetration appeared to decrease unnecessary imaging, while increasing necessary imaging.

There are several limitations to our study. This is an ecologic study and, therefore, cannot evaluate causality. We can only establish an association, but cannot determine whether the presence of medical malpractice instability led to changes in laws, or if laws impact medical practice. We hope this study will lead to further investigation of this politically germane issue. This study used secondary data collected for primary purposes of billing (rather than research). This may provide some inaccuracies that are inherent to all Medicare studies. Additionally, the ability to define defensive imaging can only be determined by comparing differences between various conditions. That is, a base rate of appropriate imaging is impossible to estimate. While we found that the group with a necessary indication for head imaging had fewer significant non-medical variables that predict imaging rates, it is unclear whether there were more insignificant variables in loss of consciousness indications because of true insignificance or sample size. The loss of consciousness group was smaller and therefore prone to larger variance. Perhaps the biggest limitation to our study is that we cannot determine how increased imaging due to malpractice fears affects patient outcomes. It is plausible that decreased fear of malpractice lead to decreased imaging but more missed serious diagnoses. Lastly, we used data

from a convenience sample, but it is uncertain how this would lead to erroneous results. It may, however, decrease the generalizability of our results.

It was speculated that the notion of physician-induced demand, whereby physicians increase test ordering to increase income, might be a color our study.[91] However, because our data only includes Part B Medicare patients (and no Part C/HMO), we presumed that the single payment scheme reimbursement would make this phenomenon negligible in our analysis.

Rates of imaging vary significantly, even after adjusting for the medical indication of the patient. This is evidenced by our findings of a strong association between rates of imaging and hostility of malpractice environment. Underlying reasons for non-medical indications of imaging orders should be further explored because such practices raise costs of care. As medical care costs continue to rise, such unnecessary expenditures must be contained to provide the most efficient health care to our population.

TABLE 1: DEMOGRAPHICS

DEMOGRAPHIC CHARACTERISTICS

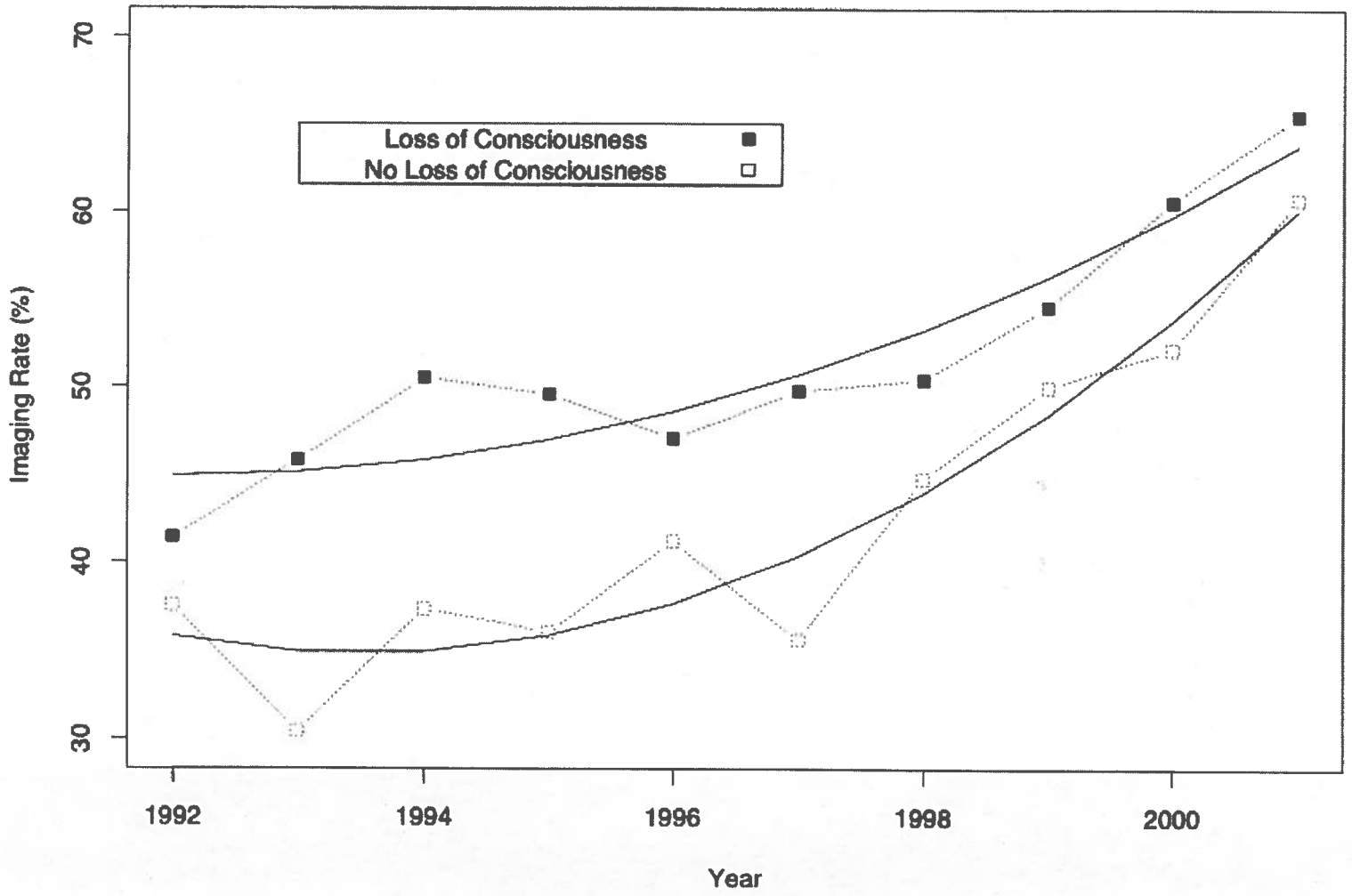
	N	%
Age (@ 1st ER Visit)		
65-74	2,481	28.17%
75-84	3,497	39.71%
≥85	2,828	32.11%
Race/Ethnicity		
White non-hispanic	7,092	80.54%
Black	629	7.14%
Hispanic	163	1.85%
Asian	218	2.48%
Other	186	2.11%
Unknown	518	5.88%
Median Income		
<$40k	2,179	24.74%
$40k-70k	4,727	53.68%
>$70k	1,032	11.72%
Unknown	868	9.86%
Had Cancer Co-morbidity		
No	4,747	53.91%
Yes	4,059	46.09%
Had Any Imaging		
No	3,586	40.72%
Yes	5,220	59.28%

	N	%
State		
AZ	94	1.07%
CA	3,079	34.96%
CT	1,091	12.39%
GA	462	5.25%
HI	187	2.12%
IA	621	7.05%
MI	2,084	23.67%
NM	233	2.65%
UT	388	4.41%
WA	567	6.44%
# of ER visits		
1	7,932	90.07%
2	778	8.83%
3	96	1.09%
AMA Malpractice Crisis Rating		
Stable	3,312	37.61%
Problematic	3,374	38.31%
Crisis	2,120	24.07%
Head Trauma		
No LOC	6,212	70.54%
With LOC	2,594	29.46%

TABLE 2: RESULTS

			Trauma with Loss of Consciousness Imaging Indicated						Trauma without Loss of Consciousness Imaging Discretionary					
			Model 1(overall AMA Rating)			Model 2(Specific Laws)			Model 1(overall AMA Rating)			Model 2(Specific Laws)		
			OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value
PATIENT	Age	65-74	referent			referent			referent			referent		
		75-84	1.02	(0.82, 1.26)	0.85	1.02	(0.82, 1.27)	0.84	0.97	(0.85, 1.11)	0.66	0.99	(0.86, 1.13)	0.86
		≥85	0.78	(0.62, 0.97)	0.02	0.78	(0.63, 0.98)	0.03	1.02	(0.88, 1.18)	0.79	1.06	(0.91, 1.22)	0.46
	Income	<$40k	referent			referent			referent			referent		
		$40-$70k	0.98	(0.79, 1.21)	0.83	1.02	(0.82, 1.27)	0.83	1.10	(0.96, 1.27)	0.17	1.03	(0.89, 1.19)	0.68
		>$70k	0.89	(0.66, 1.21)	0.47	0.92	(0.67, 1.25)	0.59	1.15	(0.94, 1.41)	0.16	1.03	(0.84, 1.27)	0.78
	Race	White	referent			referent			referent			referent		
		Black	1.01	(0.72, 1.41)	0.96	1.01	(0.72, 1.43)	0.94	1.44	(1.16, 1.79)	<0.01	1.28	(1.02, 1.60)	0.03
		Hispanic	0.92	(0.53, 1.61)	0.78	0.89	(0.50, 1.55)	0.67	1.88	(1.27, 2.80)	<0.01	1.82	(1.23, 2.70)	<0.01
		Asian	1.32	(0.81, 2.17)	0.27	1.32	(0.78, 2.24)	0.30	1.26	(0.90, 1.77)	0.17	1.51	(1.07, 2.13)	0.02
	Cancer	No	referent			referent			referent			referent		
		Yes	1.29	(1.05, 1.58)	0.02	1.30	(1.05, 1.60)	0.02	1.16	(1.01, 1.33)	0.04	1.15	(1.00, 1.32)	0.05
COMMUNITY	Locale	Rural	referent			referent			referent			referent		
		Suburban	1.91	(0.87, 4.19)	0.10	2.12	(0.99, 4.54)	0.05	3.42	(2.06, 5.68)	<0.01	3.48	(2.12, 5.70)	<0.01
		Urban	1.78	(0.88, 3.59)	0.11	1.98	(0.99, 3.92)	0.05	3.17	(1.95, 5.17)	<0.01	3.02	(1.87, 4.87)	<0.01
		Metropolitan	1.14	(0.57, 2.29)	0.72	1.56	(0.77, 3.19)	0.22	3.91	(2.40, 6.38)	<0.01	2.63	(1.59, 4.34)	<0.01
	Radiologist Density	Least	referent			referent			referent			referent		
		Less	0.79	(0.58, 1.07)	0.13	0.90	(0.66, 1.24)	0.52	1.16	(0.96, 1.41)	0.13	1.31	(1.07, 1.59)	<0.01
		More	0.75	(0.58, 0.97)	0.03	0.79	(0.60, 1.03)	0.09	1.26	(1.06, 1.50)	<0.01	1.26	(1.06, 1.49)	<0.01
		Most	1.46	(1.12, 1.90)	<0.01	1.31	(0.98, 1.75)	0.07	1.48	(1.25, 1.76)	<0.01	1.35	(1.13, 1.61)	<0.01
	HMO Penetration	Least	referent			referent			referent			referent		
		Less	1.23	(0.93, 1.63)	0.15	1.01	(0.74, 1.37)	0.96	0.90	(0.74, 1.08)	<0.01	0.90	(0.73, 1.09)	0.28
		More	1.84	(1.36, 2.48)	<0.01	1.54	(1.07, 2.23)	0.02	0.85	(0.70, 1.05)	0.13	0.98	(0.77, 1.25)	0.89
		Most	1.61	(1.09, 2.37)	0.02	1.46	(0.97, 2.21)	0.07	0.62	(0.48, 0.80)	0.26	0.80	(0.60, 1.05)	0.11
STATE MALPRACTICE ENVIRONMENT	AMA Rating	Stable	referent						referent					
		Problematic	1.68	(1.22, 2.31)	<0.01				2.54	(2.06, 3.13)	<0.01			
		Crisis	1.25	(0.90, 1.74)	0.19				1.99	(1.56, 2.54)	<0.01			
	Caps on Damages	No				referent						referent		
		Yes				1.20	(0.92, 1.74)	0.34				0.51	(0.40, 0.66)	<0.01
	Periodic Payments	No				referent						referent		
		Yes				0.47	(0.31, 0.71)	<0.01				0.61	(0.46, 0.81)	<0.01
	Attorney Fee Limits	No				referent						referent		
		Yes				0.84	(0.56, 1.25)	0.39				1.65	(1.29, 2.12)	<0.01
	Collateral Payments	No				referent						referent		
		Yes				2.13	(1.35, 3.34)	<0.01				1.81	(1.33, 2.47)	<0.01

FIGURE 1: TIME TRENDS IN IMAGING 1992-2001



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