Economic Analysis of Medical Malpractice Liability and Tort Reform

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Abstract
Medical Malpractice refers to negligence portrayed by a medical professional while providing treatment for a patient where the treatment falls below the accepted standard which leads to potential harm, injury or death to a patient. Standards and regulations of medical malpractice vary by country, but the main idea is the same: the malpractice liability system is usually designed to compensate patients who suffered from bad medical care and to deter negligence by physicians. Ideally, the theory of negligence should lead to appropriate compensation to injured patients and deter physicians from practicing negligently. However experience over the years have been different. Incidents of negligent injury in the USA, for example, have been increasing at an alarming rate, both negative and positive defensive medicine have been on the rise, and malpractice premiums increased sharply. This paper presents an overview of the malpractice system and a survey of the literature on tort reforms and their effects. Both empirical and theoretical results are discussed. The empirical results pertain mostly to the USA due to the ample availability of data that can be analyzed. These studies point to a decrease in health care costs or positive defensive medicine as malpractice pressure decreases. Empirical studies on the effect of negative defensive medicine are rare and also have more mixed conclusions. The empirical studies are based on data sets collected over the years and the findings are therefore restricted to the type of data considered and levels of variations. The theoretical models, on the other hand, offer more insight on negative defensive medicine and are more conclusive; of course within the limitations of the assumptions made while preparing the models. The theoretical models discussed in this paper demonstrate clearly that the practice of both positive and negative defensive medicine can take place. These models offer different predictions on the effect of malpractice pressure on health care spending and quality.

Keywords: Medical malpractice, Economic Efficiency, Tort Reform, Econometrics, Empirical Models, Economic Analysis

JEL Classification Code: A1, K0, K2, K4, I1

Introduction
Medical Malpractice refers to negligence portrayed by a medical professional while providing treatment for a patient where the treatment falls below the accepted standard of medical practice which leads to potential harm, injury or death to a patient. Standards and regulations of medical malpractice vary by country, but the
main idea is the same (Avraham, 2007). The malpractice liability system is usually designed to compensate patients who suffered from bad medical care and to deter negligence by physicians (Kessler, 2011). Medical doctors and other Medical professionals can obtain medical malpractice insurance that would be able to protect them against liability claims arising from their treatment of patients. This insurance would not protect them fully from the claims but instead lowers the associated costs.

Medical Malpractice is the third leading cause of death in the United States and there have been many lawsuits against medical professionals stating that malpractice has occurred. Malpractice types include diagnosis errors, childbirth injuries, medication errors, anesthesia errors and surgery errors. Diagnosis errors yield the largest contribution to medical malpractice and are attributed to around 80 to 160 thousand deaths per year in the United States alone. There have been many cases regarding medical malpractice throughout the years (Cheeks, 2013). Patients have the ability to accuse health care professionals of negligence if they believe they have not been treated properly or if they acquired harm or injury due to the medical professional’s services. Medical professionals are under constant stress regarding the medical decisions they choose to make while treating patients as well as the prospect of being sued due to the decisions they make. With the recent advancements in technology, science and medicine, the world has access to increased knowledge regarding health issues and their treatment. Doctors have been relying more often on diagnostic tools aimed at treating patients faster than before. This has opened a larger window for error when treating patients. Nowadays, medical professionals have to make a quick decision, in which they are correct most of the time. However, there have been instances when their decisions were incorrect and this has opened medical malpractice cases holding the medical professionals liable for the decision.

It is widely believed that the current malpractice system induces physicians to practice defensive medicine as a protection against potential malpractice claims (Baker, 2005). Physicians can undertake cost-ineffective treatments or over-utilization of medical services in order to avoid being sued. This is known to be positive defensive medicine. Physicians can also decide to avoid risky patients or procedures that are highly likely to result in malpractice claims; thus practicing what is called negative defensive medicine (Montanera, 2015). The possibility of malpractice error can be reduced by investing in technology and systems that assist in properly diagnosing and providing treatment. Therefore the question becomes, what malpractice liability rules should be adopted that induce physicians and medical providers to make such patient safety investments.

Economic analysis of medical malpractice deals with the above question and treats also the issue of the ability of victims to bring tort litigation for damages they have incurred (Arlen and McLeod, 2003) as well as malpractice insurance claims (Danzon, 1991). In general, the validity of malpractice claims is tested according to the negligence rule (Kessler, 2011). This rule embodies four elements that are
required for a successful claim: 1) the patient must show that the physician owed him or her a duty of care, 2) the patient suffered a compensable injury, 3) the injury was caused by substandard conduct by the physician due to action or lack of action, and 4) the physician’s breach of care immediately preceded the injury (Kessler 2011; Canadian Health Facilities Law Guide 2009).

Ideally, the theory of negligence should lead to appropriate compensation to injured patients and deter physicians from practicing negligently. However, experience over the years has been different. The incident of negligent injury in the USA, for example, have been increasing at an alarming rate, both negative and positive defensive medicine have been on the rise, and malpractice premiums increased sharply (Danzon, 1991; Kessler 2011). Moreover, it is believed that only a small fraction of patients who suffer injury due to malpractice actually receive compensation and most of the expenses go to legal and underrating costs (Anderson et al., 2005; Cohen and Hughes, 2007; Harvard Medical Practice Study, 1990).

The cost of malpractice claims in USA has been estimated at $6.5 billion in 2001 while in Canada the cost was around $237 million (Figure 1). The situation in Canada is different because of several features of Canadian law that tend to discourage parties from suing.

Figure 1: US and Canada costs of malpractice claims in 2001

Source: Anderson et al., 2005.

physicians for malpractice. The Supreme Court of Canada has limited the types of cases in which damages may be awarded. Several guidelines that cap awards have also been set. Furthermore, in Canada, a losing party is required to pay for two-thirds of a successful party’s legal fees. Finally, the Canadian Medical Protective Association (CMPA) has been known to defend medical malpractice suits extremely vigorously and is known to turn down settlement offers in order to discourage future lawsuits (Library of Congress: Medical Malpractice Liability - Canada, 2016).

It is widely believed that the current malpractice system is in need of improvements in order to create incentives for appropriate care. In the United States, the failure of the system and the high cost of health care lead many states to consider reforms in tort policy. There are currently two sides regarding the issue of tort reform (Born et
Lawyers are going against a reform stating that it is in their best interest to protect patients against the negligence of medical professionals, while on the other side medical professionals and health care providers are supporting a tort reform as it would lower potential costs with regards to a liability claim. At this time much work has been done to analyze the current tort law and tort reforms. Economic efficiency can play an important role in assessing the medical malpractice system (Danzon, 1991). Other issues that are being considered include costs to the public, claims, risk management and market conditions.

The remainder of this paper is organized as follows. Section 2 presents a review of tort reform options, the effect on malpractice insurance, deterrence effects, and provides classifications of the different types of reforms. Section 3 provides a review of the literature on empirical evaluation of malpractice options and reforms. The empirical literature has been developing substantially in the past few years with the USA system being the most studied. Section 4 is concerned with the economic efficiency and cost effectiveness of the malpractice system. Section 5 discusses the effects of malpractice reforms on defensive medicine and presents a theoretical model on defensive medicine. The model considers interactions between patients, physicians, and health insurers and incorporates aspects of both positive and negative defensive medicine. The section ends up with a summary of other topics pertinent to medical malpractice including the use of agent-based simulation aimed at providing predictive analytics and recommendations for health policy decision makers and healthcare management entities. Game theoretic applications in malpractice disputes, alternative measures aimed at decreasing litigation and lowering premiums, and the effect of life and health insurance on reducing malpractice suits are also discussed. Finally section 6 provides relevant conclusions.

1. Tort Reform Options

Several initiatives have been employed by legislatures in an attempt to reduce the rising costs of medical malpractice insurance and to render the malpractice system more efficient. Bovbjerg (2007) classified the various reforms into conventional reforms and system reforms. Conventional reforms are aimed at deterring negligent medical practice and offering fair compensations. System reforms, on the other hand, focus on the operation of the system and are aimed at amicably resolving disputes. Studdert et. al. (2000) further classified conventional reforms into three classes: A) reforms that focus on limiting access to courts, B) reforms that modify liability rules in order to reduce the frequency as well as the size of claims, and C) damage reforms that directly address the size of awards. Table 1 (adapted from Studdert et. al.,2004) provides a comprehensive list of these reforms. One type of
class (A) reforms, shortening the statutes of limitations, imposes a time limit that starts from the date of the allegedly negligent event. In California, for example, a claim for alleged medical negligence must be brought up within three years from the injury (Healthcare Professional Liability Insurance, 2016). In Ontario this period is only two years (Olga Gil research Services, 2016). Another reform, imposes the establishment of screening panels aimed at encouraging settlement without reverting to time consuming and expensive trials. An example of type (B) reform, eliminate joint-and-several liability rules, deals with cases of multiple defendants and makes sure that the healthcare provider is only liable to his or her proportionate share. In type (C) reforms, caps on damages are the most notable measures. Under such initiatives, the amount of money a claimant may recover is limited to a specific amount of money. The cap maybe imposed on the total award or only on non-economic (general) damages such as pain and suffering. Most states in USA impose a cap on non-economic damages that ranges from $250,000 to $700,000 (Nelson et. al, 2007). Other tort reforms in class (C) include limits on attorney fees, mandate collateral source offsets, and required periodic payments. In California, for example, an attorney fee is limited to 15 percent of any amount exceeding $600,000 (Healthcare Professional Liability Insurance, 2016).

According to Olga Gil research Services (2016), the top 10 medical liability reform measures are limits on non-economic damages, mandate collateral source offsets, limits on attorney fees, advance notice of a claim, shorten statutes of limitations, require periodic payments, alternate mechanisms for resolving disputes, compensate claims through a no-fault administrative system, eliminate joint-and-several liability rules, and expert affidavits. Mello and Kachalia (2010) on the other hand argued that there are 8 most widely implemented reforms by states: caps on non-economic damages, establish screening panels, certificate of merit requirements, limit attorney fees, eliminate joint-and-several liability rules, mandate collateral source offsets, require periodic payments, and shorten statutes of limitation. Most of these fall within the top 10 reforms of Olga Gil research Services (2016). Less tested reforms include schedules of non-economic damages, use medical courts, encourage early offers for settlement, shift liability from individuals to organizations, subsidies conditional upon meeting certain safety goals, and relocation of legal responsibility (Mello and Kachalia, 2010).
Table 1: Tort reform options (Studdert et. al.,2004).

<table>
<thead>
<tr>
<th>Conventional Reforms</th>
<th>System Reforms</th>
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<tr>
<td>(A)</td>
<td>(B)</td>
</tr>
<tr>
<td>Limitations on Access to Courts</td>
<td>Modification of Liability Rules</td>
</tr>
<tr>
<td>Shorten statutes of limitations</td>
<td>Eliminate join and several liability rules</td>
</tr>
<tr>
<td>Enact statutes of repose</td>
<td>Impose higher standards for proving breaches of informed consent</td>
</tr>
<tr>
<td>Establish screening panels</td>
<td>Eliminate res ipsa loquitur</td>
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Source: Studdert et. al.,2004.

The prospects of the above reforms have been analyzed extensively in the open literature from both a theoretical standpoint as well as from an empirical view. The next section focuses on the empirical studies that used regression analysis to determine the effects of reform. Sections 4 and 5 will review the literature that employed a more theoretical perspective.

2. Empirical Models

Several recent studies undertook a data-based (i.e. empirical) approach to investigate the effect of malpractice laws. In the United States and since the 1970's
various reforms have been enacted to the malpractice system and this has provided useful data for such studies.

The empirical literature examined the effects of the malpractice system and tort reforms in three different ways (Kessler, 2011): 1) survey of physicians' opinions about the role of the malpractice system, 2) effect of reforms on claim frequency and amount, and 3) quantification of how malpractice pressure affects physicians' behavior. The studies based on physicians' opinions indicated that existing malpractice systems lead to the practice of both positive and negative medicine (Kessler, 2011; Studdert et. al., 2005). This kind of conclusion, however, is only based on perception and not on quantifiable measures. Studies on effects of reforms on claims indicate that economic loss is the most important factor in determining compensations and their amounts. Similarly, these studies fail to incorporate any quantifiable measures to determine how reforms affect the behavior of doctors. Rather the focus was only on incentives and the impact of indirect reforms in these studies has been inconsistent (Farber and White, 1991; Brennan et. al., 1996; Thorpe, 2004; Avraham, 2007; Avraham, 2010).

The quantitative studies seem to be the most conclusive; although there are still inconsistencies due mainly to unobserved factors (Kessler, 2011). Several studies based on US data have even considered the longitudinal effects of space/geographical location (e.g. data across states) in addition to the time effects. Few multiple regression models using ordinary least squares (OSL) have been reported in the literature. These models all have the form:

\[
Y = f(x) = a_0 + \sum_{i=1}^{n} a_i x_i + u
\]

where Y, the dependent variable, can represent expenditures (charges), number of cases, or average payment. The explanatory variables can be individual controls (e.g. age of physician, year since graduation, patient length of stay, income, etc.) or regional controls such as per capita income, lawyers per capita, population, etc. The error term u represents the effects of variables omitted from the model or factors that cannot be observed.

Along these lines, Hunnesy (2004) presented a regression model to study the effect of malpractice tort reform on positive defensive medicine. The data used in her analysis were derived from a sample of 7,450,992 patients diagnosed of skull fracture in 28 states as part of a study by the Agency for Healthcare Research and Quality. The depended variable in the model, total patient expenditure, was used to assess the level of defensive medicine in each state. The model consisted of
explanatory variables including patient length of stay, age, number of diagnoses, number of medical procedures, mean household income, patients' insurance programs, and hospital demographic measures such as size, location, public or private, and teaching status. Dummy variables that represent tort reforms (pre-judgment, contingency fee caps, collateral source rules, joint and several liability rules, periodic payment, physician compensation funds, statutes of limitations) were also included. The results indicated that age, private insurance, and hospital teaching status are insignificant while all other variables were significant. Furthermore the majority of the control variables had the expected signs on the coefficients. For example, patient length of stay, number of diagnoses, and number of medical procedures were found to positively impact charges. All tort reforms, with the exception of voluntary arbitration, were found to have a significant impact on charges and hence on the practice of positive defensive medicine. The model was deficient in a number of ways because health outcome cannot be held constant across patients. Such imposition cannot be easily remediated due to the nature of available data. The R2 value was also low at 48.62% indicating that the model can only capture about 48% in data variability. The null hypothesis of homoscedasticity was also rejected.

Olsen (2000) presented a study on the efficiency of malpractice law to changing conditions in medical relationships. Data in this study was collected from two major sources: survey data on medical malpractice claims from 50 states compiled by the General Accounting Office (GSO) and state level control data for malpractice reforms compiled from the American Medical Association (AMA). A total of 44 explanatory variables were considered to study the effect on total malpractice award. Some of these variables and as in the case of the model of Hunnesy (2004) included dummy variables to indicate reform measures. The number of physicians involved in a given claim and for whom payment was made on their behalf was not recorded in the data sets. Physician experience was also assumed to be continuous from year of graduation. The results from the model strongly support the claim that medical malpractice law does affect physician liability (as measured by malpractice award).

In a recent study, Avraham (2007) evaluated the impact of six different types of tort reforms (caps on non-economic damages, caps on collateral source rule, caps on joint and several liability, caps on punitive damages, periodic payments) on the total annual payments, average payments, and number of cases. The data set used in the study consisted of more than 100,000 settlement payments and was obtained from the National Practitioner data bank. The data includes state control measures
(percentage of population over 65, percentage of bachelor's degrees, car fatalities per million people, per capita health care expenditures, annual per capita income, lawyers per capita, life expectancy for newborns, consumer price index for medical goods, metropolitan percentage, percentage of new residents, population, unemployment rate) and individual controls (age of physician, case length, year of graduation, field of physician, state fund payment). The results indicate that caps on non-economic damages decrease average payments by 62 to 72% while periodic payment reforms cause a decrease between 38 and 54%. The effects of the other reforms were not clear, however. The consideration of negative defensive medicine was not considered.

3. Economic Analysis

The previous two sections discussed the literature on medical tort laws and tort reforms which provided enough evidence on how medical malpractice laws affect the behavior of health care providers. Such evidence clearly showed that malpractice laws have a negative impact on supply and encourage positive defensive medicine. Since medical errors are unilateral in the sense that only physicians and not the patient can take precautionary measures to reduce or eliminate the potential of injury, a standard economic model of efficient care can be adopted (van Velthoven and van Wijck, 2012). Figure 2 shows that there are two conflicting costs in play to determine the optimal or efficient precautionary level $x^*$ of care. The cost of care $C(x)$, assumed to be linear with the level of care in Figure 2, and accidental costs or costs resulting from damages $D(x)$. The appropriate or efficient level of care $x^*$, therefore, is the level that minimizes the total overall cost: $C(x) + D(x)$ or $C'(x^*) + D'(x^*) = 0$. That is, the marginal extra unit of care must be equal to the marginal social cost at the efficient level of care (Miceli, 1997; Fenn et al., 2004). $x^*$ is sometimes called due care or socially optimal level of care (van Velthoven and van Wijck, 2012).

From a physician’s point of view, the level of care that he or she chooses depends on personal incentives or utility of wealth $u(W)$. The physician care level solves: 
\[ \begin{cases} u(W − x) & \text{if } x \geq x^*; \\ u(W − x − D(x)) & \text{if } x < x^*. \end{cases} \]
In general this will not lead to the socially optimal level of care. However, when the standard of care is specified by law, the physician care level will coincide with the socially optimal level $x^*$. Liability rules should therefore be designed to lead physicians to choose the efficient level $x^*$ of care. If his or her level of care falls short of $x^*$, he or she will be considered negligent of standard care and will be held liable for malpractice losses. If, on the other hand, the physician level of care exceeds $x^*$, no liability is imposed. This creates a discontinuity in the physician’s cost function which becomes PQRD
as shown in Figure 2. Clearly, with this cost function, the physician’s appropriate level of care will also be at $x^*$. At the due care level, the marginal benefit from additional precaution is positive. Even though more care will reduce expected harm, the additional incurred cost to society, in general, far exceeds the potential costs due to injury. It is important, therefore, for liability rules not to induce excess precautions because this will lead to economic inefficiencies. It is not in the best interest of society to incur unreasonably high cost just to eliminate very slim accidental losses.

**Figure 2: Efficient care under negligence**

![Efficient care under negligence](image)

**Source:** van Velthoven and van Wijck, 2012.

The above tort model seems to be plausible in solving the problem of medical malpractice reform. Based on Figure 2, setting the efficient level of care by law leads physicians to conform to the prescribed due care norm. However, in real world situations, many factors exist that prevent such an ideal and straightforward application of the model.

The main issue pertains to uncertainty about due care (van Velthoven and van Wijck, 2012). Even a specialist in the field cannot often determine the appropriate level of care with absolute certainty. Courts are, therefore, unable to set a precise level of care and have to assess malpractice cases against standard practice in the medical profession. Judges can also misgauge and this complicates matters more. Physicians end up uncertain about the amount of due care they have to exhibit to
avoid liability and become tempted to employ a due care that is higher than the due norm. The increase in costs are often passed on to the patient.

Another issue with the standard tort model is that compensations to the patient due to negligence are subject to lengthy delays (Cohen and Hughes, 2007). The patient is usually unaware of the negligence of the physician and even if he or she files a claim there is too much doubt in the ability of the provider having the financial means to pay compensation and what the judge will decide. In order to save on litigation costs, parties may decide to settle out of court at a cost way below the damage cost due to malpractice. This can induce physicians to practice care below the standard.

Another valid concern is that most medical providers are insured against malpractice suits and this insulates against sanctions of the court system and nullifies the deterrent effect of malpractice law. However, the deterrent effect of the law can be preserved if premiums are adjusted to reflect the frequency of undue care by physicians. The deterrent effect is also preserved because claims bring along other hidden costs such as reputational harm, hassle, and time wastage.

4. Theoretical Modeling of Defensive Medicine

As discussed earlier, the fear to malpractice lawsuits steer physicians to practice defensive medicine. This is manifested by physicians taking extra costly precautions well above the standard due care (i.e. practicing positive defensive medicine). A physician may instead practice negative defensive medicine and decide to avoid high risky patients or procedures, relocate his or her activities, or even exit the profession altogether in order to stay away from exposure to malpractice suits (Kessler et al., 2005; Masta, 2007; Mello et al., 2005). Opinion surveys of physicians about the role of the malpractice system point out to an overall presence of defensive medicine (Studdert et. al., 2005). A number of studies dealing with the theoretical modeling of defensive medicine were carried out. However the models fail to completely account for defensive physician behavior (Feess, 2012). Such models employed a framework based on taking into account patient-physician interactions through a simple approach that considers a single insurer inducing a single physician to provide treatment to a single patient. Access to treatment was assumed to be exogenous in that the number of patients a physician can treat is fixed. Although these models provided preliminary explanation on why defensive medicine takes place, they failed to explain inconsistencies in the empirical literature with respect to the existence and extend of both types of defensive medicine and if tort reforms produce the intended results (Danzon, 1985; Danzon, 1991; Olbrich, 2008).

Montanera (2015) presented a new model that alleviates the above drawback in existing models and in which the practice of defensive medicine both positive and negative can take place. The model accounted for both positive and negative defensive medicine, took into account insurers’ reaction, and incorporated the ability of physicians to determine the number of patients, type of care and intensity.
The model consists of two components: a physician submodel and a managed care organization (MCO) submodel. The MCO is assumed to be a final decision maker that offers consumers a health insurance policy at a contract of $\tau$ with an associated probability of recovery or patient access to care $Q$:

$$Q = \frac{Dn}{q}$$

Where $D$ is a measure of available physicians, $n$ is physician caseload, and $q$ is the probability that the consumer becomes ill. A patient $i$ falling ill to a health status $H2$ and receiving treatment $t_i$ from a physician will recover to an original health status $H1$ with a probability $\rho(t_i)$. Therefore, a measure of the quality of health insurance that indicates that treatment is received and is also successful is:

$$Q(n, t_i) = \frac{Dn}{q}(1 - \rho(t_i))$$

Following through the same lines of thought as in the derivation by Montanera (2005), assume that each physician has a stock $s$ of resources and the revenue per patient is $w$, the physician will choose the caseload $n$ that maximizes his or her net income. Let the monetary equivalent for all uninsurable expected liability (including reputational and emotional costs) be represented in a linear fashion as:

$$g(t_i, P) = \rho(t_i)P$$

Where $P$ is a parameter representing expected liability cost and serves as a measure of malpractice pressure. With this, a physician with $w$, $s$, and $P$ will choose a caseload $n*$ that maximizes total income consisting of revenues minus liability costs, i.e.

$$\max\{wn - n.\rho\left(\frac{s}{n}\right)P\}$$

From the MCO point of view who sets contracts with physicians consisting of a payment of $w$ per patient and offers resources $s$ to use in the treatment, the problem is to:

$$\max_{w,s,\tau}\{\text{prob}(H_1).U(H_1, m - \tau) + \text{prob}(H_2).U(H_2, m - \tau)\}$$

Where $U$ represents the consumer utility as a function of health status and health care consumption. Due to resource considerations, the maximum number of patients a physician can treat is $\frac{q}{D}$ and for the MCO problem $n = \tilde{n}(w, s, P, q, D) = \min\left(n^*, \frac{q}{D}\right)$. The contract price $\tau$ of treatment from the MCO point of view is equal to the pay of physicians and the cost of resources $s$ contracted at a marginal cost of $c$, i.e.

$$\tau = Dw\tilde{n} + Dcs$$

The probabilities of achieving a health status of $H1$ and $H2$ are given by:
\[ \text{prob}(H_1) = (1 - q) + q\tilde{Q} \]
\[ \text{prob}(H_2) = q - q\tilde{Q} \]

Where:
\[ \tilde{Q} = \frac{D\bar{n}}{q} (1 - \rho(s\bar{n})) \]

The physician model can be used to assess physician behavior. The derivations in the original manuscript by Montanera (2015) showed that:
\[ \frac{\partial n^*}{\partial P} < 0 \]
and
\[ \frac{\partial t^*}{\partial P} > 0 \]

indicating that the model is able to describe both positive and negative defensive medicine by physicians as malpractice pressure P changes.

Figure 3 based on the MCO model shows an optimal level of treatment \( t^* \) chosen by physicians that is independent of the amount of funds available (limited access equilibrium). Higher policy prices \( \tau \) induce physicians to follow a vertical expansion path by increasing their caseload n. The expansion path is limited by the number \( \frac{a}{D} \) of patients a physician can treat and cannot go beyond an isocline line of \( \tilde{\tau}(P) \). Beyond this line the MCO can only restructure the contracts by increasing t and must maintain \( n = \frac{a}{D} \) (full access equilibrium).

The above model is therefore able to explain the effect of malpractice pressure on healthcare quality and expenditure. As malpractice pressure is increased both health care quality and expenditure increase but only up to a certain threshold after which access to care is reduced and negative defensive medicine can take place. This non-monotonic relationship has not been elucidated in previous models. Although the model is an excellent contribution to the literature, it has a number of drawbacks in that it assumes that only consumers with insurance receive treatment, it neglects legal costs and costs due to loss of reputation as well as emotional costs endured by physicians, and assumes risk neutrality (P independent of ti).

The model does not consider alternative measures that consider the system as a whole such as accountable care organizations and bargaining strategies. Furthermore, the model assumes a linear provider behavior proportional to deterrence, does not take into account matching of patients to physicians, and does not examine dispute settlement issues.
Figure 3: Optimal allocation of revenues as health care policy prices increase

Source: (Montanera, 2015).

These latter deficiencies in the theoretical modeling framework are usually addressed through other economic tools such as game theory and agent based simulation. For example, Liu and Wu (2014) used an agent based approach to construct a health care system by combining different agents: a patient agent, a provider agent, and a payer agent. The approach considered also health care costs and was able to provide recommendations on the effects of various policies. Game theoretic approaches have been shown to help in modeling malpractice disputes (Watanabe, 2006; Sieg, 1998).

Conclusion

This paper presented an overview of the malpractice system and surveyed the literature on tort reforms and their effects. The assay included both empirical and theoretical studies and from both law and economics perspectives. The empirical studies point to a decrease in health care costs or positive defensive medicine as malpractice pressure decreases. Empirical studies on the effect of negative defensive medicine are rare and also have more mixed conclusions.

The empirical studies are based on data sets collected over the years and the findings are therefore restricted to the type of data considered and levels of variations. There are always unobserved factors that can be correlated to charges. Due to this specific nature of data sets, it should be kept in mind that the
conclusions on effects of reforms on medical malpractice cannot be generalized. In addition, there are always spatial variations and variations across medical specialties as well as non-financial consequences that may affect the behavior of physicians. The theoretical models, on the other hand, offer more insight on negative defensive medicine and are more conclusive; of course within the limitations of the assumptions made while preparing the models. The theoretical models discussed in this assay demonstrate clearly that the practice of both positive and negative defensive medicine can arise. These models offer different predictions on the effect of malpractice pressure on health care spending and quality.

It is agreed upon that tort laws and tort reforms should provide incentives to practice the optimal level of care in order to prevent injury. However medical errors will always be present and the medical malpractice system should be able to provide compensation in a fair and consistent manner. This fair level of compensation has not been studied. The current empirical literature focused more on the effects of reforms on levels of compensation and calculations of the appropriate level of compensation or cost-benefit analysis studies are non-existent. Improvements to the current malpractice system and alternative approaches aimed at supplementing its efficiency should also be investigated.

REFERENCES


