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MEDICAL MALPRACTICE: AN EMPIRICAL EXAMINATION OF THE LITIGATION PROCESS

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ABSTRACT

New data on medical malpractice claims against a single hospital where a direct measure of the quality of medical care is available are used to address 1) the specific question of the role of the negligence rule in the dispute settlement process in medical malpractice, and 2) the general question of how the process of negotiation and dispute resolution in medical malpractice operates with regard to both the behavior of the parties and the outcome of the process. We find that the quality of medical care is an extremely important determinant of defendants' medical malpractice liability. More generally, we find that the data are consistent with a model where 1) the plaintiff is not well informed *ex ante* about the likelihood of negligence and 2) the *ex ante* expected value to the plaintiff of a suit is high relative to the costs of filing a suit and getting more information. Thus, suits are filed even where there is no concrete reason to believe there has been negligence, and virtually all suits are either dropped or settled based on the information gained after filing. We conclude that the filing of suits that appear, *ex post*, to be nuisance suits can be rational equilibrium behavior, *ex ante*, where there is incomplete information about care quality.

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I. Introduction

In this study we analyze a new data set on medical malpractice claims against a single hospital where a direct measure of the quality of medical care is available. These data are used to address 1) the specific question of the role of the negligence rule in the dispute settlement process in medical malpractice, and 2) the general question of how the process of negotiation and dispute resolution in medical malpractice operates with regard to both the behavior of the parties and the outcomes of the process.

The question of whether negligence matters in determining liability in medical malpractice cases is an important one for two reasons. First, it has been suggested that medical malpractice law (like products liability law) has been evolving from negligence toward strict liability (Epstein, 1979). Second, a number of jurisdictions are considering abolishing the negligence rule in medical malpractice and replacing it with a no-fault system.[1] However, the operation of the negligence rule in medical malpractice has not been studied empirically, since data that include a measure of quality of medical care has not been available.

We find that the quality of medical care is an extremely important determinant of defendants' medical malpractice liability -- including both whether defendants are liable at all and how much defendants compensate plaintiffs in cases that settle out of court.[2] More generally, we find that the data are consistent with a model where plaintiffs are poorly informed *ex*

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[1]See the Harvard Medical Practice Study (1990) for a survey.

[2]The direct relationship between quality of care and liability that we find is a necessary condition for the negligence system to encourage efficient levels of care quality. See Shavell (1978) and Danzon (1985) for discussions of the incentive effects of liability rules in medical malpractice. See White (1989) for an empirical test of the deterrent effects of liability rules in the automobile accident field.

ante about whether there has been negligence, file suit to gather information and either drop the case if they find that negligence is unlikely to have occurred or settle for a positive payoff if they find that negligence was likely. Thus, we find that the negligence rule does matter in the medical malpractice field and that liability provides a real incentive to avoid negligence.

In the next section of this study, we describe the multi-stage litigation process for medical malpractice cases that applies in the state where our study was conducted. This process is generally similar to that used elsewhere in the United States. Section III contains the development of an empirical framework for analysis of the litigation process. A description of the data and simple summary statistics are presented in section IV. Section V contains single equation estimates of models of settlement amounts and the probability that a case is dropped or settled, while a joint model of the determination of these quantities is the focus of section VI. In section VII, we present the implications of our empirical analysis for how case outcomes are related to care quality and the severity of injury. Section VIII contains a discussion of the role of information in the litigation process in medical malpractice and a reinterpretation of nuisance suits. Section IX concludes.

II. The Litigation Process in Medical Malpractice

The first stage of the litigation process generally involves the plaintiff filing a lawsuit, although case filing is sometimes preceded by communication in which the plaintiff attempts to extract a settlement offer without filing suit. In medical malpractice cases, plaintiffs' lawyers are normally paid on a contingency basis. The lawyer receives a proportion, typically around one-third, of the settlement amount if the case settles or

of the damage award if the plaintiff wins at trial. If the plaintiff drops the case or loses at trial, the lawyer receives nothing. Usually, plaintiffs' lawyers also pay for court fees and the cost of expert witnesses. These costs are deducted from the damage award or settlement. Thus the contingency fee system gives plaintiffs' lawyers a strong incentive to screen prospective plaintiffs and to accept only cases having high expected value.[3]

The second stage of litigation is pre-trial discovery, which involves exchange of information (evidence) between the plaintiff and defendant. Our data set concerns cases involving alleged medical malpractice incidents that occurred during patients' stays at a particular hospital. Therefore, the first part of discovery normally involves the plaintiff's lawyer demanding a copy of the plaintiff's hospital record and the hospital demanding an opportunity for a physician it names to examine the plaintiff in order to verify damage claims. Later in the process, both sides must name medical expert witnesses who will testify for them at trial concerning whether the plaintiff's medical care was negligent. Expert witnesses are necessary in medical malpractice cases since the judge or jury is not expected to be able to evaluate the quality of medical care without having an expert in the relevant medical specialty define the standard of care and indicate whether or not it was met. Toward the end of the discovery process, each side's expert is deposed by the other side to learn what evidence will be presented if a trial occurs and how strong the other side's case is. The plaintiff and/or the medical personnel involved in the incident may also be deposed in order to learn whether they will make effective witnesses in court.

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[3]In some states, medical malpractice cases can only be filed in court if they are reviewed and approved by a screening panel beforehand. Depending on the state, these panels may consist of physicians, lawyers, laypersons or some combination of these groups. The panel must decide that the complaint is not frivolous before it can go forward.

Obviously, each step in the discovery process increases both sides' legal costs.

The next stage of litigation involves mediation (non-binding arbitration), which must occur before a case goes to trial in a local court. If the case has been filed in state court, mediation is not mandatory. In mediation, a panel of three lawyers, one named by each side and one named by the court, hears an abbreviated presentation of the evidence that each side will present at trial. It then decides on an award figure that is intended to encourage settlement.[4] Each side must explicitly accept or reject the mediation award. If it is accepted by both sides, then the case ends with the defendant paying the amount of the award to the plaintiff. If either or both sides reject the mediation award, then the case may proceed to further settlement negotiations and/or trial.[5]

The final stage of litigation is the trial. If the case goes to trial, either side has the right to demand a trial by jury and, normally, plaintiffs in medical malpractice cases do so. The jury decides both whether the defendant is liable and, if so, the amount of the damage award.

In practice, few cases go through all stages. Instead, most medical malpractice cases are either dropped by plaintiffs or settled out of court at some point during the discovery stage. The two-way exchange of information during the discovery process encourages resolution of cases without trial by making the information available to both sides more alike and increasing the

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[4]In our empirical analyses we investigate how the mediation awards are related to the level of care and settlement values.

[5]If a case proceeds to trial and the trial outcome is less favorable to a party that has rejected the mediation award then that party is liable for the other side's legal expenses at trial. However, this fee shifting generally only benefits the plaintiffs because defendants usually do not find it worthwhile to attempt to collect legal expenses from plaintiffs.

likelihood that both parties have the same expectations about the trial outcome. Perhaps most important is the flow of information from the defendant to the plaintiff concerning the likelihood that negligence occurred. For example, the plaintiff's hospital record may indicate that the plaintiff was given a larger dose of a drug than the physician ordered. Or it may indicate that a monitoring device failed and that the failure was not noticed for several hours. These events demonstrate clear negligence, which means that the defendant is likely to be found liable by a judge or jury. But the record may not indicate clear negligence, and the plaintiff (or his/her lawyer) may then decide that it is best to drop the case.[6]

The mediation procedure also encourages the parties to resolve cases by providing them with a common external evaluation of the plaintiff's claim, which increases the likelihood that both sides will have similar expectations about the trial outcome. The incentive to settle after mediation is particularly strong, since if the litigation continues to trial, both sides must incur the high legal expenses of the trial itself.

Cases may also be dismissed by the judge at any stage of litigation. The judge may dismiss a case for a variety of reasons---the statute of limitations for filing a lawsuit has run, the case was filed in the wrong court, the defendant hospital is public or non-profit and may have governmental or charitable immunity from liability, the plaintiff fails to appear or fails to produce an expert witness for deposition, or the judge feels that the case is without merit. Dismissals may occur early in the litigation process or as late as during the trial. It should be noted that it is often difficult to distinguish between cases dropped by plaintiffs and

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[6]There is a potential conflict of interest between the plaintiff and the plaintiff's lawyer here.

cases dismissed by the judge.[7] These two outcomes are combined in the data set discussed below.

III. An Empirical Framework

In any negotiation, the central governing factor is the dispute settlement mechanism and what will be the outcome if the parties ultimately fail to agree.[8] In our medical malpractice study, if the parties fail to agree the case will ultimately be decided by a trial. Expectations about the decision that would be made by a jury in a given case provide an important constraint on negotiations in that each party will use this expected outcome as a benchmark to judge settlement offers. With sufficient data, we would estimate a model of trial outcomes as a function of the facts of each case and use this estimated model to understand settlement behavior and the drop decision. However, there are not a sufficient number of trial outcomes in our data (and they all were decided in favor of the defendant!) to calibrate such a model. Therefore, we have to make indirect inferences about strategies, preferences, and trial outcomes based on the available data.[9]

A trial under a negligence rule leaves a jury with a two-stage decision process. In the first stage, the court decides if there is liability which requires negligence on the part of the defendant. If it decides there is

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[7]When a plaintiff drops a case, the formal procedure requires that the plaintiff ask the judge to dismiss it "with prejudice," meaning that it cannot be filed again.

[8]See Mnookin and Kornhauser (1979) and Farber and Katz (1979).

[9]The available data include information on 1) the facts of the case including care quality and severity of injury, 2) whether the case was dropped or settled, 3) the amount of the settlements in settled cases, 4) the mediation award in mediated cases, 5) which of the parties accepted the mediation award, and 6) the trial outcome in tried cases. The data are described in detail in the next section.

liability, the court then determines the amount of damages. The expected trial outcome is therefore

$$E(Y) = Pr(L)*E(Y|L) \qquad \text{(III.1)}$$

where Pr(L) is the probability that the court finds liability and E(Y|L) is the expected award given liability.

A. *The Expected Settlement and Mediation Awards*

Both sides will base their behavior in settlement negotiations on the expected trial outcome and the costs of pursuing the case. Suppose the logarithm of the probability of liability is

$$\log(P) = X_p\beta_p \qquad \text{(III.2)}$$

where X_p is a vector of variables that affect liability and β_p is a vector of parameters. In our case, this vector consists of variables measuring care quality. Suppose further that the logarithm of damages conditional on liability is

$$\log(Y|L) = X_y\beta_y. \qquad \text{(III.3)}$$

where X_y is a vector of variables that affect damages and β_y is a vector of parameters. In our case, this vector consists variables measuring the severity of injury and age of the patient.[10]

Without detailed information on enough trial outcomes we cannot estimate equations III.2 and III.3 separately. However, we can add these expressions to form the logarithm of the expected trial outcome as

$$\log(E(Y)) = X\beta + \varepsilon_1 \qquad \text{(III.4)}$$

where X is the union of the sets of variables in the liability and damage equations and ε_1 is an additive error term that captures unmeasured factors

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[10]Under the negligence rule, liability depends only on whether the defendant was negligent. If the defendant is found liable then the damage award provides full compensation to the plaintiff, which implies that it depends on the severity of the injury.

affecting the expected trial outcome. We can identify only the elements of β_p and β_y that relate to variables not contained in both X_p and X_y. For variables that are contained in both vectors (e.g., the constant) we can identify only the sum of the β's. Note that this analysis provides a foundation for analyzing the awards and settlements in logarithmic terms. The natural multiplicative relationship between the liability and damage variables is translated into a linear relationship in the logs.

A wide class of bargaining models (e.g. Nash, 1950; Crawford, 1982; Rubinstein, 1982) suggests that the average negotiated outcome (settlement) will be equal to the expected trial outcome on average. This equality requires symmetry between the parties in two dimensions. First, they must hold either identical expectations about the trial outcome or expectations that are symmetric around the true value.[11] Second, the parties must have the same cost of litigation, including both legal expenses and any risk premium that they would be willing to pay to avoid the uncertainty of litigation. Given the assumption of symmetry, we can estimate equation III.4 directly using the log of the settlement as the dependent variable.

We can shed some light on the validity of the symmetry assumption by assuming that the mediation award represents the mediation panel's estimate of the expected trial outcome and comparing mediation awards with settlement amounts in the same cases. The bargaining models referred to above suggest that if costs are not symmetric then the negotiated outcomes will favor the party having lower costs. Thus, finding that mediation awards are systematically lower (higher) than settlements in the same cases would imply

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[11]Formally, suppose that δ is the true expected outcome but that the plaintiff expects $\delta+\alpha_p$ while the defendant expects $\delta-\alpha_d$. Symmetry requires that $\alpha_p=\alpha_d$. If both α_p and α_d are zero then the parties hold identical expectations. If both are positive then the plaintiffs are both optimistic.

that the defendant has systematically lower (higher) costs of litigation.

Another piece of information that can shed some light on the symmetry assumption is information on how often each party accepts the mediation award. It is reasonable to assume 1) that parties independently accept or reject mediation awards that yield them higher utility than they expect to get from continuing the litigation (perhaps to trial) net of their costs and 2) that mediation awards are symmetrically distributed around the true expected trial outcomes. In this case, if the parties are symmetric with regard to both expectations and costs, they will accept mediation awards with the same frequency. If one party either is relatively optimistic about the trial outcome or has lower costs of continuing the litigation, then that party will reject mediation awards with higher frequency.

B. *The Plaintiff's Drop Decision*

A risk-neutral plaintiff will compare the expected value of pursuing a case to its cost and will decide to drop the case if cost exceeds expected value. The criterion for dropping a case is, therefore,

$$(III.5) \qquad I_d = C - \log(E(Y)) > 0$$

where C is the logarithm of the cost to the plaintiffs of pursuing a case. Let C be a function of observable characteristics of the case such that

$$(III.6) \qquad C = Z\gamma + \varepsilon_2$$

where Z is a vector of characteristics, γ is a vector of coefficients, and ε_2 is an additive error term that captures unmeasured factors affecting the cost of pursuing a case. In our empirical analysis, we assume that the costs of pursuing a case are simply a constant plus an additive error so that the Z vector includes only a constant. Substituting into equation III.5 from equations III.4 and III.6, the criterion for the plaintiff dropping or dismissing a case is

$$(III.7) \qquad I_d = Z\gamma - X\beta + \mu_1 > 0$$

where $\mu_1 = \varepsilon_2 - \varepsilon_1$. Assuming normality for the ε's, this is a standard probit specification.

The theory outlined here yields a set of testable restrictions based on equations III.4 and III.7. Assuming risk-neutrality and that the costs of pursuing a case are constant (the vector Z includes only a constant), the coefficients on the variables determining expected liability estimated from the log settlement regression (equation III.4) ought to be equal in magnitude and opposite in sign to the coefficients on the same variables estimated from the drop probit function (equation III.7).[12] The two equation system defined by equations III.4 and III.7 is estimated by maximum likelihood in section VI and compared to an unconstrained version where the variables determining expected liability are allowed to have different coefficients in the two functions (the vector Z includes all of the variables in the vector X).

Another implication of this theory is that single-equation OLS estimation of the settlement equation could yield inconsistent estimates of the parameters because cases are dropped in a way that is clearly correlated with the settlement values. The error in the log settlement equation (ε_1) is correlated by construction with the error in the drop probit ($\mu_1 = \varepsilon_2 - \varepsilon_1$). The maximum likelihood estimation allows us to investigate the seriousness of this selection bias in the context of a carefully specified structural model.

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[12]Note that these restrictions enable us to identify the variance of μ_1 which is generally normalized to one in a probit analysis. Essentially, this means that the restriction implied by the theory is that the estimates of β derived from a log settlement regression should be proportional to those derived from a drop probit. If there are k elements in β, there are k-1 restrictions.

IV. The Data and Descriptive Statistics

The data used here consist of information concerning medical malpractice charges raised against a single large hospital and the physicians who treated patients during their stay at the hospital.[13] In order to be included in the data set, the case must have been initiated in 1977 or later and resolved by the end of 1989. An unusual aspect of the data set is that the data are taken not from court records, but from the hospital's internal records. There are 326 cases in total for which we have data on care quality, the severity of injury, and the outcome. In 68 of these cases, the hospital was one of several defendants.[14] Since we do not have complete data for these cases on how the case was resolved against defendants other than the hospital, these cases are omitted from our analysis. Of the remaining 258 cases, six were resolved through a binding arbitration process that the parties had agreed to *ex ante*, and these too are omitted from our analysis.[15]

The first panel of table 1 shows how the 252 cases in the sample were resolved. A total of 92 (36.5%) cases were dropped by plaintiffs or dismissed by the judge. A total of 147 (58.3%) were settled out of court (with or without mediation) and 13 (5.2%) were tried to a verdict in court.

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[13]The state in which the hospital is located has not adopted tort reforms which limit liability in the medical malpractice area, nor is the hospital shielded from liability by governmental immunity.

[14]Other defendants include manufacturers of hospital equipment and other hospitals or physicians who treated the patient for the same condition.

[15]Such an arbitration process may provide different incentives to the parties than the usual court-based dispute resolution mechanism. In fact, many patients at the subject hospital signed a form upon admission agreeing to submit any claims against the hospital to binding arbitration. However, almost all patients who sue the hospital generally repudiate this agreement. This binding arbitration procedure is distinct from the mediation process that cases filed in local court are required to go through.

Table 1

Disposition of Cases

Disposition of All Cases

Disposition	Frequency	Percentage
Dropped/Dismissed	92	36.5%
Settled	147	58.3%
Trial Outcome	13	5.2%
Total	252	100.0%

Disposition of Cases Filed in Local Courts

Disposition	Frequency	Percentage
Dropped/Dismissed	51	34.2%
Settled	88	59.1%
Trial Outcome	10	6.7%
Total	149	100%

Disposition of Cases Filed in Local Courts by Stage
Frequency
(column percent)

Disposition	Before Mediation	After Mediation
Dropped/Dismissed	44 (53.0%)	7 (10.6%)
Settled	39 (47.0%)	49 (74.2%)
Trial Outcome	0 (0.0%)	10 (15.2%)
Total	83 (100%)	66 (100%)

These numbers demonstrate how rare trial outcomes are in this area.[16] The defendant won all thirteen cases tried in court.[17]

With regard to stage of settlement, twelve cases were resolved without the filing of a suit (two were dropped and ten were settled). The second benchmark event is the mediation process. Considering only the 149 cases that were filed in a local court (and, thus, had mandatory mediation), 34 percent were dropped or dismissed, 59 percent were settled, and 7 percent had a trial outcome. This is not significantly different from the sample as a whole (p-value= .31).[18] These data are in the second panel of table 1.

The last panel of table 1 shows that the disposition of cases was strongly related to the stage of settlement for the 149 cases that were filed in a local court. Over half (56%) were resolved prior to mediation, and more than half (53%) of these were dropped or dismissed. Of the cases resolved after mediation, only 11 percent were dropped or dismissed while 74 percent were settled.

A. *Care Quality as a Measure of Negligence*

A key feature of our data set is that it contains a measure of care quality taken from the hospital's records. The hospital asks experts to evaluate each incident to determine whether the professional standard of care was met. These evaluations may be provided by the supervisors of the relevant departments, by other hospital personnel in the relevant specialty,

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[16]Twenty-one cases started trial, but seven of these were resolved prior to the trial's conclusion. Six of the seven were settled and one was dropped or dismissed.

[17]This win rate is significantly lower than the 32% plaintiff win rate found by Danzon (1985, p. 54.) in a much larger sample of medical malpractice cases in 1975-79.

[18]Unless otherwise noted, the p-values presented throughout this section are based on a standard χ^2 test of independence in a contingency table.

and/or by outside experts who would appear as the hospital's expert witnesses if the case went to trial. The experts' evaluations of care quality consider 1) whether the correct treatment was provided, 2) whether the actual treatment failed due to inadequate care or because it was not provided quickly enough, and 3) whether any harm suffered by the patient was causally related to the treatment.[19]

Quality of care provided by the hospital is divided into three categories. Care was coded as "bad" if the experts' reports prepared for the hospital were in agreement that the care provided fell short of the professionally accepted standard in the relevant medical specialty. Care was coded as "good" if the experts' reports agreed that the care provided met the standard. Care was coded as "ambiguous" if the experts' reports were ambiguous or if there was disagreement. Although the evaluations of care quality were made for the hospital and are not impartial, they are not "discoverable" by the plaintiff.[20] This means that there is no incentive for the hospital to put biased information into its own record. These reports were used by the hospital in deciding on its litigation strategy in individual cases.

Table 2 shows the breakdown of cases by care quality and disposition, and there is a strong relationship between these two variables (p-value < .0001). Cases where care quality was rated as good were dropped or dismissed

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[19]The last issue is important because a finding of liability by the jury requires there there be both causation and negligence, and the care quality variable discussed here includes a judgment about both. Thus, the defendant's care quality would be rated good if the patient suffered harm but the expert believes that the harm was not due to negligence.

[20]The expert reports are covered by the attorney's work product rule, so that they are considered to be part of the defendant's attorneys' legal work, which is not "discoverable".

Table 2

Disposition of Cases by Care Quality

frequency
(row percentage)
[column percentage]

Quality	Dropped/Dismissed	Settled	Trial Outcome	Total
Bad Quality	8 (10.0%) [8.7%]	71 (88.8%) [48.3%]	1 (1.2%) [7.7%]	80 (100%) [31.8%]
Ambiguous Quality	21 (27.2%) [22.8%]	53 (68.9%) [36.1%]	3 (3.9%) [23.1%]	77 (100%) [30.6]
Good Quality	63 (66.3%) [68.5%]	23 (24.2%) [15.6%]	9 (9.5%) [69.2%]	95 (100%) [37.7%]
Total	92 (36.5%) [100%]	147 (58.3%) [100%]	13 (5.2%) [100%]	252 (100%) [100%]

in two-thirds of the cases, were settled in about one-fourth of the cases, and were tried to a verdict in the remainder. Since hospital won all of the trials, plaintiffs received damage payments in only one-fourth of the cases where care was good. Where care quality was rated as bad, only ten percent of the cases were dropped or dismissed, and plaintiffs received damage payments in about 89 percent of the cases. Where care quality was rated as ambiguous, the dispositions were intermediate, with the plaintiffs receiving money in about two-thirds of the cases. This is strong evidence that negligence matters in determining liability.

An interesting feature of the data in table 2 is that the distribution of care quality within outcome group is indistinguishable between the cases that were dropped or dismissed and the cases that were tried to a verdict (p-value > .99). Of the cases with these outcomes, about two-thirds had good care and less than ten percent had bad care. This contrasts with the cases that were settled, of which only 16 percent had good care and almost half had bad care.[21] The facts that the average care level was high in cases tried to a verdict and that the plaintiff lost all of trials yield further evidence that negligence matters.[22]

B. *Severity of Injury and Age as Measures of Damages*

The data also contain a measure of the severity of damage that the patient claims to have suffered as a result of the medical malpractice. The severity measure is divided into four categories: 1) temporary disability (51.2%), 2) permanent partial disability (24.6%), 3) permanent total

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[21]A χ^2-test of the hypothesis that the trial outcomes and the settled cases had the same distribution of care qualities rejects the hypothesis with p-value <.0001.

[22]Unfortunately, there are not enough trials to estimate a model determining trial outcomes.

disability (4.4%), and 4) death (19.8%). Note that the severity of damage due to medical malpractice is often a matter of dispute between the plaintiff and the defendant. The severity measure is a key determinant of the damage award if the defendant is found negligent at trial. Patients who suffer permanent total disability have higher future medical care costs and more lost income than patients who suffer permanent partial disability, so that the hospital's expected liability is higher. For patients who die, future medical care costs are zero, so that the hospital's expected liability is lower in cases involving death than in cases involving permanent total disability. The hospital's liability is lowest in cases of temporary disability.

Table 3 contains a breakdown of case disposition by the severity measure. There is a relatively strong relationship (p-value=.028) between severity and case disposition with higher damage cases (all but temporary disability) significantly more likely to be settled rather than dropped, dismissed, tried to a verdict. There is no significant difference in disposition patterns by severity across the three higher damage severity categories (permanent partial, permanent total, and death) (p-value = .634). There is also no significant difference in disposition patterns by severity between cases that were dropped or dismissed and cases that were tried to a verdict (p-value = .384).[23]

These results indicate that the cases that were tried to a verdict in court look like the cases that were dropped or dismissed in both the care and severity dimensions. This suggests that trials tend to result from plaintiffs' mistakes, i.e., they occur when plaintiffs fail to drop cases

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[23]A χ^2-test of the hypothesis that the trial outcomes and the settled cases had the same distribution of severity rejects the hypothesis with p-value = .007.

Table 3

Disposition of Cases by Severity

frequency
(row percentage)
[column percentage]

Severity	Dropped/Dismissed	Settled	Trial Outcome	Total
Temporary	60 (46.5%) [65.2%]	63 (48.8%) [42.9%]	6 (4.7%) [46.2]	129 (100%) [51.2%]
Permanent Partial	18 (29.0%) [19.6%]	39 (62.9%) [26.5%]	5 (8.1%) [38.5%]	62 (100%) [24.6%]
Permanent Total	3 (27.3%) [3.3%]	8 (72.7%) [5.4%]	0 (0.0%) [0.0%]	11 (100%) [4.4%]
Death	11 (22.0%) [12.0%]	37 (74.0%) [25.2%]	2 (4.0%) [15.4%]	50 (100%) [19.8%]
Total	92 (36.5%) [100%]	147 (58.3%) [100%]	13 (5.2%) [100%]	252 (100%) [100%]

which are not worth pursuing.

One other measure that will be used is the age of the patient at the time of the incident. This may be related to damages since both lost earnings and the costs of future medical care resulting from any injury are inversely related to age.

C. *Settlement Amounts*

The top half of figure 1 contains a graph of settlement amounts and the natural logarithms of the settlement amount for the 147 cases where there was a settlement.[24] The distribution of the settlement amounts is dramatically right skewed while the distribution of the logarithms is much more symmetric. The mean settlement is $191,040 (sd=$544,878) while the median is only $35,140. In contrast, the mean log settlement is 10.39 with an almost identical median of 10.47. For this reason and for the theoretical reasons outlined in the previous section, the analysis here focuses on the log settlements.

The first two columns of table 4 contain average log settlement amounts broken down separately by care quality and severity for the 147 cases where there was a settlement. These results are presented in regression format to highlight differences in mean log settlements across groups. The results with regard to care quality in the first column are in accord with our expectations in that settlement amounts are significantly lower where care quality is good (the base group) than where care quality is ambiguous or bad. The proportional differences are large. Settlements are about 2.5 times larger on average where care is ambiguous than where care is good and about 4.7 times larger where care is bad than where care is good.

The differences in settlements by severity of injury in the second

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[24]All dollar amounts in this study are expressed in real 1982-84 dollars.

Figure 1
SETTLEMENT AMOUNTS AND MEDIATION AWARDS

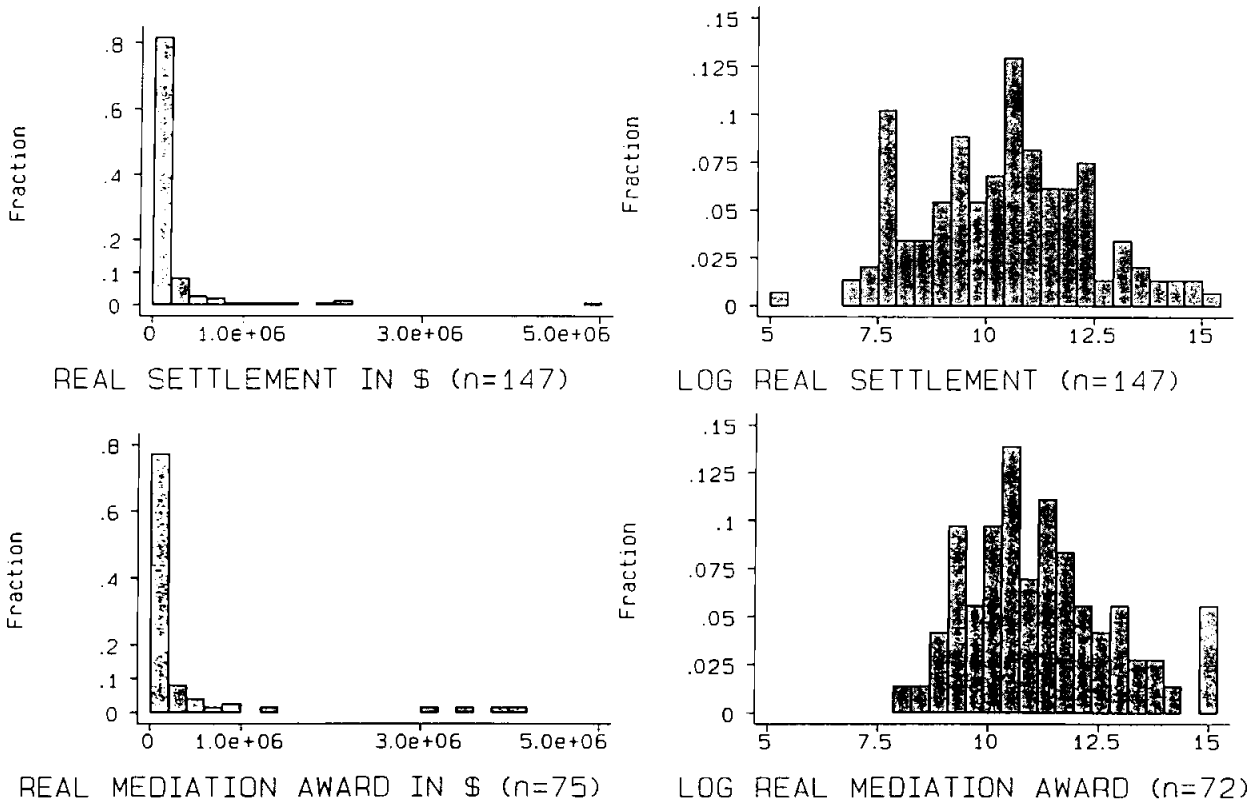

Table 4

Average Log Settlement Amounts and Mediation Awards

by care quality and severity

Variable	(1) log settlement amount	(2) log settlement amount	(3) log mediation award	(4) log mediation award
Constant	9.31 (.389)	11.14 (.250)	10.48 (.306)	11.3 (.330)
Care Bad	1.54 (.448)		1.60 (.424)	
Care Ambiguous	.931 (.466)		.273 (.394)	
Temporary Disability		-2.03 (.314)		-1.27 (.402)
Permanent Partial Disability		.0352 (.348)		.136 (.404)
Permanent Total Disability		2.13 (.592)		2.21 (.585)
R-squared	.08	.40	.18	.36
n	147	147	83	83

Note: These are OLS regressions where the coefficients are mean differences from the base group. The base group is good care quality in the first and third columns and death in the second and fourth columns.

column are even stronger. Compared to the death category (the base group), patients who suffered temporary injury received settlements that were only 13 percent as large while patients who suffered permanent total disability received settlements that were 8.4 times as large. There was no difference between the base group and the group that suffered permanent partial disability. Even more striking is the fact that almost 40 percent of the variance in log settlements is accounted for by the four severity categories. In contrast, only 8 percent of the variance can be accounted for by care quality.

D. *Mediation Awards*

A comparable analysis is carried out for the 86 available mediation awards. The bottom half of figure 1 contains a graph of mediation awards and the natural logarithms of the mediation awards.[25] The distribution of mediation awards is as right skewed as that of the settlement amounts, but the distribution of the logarithms is much more symmetric. The mean mediation award was $291,416 (sd=$777,295) while the median is only $44,399. In contrast, the mean log mediation award is 10.82 with an almost identical median of 11.07. Once again, the analysis here focuses on the log mediation awards.

The third and fourth columns of table 4 contain average log mediation awards broken down separately by care quality and severity for the 83 cases where there was a positive mediation award. The results with regard to care quality in the first panel show that mediation awards are significantly lower where care quality is good (the base group) than where care quality is bad. The proportional difference is large. Mediation awards are about five times

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[25]Three cases where the mediation award was zero are deleted from the log plot.

larger on average where care is bad than where care is good. However, there is no significant difference in mediation awards between where care is good and care is ambiguous.

The differences in mediation awards by severity of injury parallel those for settlement amounts. Compared to the the death category (the base group), patients who suffered temporary injury received mediation awards that were only 28 percent as large while patients who suffered permanent total disability received mediation awards that were 9.1 times as large. There was no difference between the base group and the group who suffered permanent partial disability. Once again, almost 40 percent of the variance in log mediation awards is accounted for by the four severity categories while only about 18 percent can be accounted for by care quality.

One fact not apparent from the tables is that there are only three instances out of 83 cases where the mediation award was zero. In actual trials in medical malpractice cases, defendants usually win (Danzon, 1985), so that the frequency of the plaintiffs receiving zero is much greater than would be inferred from our mediation awards. This suggests that mediation panels do not attempt to mimic actual trial outcomes. Rather, it seems likely that they award the expected trial outcome, which is the product of the probability of liability and expected damages given liability.[26]

Finally, consider the relationship between the mediation award and settlement amounts in the 67 cases that both settled and have mediation amounts available. In 17 of these cases the mediation award was accepted by both sides. The correlation between the mediation award and the settlement in the remaining 50 cases is .93 in either levels or logs. However, the settlement amounts are, on average, significantly lower than the mediation

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[26]The implications of this finding are discussed in the next section.

awards in the 50 cases (p-value < .001 from t-test). Using logs, the average settlement amount is less than seventy percent of the average mediation award.[27] Based on the discussion in section III, this suggests a lack of symmetry between the parties with regard to the costs of disagreement. The plaintiffs appear to have higher costs of litigation than the defendant. However, the defendant's legal expenses are likely to be higher than the plaintiff's since, in addition to lawyers' fees, the hospital must pay for the time of medical personnel while they are are involved in litigation and also incurs reputation costs. This suggests that the risk premium the plaintiff is willing to pay to avoid further litigation is greater than the risk premium the defendant is willing to pay . Thus, the plaintiff seems to be risk averse relative to the hospital.

Table 5 contains a breakdown of whether the plaintiff and/or the defendant accept or reject the mediation award in the eighty cases for which this information is available. The simple framework presented in section III suggests that the parties will make independent decisions about whether to accept a mediation award by comparing the award with their expectation of the value of continuing litigation. The model also implies that the parties will accept mediation awards at the same rate if expectations and costs are symmetric.

The breakdown in table 5 is not consistent with this simple model. First, the parties are not making decisions regarding the mediation award independently (p-value <.0001). More importantly, the plaintiff is significantly (p-value=.078 from t-test) more likely to accept the mediation award than the defendant. This is consistent with our earlier finding, and

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[27]The mediation award was greater than the settlement amount in 37 of the fifty cases.

Table 5

Acceptance of Mediation Awards

Frequency
(cell percentage)

	Plaintiff		
Defendant	Accepts	Rejects	Total
Accepts	6 (7.5%)	23 (28.8%)	29 (36.3%)
Rejects	34 (42.5%)	17 (21.3%)	51 (63.7%)
Total	40 (50%)	40 (50%)	80 (100%)

suggests that plaintiffs either face higher costs of continuing litigation (probably because they are relatively risk averse) or are relatively pessimistic about the value of the case.

V. Single Equation Estimation of Models of the Mediation Award, Settlements, and the Drop Decision

The analysis in section III suggests that there is a common underlying structure to settlement amounts and plaintiffs' decisions to drop cases. One implication of this is that estimation of a model of settlement amounts that ignores the endogeneity of the drop decision will yield biased estimates. Another implication is that a test of the underlying structure of the model can be carried out based on the implied restrictions of the model. In this section we estimate single equation models of mediation awards, the drop decision, and the settlement amount that ignore the cross-equation restrictions. These estimates are important benchmarks that provide information on the underlying variation in the data. In the next section, we estimate a structural model of the drop/settle decision and settlement amounts using maximum likelihood.

The analysis in this section is based on the 239 cases which were either dropped/dismissed or settled. It does not include the 13 cases that were tried to a verdict. As was pointed out in the preceding section, the cases that went to trial are indistinguishable on the basis of care quality or severity of injury from the cases that were dropped or dismissed. It is anomalous that these particular cases were pushed to a trial, and we present no theory explaining it. Our analysis should be seen as an analysis of why some cases are dropped or dismissed while others are settled.[28]

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[28]In fact, the estimation in this section was redone including the 13 cases as cases that were *not* dropped, and the results were indistinguishable from

A. *OLS Estimates of the log Mediation Award*

The first column of table 6 contains estimates of the OLS regression of the log mediation award on a constant, two dummy variables for care quality, three dummy variables for severity of injury, and age of patient. The base group for the analysis is good care quality and death as the severity of injury. This analysis uses the 72 observations for which positive mediation awards are available. The mediation award is significantly related to all three dimensions of explanatory variables. Mediation awards are significantly higher where care is bad than where care is ambiguous (p-value = .0017) or where care is good (p-value = .004).[29] There is no significant difference between cases where care is ambiguous versus those where care is good. Compared to cases where the patient died, cases with temporary injuries had significantly lower mediation awards and cases with permanent total disability had significantly higher mediation awards. There was no difference in mediation awards between cases where death occurred and cases with permanent partial disabilities. Older patients had significantly lower mediation awards -- about 1.8 percent lower for each additional year of age.

These results are in accord with our expectations and are consistent with the view that mediation awards reflect estimates of the expected trial outcome.

B. *OLS estimates of log Settlement Amount*

The second column of table 6 contains estimates of the OLS regression of the log settlement amount on same explanatory variables for the 147 cases that were settled. These estimates are qualitatively similar to those

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those presented here.

[29]The p-values in this section are from regression-based t-tests, regression based F-tests, or likelihood-ratio tests (χ^2) as appropriate.

Table 6

Single Equation Estimation

Coefficient Estimate
(standard error)
[mean effect on probability of unit change]

Variable	(1) log(Med. Awd) OLS	(2) log(Sett. Amt) OLS	(3) Pr(Drop) PROBIT
Constant	11.66 (.451)	10.41 (.409)	.186 (.307)
Care Bad	1.06 (.390)	1.67 (.340)	-1.87 (.245) [-.514]
Care Ambiguous	.0330 (.368)	1.08 (.354)	-1.15 (.217) [-.316]
Temporary Injury	-1.30 (.393)	-2.05 (.292)	.462 (.255) [.127]
Permanent Partial Injury	.248 (.398)	.111 (.325)	.0650 (.290) [.0179]
Permanent Total Injury	1.59 (.567)	1.71 (.563)	.156 (.522) [.0429]
Age of Patient	-.0180 (.00633)	-.0125 (.00539)	.00410 (.00475) [.00113]
R-squared	.562	.497	
n	72	147	239
Log-Likelihood			-117.1

Note: The base group is good care quality and and a severity of death. The log-likelihood for a constrained probit model containing only a constant explaining the probability that a case is dropped is -159.3. The mean effect on the probability of a unit change in the variable in the probit is computed as the coefficient estimate times the mean value for the sample of the standard normal PDF evaluated at the parameters contained in column 3 (.275).

presented for the log mediation award.[30] Settlements are significantly higher where care quality is bad than where it is either ambiguous (p-value = .013) or good (p-value < .0001). Settlements are also significantly higher where care quality is ambiguous than where it is good (p-value = .0015). Compared to cases where the patient died, cases with temporary injuries had significantly lower settlements and cases with permanent total disability had significantly higher settlements. Once again, there was no difference in settlements between cases where death occurred and cases with permanent partial disabilities. Older patients had significantly lower settlements -- about 1.2 percent lower for each additional year.

C. *Simple Probit on Drop versus Settled*

The third column of table 6 contains estimates of a reduced form probit model of whether cases are dropped or dismissed based on the model in section III. The probability that case i is dropped or dismissed is

$$\text{(V.1)} \qquad \Pr(D_i=1) = \Pr(\upsilon_i < X_i\Gamma) = \Phi(X_i\Gamma)$$

where it is assumed that the error term (υ) has a standard normal distribution, $\Phi(\cdot)$ represents the standard normal cumulative distribution function, D_i is a dummy variable that equals one if the case was dropped or dismissed, X_i is the vector of explanatory variables for the ith observation, and Γ is a vector of parameters. This is the reduced form version of equation III.8, and we cannot identify the cost of pursuing a case (γ)

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[30]Based on a regression (not presented here) of the difference between the log settlement and the log mediation award in the 67 cases where both were available, the hypothesis that all coefficients but the constant equal zero is rejected (p-value = .055). Casual analysis of the point estimates suggest that there is a significant negative difference between settlements and mediation awards for the base group (good care, death), but this difference is not significant in the lower care quality categories. The difference is larger (more negative) in the other severity categories.

separately from the constant in the settlement value vector (β). In addition, the parameters are identified only as a ratio with the standard deviation of the error (normalized to one).[31]

The probit model includes the same set of explanatory variables and is estimated over the same sample of 239 cases that were either settled or dropped/dismissed. It is clear from the probit estimates that care quality has a strong and significant influence on whether a case is dropped. Cases with good care quality are significantly more likely to be dropped than cases with either bad or ambiguous care quality. Cases with ambiguous care quality are significantly more likely to be dropped than cases with bad care quality (p-value=.0044).

In order to investigate the relative importance of the other variables on the probability that a case is dropped, table 7 presents log-likelihood values and p-values from likelihood-ratio tests for various constrained versions of the probit model in the last column of table 6. After controlling for care quality, neither severity of injury nor age of patient is significantly related at conventional levels to the probability that a case is dropped.[32]

These results present a puzzle when viewed in relation to the mediation award and settlement equations. The theory implies that the plaintiff's drop decision should be a function of the settlement value. Thus, any variables that significantly affect the settlement value (i.e., care, severity, and

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[31]This is the usual case with a probit analysis, but we will be able to identify these parameters when we estimate the structural model in the next section.

[32]A test of model #5 against the model #4 in table 7 fails to reject the hypothesis that the coefficients on the severity variables are zero (p-value=.172). A test of model #5 against the model #3 in table 7 fails to reject the hypothesis that the coefficient age is zero (p-value=.371).

Table 7

Likelihood Ratio Tests of Various Constrained Pr(DROP) models

Model	Log L	Parameters	p-value, v. #1	p-value, #7 v.
#1 constant, care, severity, age	-117.1	7	---	<.0001
#2 constant, severity, age	-153.0	5	<.0001	.0134
#3 constant, care, age	-119.6	4	.175	<.0001
#4 constant, care severity	-117.5	6	.371	<.0001
#5 constant, care	-120.0	3	.215	<.0001
#6 constant, severity	-153.1	4	<.0001	.0061
#7 constant	-159.3	1	<.0001	---

Note: All log-likelihood values are derived from a probit specification for the probability that a case is dropped for dismissed and estimated using the 239 observations for cases that were either dropped/dismissed or settled.

age) should be significantly related to the drop decision. However, we find that the drop decision is not significantly related to severity or age, despite the fact that the settlement amount is a function of these variables. It is possible that our estimates of the settlement amount are biased by the sample selection process that results from the drop decision, but we would still expect the drop decision to be related to variables that determine damages.

VI. Joint Estimation of the Model of the Drop Decision and Settlement Amounts

Equations III.4 and III.7 define a two-equation system determining the settlement amount and the probability that a case is dropped assuming that the settlement amount is equal to the expected trial outcome. A log-likelihood function is constructed by assuming a joint distribution for ε_1 and μ_1, and we assume joint normality. The probability that case i is dropped is

$$\text{(VI.1)} \qquad \Pr(D_i = 1) = \Pr(\mu_{1i} > X_i\beta - Z\gamma)$$

and that the joint probability-density that case i is settled (not dropped) at S_i (the expected trial outcome) is

$$\text{(VI.2)} \qquad \Pr(D_i = 0,\ \ln S_i = X_i\beta + \varepsilon_{1i}) = \Pr(\mu_{1i} < X_i\beta - Z\gamma,\ \varepsilon_{1i} = \ln S_i - X_i\beta)$$

where D_i is a dummy variable that equals one if a case is dropped and equals zero if a case is settled.

The log-likelihood function implied by these probabilities is

$$\text{(VI.3)} \qquad \log L = \sum \left\{ D_i \ln\left[\Pr(\mu_{1i} > X_i\beta - Z\gamma)\right] + (1-D_i)\ln\left[\Pr(\mu_{1i} < X_i\beta - Z\gamma\ ,\ \varepsilon_{1i} = \ln S_i - X_i\beta)\right] \right\}.$$

Note that this is the usual sort of likelihood function implied by a censored data problem. The settlement amount is censored by the drop decision, and, because the drop decision is related to the settlement amount, joint

estimation is required in order to derive consistent estimates. In our case, the advantages of joint estimation go beyond this because there are important cross-equation restrictions. The β vector is common across the two equations, and, in contrast to the usual case without a structural theory for the censoring process, we are able to estimate the variance of the error (μ_1) in the probit that determines the drop decision. The parameters to be estimated include β, γ, and the three elements of the covariance matrix of ε_1 and μ_1 (σ^2_{μ}, σ^2_{ε}, and $\sigma_{\mu\varepsilon}$).

The restriction that the cost of pursuing a case is constant can be tested by estimating the model allowing the vector Z to include only a constant. The unrestricted model, which allows the cost of pursuing a case to be determined by the same set of variables that determine the settlement value (Z and X contain the same variables), can also be estimated. In this case, the model is identified only from the nonlinearities in the normal distribution function and we lose identification on the variance of μ_1, but the restriction can still be tested with a likelihood-ratio test.

The first two columns of table 8 contain estimates of the settlement value (β) and cost (γ) functions for the constrained structural model. There is a significant negative relationship between care quality and settlement value. There is also a significant relationship between severity of injury and settlement value, and older plaintiffs have smaller settlement values. We estimate a significant positive cost of pursuing a case. Assuming log-normality for the error, the expected cost is exp(8.51+5.35/2) = $72,041.[33]

The covariance between the random components in the settlement and drop

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[33]This computation is based on the fact that the mean of a log-normally distributed random variable is $\exp(\mu + (1/2)\sigma^2)$.

Table 8

Joint Estimation of Model of Settlements and Drop Decision

	log(Sett) (β)	Cost (γ)	log(Sett) (β)	Drop $(\gamma-\beta)/\sigma_\mu$	log(Sett) (β)	Drop $(\gamma-\beta)/\sigma_\mu$
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Constant	9.32	8.51	10.2	.186	10.4	.186
	(.639)	(.719)	(2.53)	(.307)	(.445)	(.290)
Care Bad	2.81		1.82	-1.87	1.67	-1.87
	(.595)		(2.49)	(.251)	(.312)	(.251)
Care Ambiguous	1.94		1.19	-1.15	1.08	-1.15
	(.438)		(1.77)	(.225)	(.308)	(.224)
Temporary Injury	-2.02		-2.08	.456	-2.05	.463
	(.529)		(.658)	(.249)	(.378)	(.247)
Permanent Partial Injury	.0670		.107	.0406	.110	.0647
	(.337)		(.402)	(.277)	(.387)	(.276)
Permanent Total Injury	1.35		1.70	.152	1.72	.153
	(.590)		(1.677)	(.669)	(.667)	(.664)
Age of Patient	-.0146		-.0127	.00424	-.0125	.00409
	(.00561)		(.00823)	(.00511)	(.00606)	(.00508)
Variance	2.18	5.35	1.87	1[a]	1.86	1[a]
	(.621)	(2.54)	(.426)		(.240)	
Covariance	-1.56		-.159		0[a]	
	(2.27)		(2.58)			
Log-Likelihood	-384.1		-371.3		-371.4	

Note: The base group is good care quality and and a severity of death. The models were estimated using the 239 observations for cases that were either dropped/dismissed or settled.

[a]The variance is normalized to one, and the parameter estimates are interpreted as ratio of $\gamma-\beta$ to σ_μ.

equations is rather imprecisely estimated and not significantly different from zero. Recall from section III that the random component in the drop equation is $\mu_1 = \varepsilon_2 - \varepsilon_1$ where ε_1 is the random component in the settlement equation and ε_2 is the random component in the cost of pursuing a case. One potential constraint on the model is that ε_1 and ε_2 are independent so that $\text{cov}(\varepsilon_1,\mu_1) = \text{var}(\varepsilon_1)$. The estimates of this constrained model, while not presented, are virtually identical to those for the first model, and the hypothesis that ε_1 and ε_2 are independent cannot be rejected at any reasonable level of significance using a likelihood ratio test.[34]

The estimates in third and fourth columns of table 8 refer to a reduced-form censored-data model where the vector in the drop probit function includes all of the variables in the model. The constraint that care quality, severity, and age only affect the drop decision through the settlement amount is relaxed in this specification. This model is similar to a censored data estimation using a reduced form probit choice model, and it can be estimated using a two-step estimator.[35] There are no cross-equation restrictions, and we can identify only the ratio of the parameters in the drop equation (γ-β) to the variance of the error in the drop equation (μ=ε_2-ε_1).

There are two points to note regarding these results. First, this model fits the data significantly better than the model that embodies the cross-equation restrictions. A likelihood-ratio test of the hypothesis that

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[34]The log-likelihood value of this constrained model is -384.3 compared with the log-likelihood for the unconstrained model of -384.1. The constraint is rejected with p-value =.841.

[35]Heckman (1974) presents an econometric analysis of wages and labor supply that has a structure very similar to ours. Maddala (1983) presents a detailed survey of related econometric models.

the cost of pursuing a case is constant is rejected (p-value = .0001), and we must conclude that the simple model of the drop decision where the cost of litigation is constant is incomplete.[36] The second point is that the reduced form model is not estimated very precisely. The care quality variables are not significantly different from zero in the settlement equation although they are significant in the drop decision function. In addition, the covariance of the errors is estimated very imprecisely. This is not surprising given that identification in this model is based completely on the nonlinearity of the normal probability function.

To explore this further, the last two columns of table 8 contain estimates of the reduced form probit model where the covariance between the errors in the settlement and drop functions (ε_1 and μ_1) is constrained to be zero. These estimates are identical to those presented in table 6 using single-equation methods separately for the log settlement equation and the drop probit. The value of the log-likelihood function is virtually the same as in the unconstrained reduced-form model in columns 3 and 4 of table 8, and the hypothesis that this covariance is zero cannot be rejected using a likelihood ratio test (p-value = .65). However, the parameter estimates are much more precisely determined with the covariance constrained to zero. Both care quality and severity are important in determining settlement amounts while only care quality is significantly related to the drop decision.

There are two conclusions to draw from this analysis. First, the

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[36]The hypothesis that only a constant enters the cost function and that the drop choice is made based on a comparison of this constant with the settlement value implies five restrictions on the unconstrained model. There are six explanatory variables in the settlement equation that are restricted in the cost function. Noting that one of these restrictions was used to identify the variance of the choice function in the structural model leaves five restrictions relative to the unconstrained model in columns three and four.

simple model of the drop decision, where the plaintiff compares the expected settlement value to a constant cost of pursuing a case, is not correct. Second, there is simply not enough data to estimate precisely the settlement equation and an unrestricted drop decision function together with an unrestricted correlation in the unobserved components.[37] Given that the structural model with constant cost of pursuing a case is rejected by the data, any attempt to present "selectivity-bias corrected" estimates of the settlement value equation must rely on unverifiable identifying restrictions.

VII. How are Case Outcomes Related to Care Quality and Severity of Injury?

Despite the fact that the constrained model of the drop decision was rejected by the data so that we could not estimate the full structural model very precisely, a reinterpretation of the estimations allow us to investigate how expected settlement amounts are related to care quality and injury severity. We cannot recover the expected trial outcome unconditional on whether a case was dropped, but we can reinterpret our single equation estimate of the log settlement from equation III.5 and table 8 as the settlement conditional on a case not being dropped. This is

$$\text{VII.1} \qquad \ln(Y|D=0) = X\beta + \varepsilon$$

where ε is assumed to be normally distributed conditional on a case not being dropped. Given our OLS estimates in table 6 of the log settlement amount, the predicted expected value of settlement conditional on a case not being dropped is

$$\text{VII.2} \qquad E(Y|D=0) = \exp(x\hat{\beta} + \frac{1}{2}\hat{\sigma}^2)$$

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[37]Estimation of the reduced form model constraining the correlation between the errors to a wide range of specific values shows that the likelihood value is not affected to a significant extent by the choice of this correlation.

where $\hat{\sigma}^2$ is the estimated residual variance from the OLS regression.[38] We can also use the estimates, contained in table 6, of the simple probit model of the probability that a case is dropped to derive the predicted probability that case is not dropped as

$$\text{VII.3} \qquad Pr(D=0) = 1 - \Phi(X\hat{\Gamma}).$$

Finally, the unconditional expected settlement in a given case is computed as

$$\text{VII.4} \qquad E(Y) = E(Y|D=0)\cdot Pr(D=0)$$
$$= \exp(x\hat{\beta} + \frac{1}{2}\hat{\sigma}^2)\cdot\left[1- \Phi(X\hat{\Gamma})\right].$$

Table 9 contains the predicted values of E(Y|D=0) and Pr(D=0), defined in equations VII.2 and V.3, for the various combinations of care quality and severity of injury. These calculations are based on the estimates in columns 2 and 3 of table 6, and they are computed assuming that the age of the patient is forty years. The first panel contains the predicted expected settlement amounts conditional on the case not being dropped. There is a high degree of variation of conditional settlement amounts with severity. The predicted expected settlement in the highest category (permanent total) is 43.2 times the value for the lowest category (temporary). In contrast, the predicted difference between expected settlements for good care quality and bad care quality cases is only a factor of 5.3.

The second panel of table 9 contains the predicted probabilities that a case is dropped. Here we see the primary influence of care quality. Cases with good care are five to ten times more likely to be dropped or dismissed than cases with bad care. In contrast, severity of injury is simply not very important. There are only small differences in drop probabilities among three of the severity categories (permanent partial, permanent total, and

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[38]The precise form of this expectation with the variance correction is based on the assumption of normality of ε.

Table 9

Predicted Values for Settlements and Drop Probabilities

Predicted Settlement Conditional on Case Not Dropped or Dismissed

	Severity			
Care Quality	Temporary	Permanent Partial	Permanent Total	Death
Bad Quality	$36,460	$317,721	$1,575,096	$284,468
Ambiguous Quality	$20,204	$176,064	$872,803	$157,637
Good Quality	$6,859	$59,773	$296,325	$53,518

Predicted Probability That Case is Dropped or Dismissed

	Severity			
Care Quality	Temporary	Permanent Partial	Permanent Total	Death
Bad Quality	.145	.0729	.0863	.0643
Ambiguous Quality	.367	.230	.259	.211
Good Quality	.792	.661	.693	.637

Note: The calculations assume patient is age 40 and are based on estimates in columns 2 and 3 of table 6.

death), and the fourth category has drop probabilities that are twice as large at most and only about 25 percent larger at least.

These numbers are combined in table 10 to compute predicted unconditional expected settlements as defined in equation VII.4. These calculations show that both care quality and severity are extremely important in determining expected settlements. The largest expected settlement (bad care quality, permanent total disability) is one thousand times larger than the smallest expected settlement (good care quality, temporary disability).

The last two rows of table 10 contain average expected settlements for each severity class. The motivation for computing this is to explore the notion that, while plaintiffs are likely to be well informed *ex ante* about the severity of their injuries, they are probably not well informed about the likelihood that the hospital was negligent. Weighted average #1 assumes that plaintiffs know only the overall distribution of care quality in our sample (31.8% bad, 30.6% ambiguous, 37.7% good) and they can compute an expected settlement by using these probability weights in combination with the expected settlement conditional on each care level for their particular severity class. These numbers show that *ex ante* expected values are substantial relative to the cost of the initial filing of a suit even where severity is low and where there is no particular reason to believe that negligence is likely. Weighted average #2 differs only in assuming that the plaintiff both knows the distribution of care quality for his or her specific severity class and uses this information in formulating the *ex ante* expected value of the case.

These calculations suggest that, within the class of medical cases where the patient suffers harm and where suit has been filed, there is substantial expected value in most configurations of the data. However, this finding cannot be extended to the population of medical cases with bad

Table 10

Predicted Unconditional Expected Settlement

For Each Care-Severity Combination and Average by Severity

Predicted Unconditional Expected Settlement

	Severity			
Care Quality	Temporary	Permanent Partial	Permanent Total	Death
Bad Quality	$31,163	$294,564	$1,439,097	$266,176
Ambiguous Quality	$12,794	$135,529	$646,949	$124,380
Good Quality	$1,429	$20,277	$90,845	$19,444
Weighted Average 1	$14,364	$142,788	$689,849	$130,034
Weighted Average 2	$12,722	$138,946	$833,893	$163,685

Note: The calculations assume patient is age 40 and are based on estimates in columns 2 and 3 of table 6, the calculations in table 9, and equation VII.4. The weighted Averages for each severity level are probability (of a given care quality) weighted averages of the expected unconditional settlement care level by care quality for that severity level. Weighted average #1 uses the observed overall marginal distribution of care quality for all severity classes. This distribution is in table 2. Weighted average #2 uses the observed care distribution within each each severity class.

outcomes more generally. This is because it is likely that the probability of anything other than good care quality is rather low so that the cases not filed would have lower expected value than those that are filed. Since our data are limited to cases filed, we cannot carry out the analysis of the filing decision necessary to test this view.[39]

VIII. Incomplete Information and a Reinterpretation of Nuisance Suits

In the medical malpractice field, plaintiffs generally have a good idea of the severity of damage before filing a lawsuit, but do not have very good information about whether negligence occurred. After the plaintiff files a lawsuit, the hospital investigates and learns about care quality very quickly. The plaintiff learns about care quality during discovery, first by obtaining his/her hospital records, perhaps by consulting a medical expert to interpret the record, and later by deposing the medical personnel involved in the incident. The plaintiff also learns about care quality by whether or not the defendant makes a settlement offer. But the plaintiff does not obtain the hospital's evaluations of care quality, so that its information is generally less certain than the hospital's.

Suppose care quality was either good or bad. Then the hospital's evaluation of whether negligence occurred or not is clear and certain, and the information received by the plaintiff is also likely to be certain. If care quality was good, the plaintiffs recognizes that the defendant is unlikely to be found liable and usually drops the case. The data in Table 2 indicates that drops occur in 66 percent of the good care cases. If care

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[39]Some evidence not fully consistent our view is provided by a recent Harvard (1990) study with information on cases not filed as well as cases filed that does not find a strong relationship between care quality and the likelihood that a suit is filed.

quality was bad, then the defendant recognizes that the hospital is likely to be liable and a settlement is reached. This occurs in 89 percent of the bad care cases in the data set. Now suppose the hospital's information is uncertain, i.e., care quality is ambiguous. In this case, neither party can predict the outcome at trial with any degree of certainty, and this suggests that litigation is likely to go on longer.

The notion that clear information about care quality is associated with relatively quick dispute resolution is supported by the analysis in table 11 of stage of resolution by care quality for the 149 cases filed in local court (where mediation is required before a case can go to trial). About 60% of cases having either good care quality or bad care quality are resolved before mediation. However, only about one-third of cases involving ambiguous care quality are resolved before mediation. This difference is statistically significant (p-value = .004).

A high proportion of cases in the data set are dropped or dismissed. In the litigation literature, the phenomenon of dropped cases has usually been associated with nuisance suits.[40] These are suits recognized by both sides as having no merit (very low expected damages) that are filed by plaintiffs in hopes of receiving a settlement. However, our calculations of high *ex ante* expected values for suits filed suggest that suits that are dropped are not nuisance suits. Plaintiffs simply do not know at the time of filing whether their cases have merit or not. In order to learn whether cases have merit, plaintiffs must learn about care quality which requires that they file a lawsuit. If they find out that care quality was high, then they drop the suit. Thus, the fact that many suits are filed and dropped

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[40]Cooter and Rubinfeld (1989) and Bebchuk (1988) present models of nuisance suits that are applicable to medical malpractice litigation.

Table 11

Stage of Resolution by Care Quality

(133 Local Court Cases)

Frequency
(row percentage)

Care Quality	Before Mediation	After Mediation	Total
Bad Care	24 (61.5%)	15 (38.5%)	39 (100%)
Ambiguous Care	14 (33.3%)	28 (66.7%)	42 (100%)
Good Care	31 (59.6%)	21 (40.4%)	52 (100%)
Total	69 (51.9%)	64 (48.1%)	133 (100%)

implies that negligence was not indicated in these cases *ex post*, but it does not necessarily imply that these were nuisance suits.

IX. Concluding Remarks

We found strong evidence that negligence, as measured by care quality, plays an important role in the negotiation and dispute resolution process in medical malpractice cases faced by one hospital. We also found evidence from a comparison of mediation awards with negotiated settlements and from acceptance rates of mediation awards that plaintiffs face higher costs of litigation, suggesting that plaintiffs are generally risk-averse relative to the defendant/hospital. Although the number of cases tried in court was too small to allow us to estimate a model determining trial outcomes, we did find that cases tried were indistinguishable from cases dropped or dismissed. This suggests that cases go to trial because plaintiffs make mistakes, rather than because bargaining over a settlement breaks down.

Our model of the plaintiff's drop decision as being based on a comparison of expected settlement values with a constant cost of pursuing a case was not supported by the data, and were unable to estimate precisely a joint structural model of the drop decision and the settlement amount. However, we did find evidence consistent with the view that 1) the plaintiff is not well informed about the likelihood of negligence and 2) the *ex ante* expected value to the plaintiff of a suit is high relative to the costs of filing and getting more information. Thus, suits are filed even where there is no concrete reason to believe there has been negligence, and virtually all suits are either dropped or settled based on the information gained after filing. We conclude that so-called nuisance suits can be equilibrium behavior where there is incomplete information at the time of filing.

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