The Frequency and Severity of Medical Malpractice Claims

Patricia Munch Danzon
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The Frequency and Severity of Medical Malpractice Claims

Patricia Munch Danzon

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Foreword

The ebb and flow of claims for compensation of wrongful bodily injury are among the most noted but least analyzed of contemporary social phenomena. Cries of alarm and outrage marked the exponential increase in the frequency of many types of these claims during the early and mid-1970s. The political noise level then died down during the latter part of the decade as claim frequency declined just as mysteriously as it had risen. Projections available to the makers of public policy had accurately predicted neither the upswing nor the downturn, and there were huge disparities among the experiences of individual states.

Meanwhile, entirely different things seemed to be happening to the average severity of bodily injury claims. Far from gyrating between growth and shrinkage as did frequency, average severity surged upward in a relentless expansion that continued throughout the decade at a rate in excess of even the rampant price inflation that characterized the economics of the period. Thus, whatever the variations in the frequency of claims, they became steadily more expensive, on average, even after the effects of inflation were discounted.

Medical malpractice claims were among the most celebrated examples of trends in both frequency and severity. They were often perceived as the bellwether of an historic shift in the national philosophy of compensable injury, which many observers believe is still under way. Almost all states reacted in mid-decade with a raft of changes in the tort law as applied to medical injuries only. Taken together, these changes added up to the most concerted statutory alteration of that body of law since widespread introduction of Workers' Compensation programs early in this century.

What happened then? Did the frequency or severity patterns of malpractice claims depart from those of other types of bodily injury claims? Can one largely explain the drop in frequency during the latter part of the decade as the result of the changes in the law? If so, which specific changes seem to have mattered most? To the extent
that shifts in the law do not explain claim behavior, what other factors can be shown to have been associated with it? Was there some relation between claim behavior and the number or concentration of physicians or of attorneys? Did the upward shift in the age profile of the society seem to make a difference? What about urbanization or other changes in the social structure?

These are not academic questions. The answers to them are precisely what policymakers need to know as they consider current proposals for changes in the law as well as measures that might affect the social structure. Answering these questions, however, is a formidable technical task. Analytic models suited to available data on closed and pending claims must be constructed and tested. The data must be closely examined and prepared for use. And the output of the model must be painstakingly reviewed to be certain that the conclusions reached are neither more nor less sweeping than the data will support.

This document reports the outcome of such a process as applied to the principal data sources available on the trends in medical malpractice claims during the 1970s. It is the first full-scale analysis of what actually happened to claim frequency and severity both before and after the rush of legislative change, and of why it happened as and where it did. For most of us, the analysis will confirm some hunches about what went on in that turbulent decade, but it will also disprove others. More important, it will give civil justice theorists, practitioners, and decisionmakers some solid evidence concerning what actually influences the rises and falls in these critical factors. And it provides analysts with a model and a methodology that we believe can be used in the study of other categories of claims.

In short, the study represents an important beginning toward a basic understanding of what determines the number and characteristics of compensation claims—an understanding that is critical to any attempt to adapt the civil justice system to deal with changes in frequency or severity. The capacity to trace such causative factors is one of the analytic capabilities that the Institute was established to create. We are particularly pleased to commend to the reader a work that presents both a most promising analytic tool and the practical results that emerge when that tool is applied to an unusually expensive and rapidly growing class of claims. We believe that the implications for the continuing malpractice debate are profound, but that the long-term significance of both method and findings is even greater.

Gustave H. Shubert
Director, The Institute for Civil Justice
Executive Summary

The frequency and severity of medical malpractice claims increased dramatically in the early 1970s. After 1975, claim frequency tapered off, but severity outpaced the rate of inflation throughout the decade. There was also considerable variation among states. In 1978, after the gap between the most and least litigious states had narrowed somewhat, there was still a twelvefold range in frequency and a thirtyfold range in severity. This study provides empirical evidence on the contribution of medical, legal, and other demographic factors to claim frequency and severity. These findings should be useful for determining appropriate policy changes that could be effective in controlling claim costs. A comparison of trends indicates that malpractice experience has been more extreme than that in other lines of tort law, but it is not unique. This suggests that a more extensive study is needed to examine the determinants of trends in litigation in general; however, such an analysis is beyond the scope of the present report.

We develop a simple theoretical model of determinants of claim frequency and severity to structure the empirical analysis and to show how feedbacks and lags in claim disposition complicate measurement of effects on claim filings. These lags are inherent in data on claims closed, which are the only data available. Data on claims closed in 1970 and 1975-78 are analyzed, using pooled time-series cross-section techniques to allow for correlation over time.

The main empirical findings are summarized below:

- Diversity and growth in claim frequency are partly the result of changes in medical services and would therefore not be fully eliminated even if legal environments were uniform. An increase of 100 doctors per 100,000 population is associated with an increase of 3.6 claims per 100,000 population.
- The density of lawyers per capita does not significantly affect claim frequency, after we control for physician density per capita and urbanization. The high simple correlation be-
tween lawyer density and claim frequency is a spurious reflection of the high correlation between lawyer density and physician density and between physician density and claim frequency.

- A no-fault automobile law does not significantly affect claim frequency. This is consistent with the above result and with the finding that increases in the number of lawyers tend to reflect increases in the demand for legal services and so do not depress earnings of lawyers (Pashigian, 1977).

- Claim frequency is not significantly related to the proportion of the population over 65 years of age, although the elderly have more potential claims, due to higher exposure to and rates of iatrogenic injury. Rough calculations suggest that the probability of suit, given an actionable injury, is four times lower for those over 65 than for those under 65.

- Pro-plaintiff changes in common law doctrines contributed significantly to the rapid growth in frequency and severity of medical malpractice claims in some states in the early 1970s. States that abolished charitable immunity and the locality rule and adopted informed consent and respondeat superior by 1970 had claim costs in 1976 over twice as high as states that had adopted none of these doctrines. Of the four, informed consent and respondeat superior appear to have had the greatest impact. The extension of these doctrines to other states was one factor narrowing the gap between the most and least litigious states.

- Because of long lags in disposition, effects of the statute of limitations are reflected in changes in claim closures with a lag. Long pre-1975 statutes of limitations and discovery rules contributed to higher claim costs in some states through 1978, with a greater impact on severity than on frequency. Although most states shortened their statutes in response to the 1974-75 crisis, the 1975-78 data still do not reveal the effects of these changes.

- Of the post-1975 tort reforms, caps on awards and mandatory offset of collateral compensation appear to have had the greatest effects. States enacting a cap are estimated to have had 19 percent lower average severity within two years. Mandatory collateral source offset in effect for two years is estimated to result in a 50 percent reduction in severity. However, these estimates, based on claims closed in calendar years 1975-78, cannot measure the full long-run effects on claim costs on a policy-year basis and may be influenced by
other factors occurring at that time, which could not be included in the analysis.

- After we control for medical and legal factors, urbanization remains a highly significant determinant of claim frequency and severity. The impact of urbanization cannot be explained in terms of per capita income, welfare or unemployment rates, capital-intensive medical facilities, or frequency and severity in other liability lines.

- Tort reforms were more numerous and were enacted earlier in highly urbanized states and those that adopted pro-plaintiff common law doctrines early; in states with high insurance premium levels or proposed increases; and where multiple insurance companies were active in the market.

- Although some of the post-1975 tort reforms had an early effect on severity and contributed to narrowing the gap between the most and least litigious states, they cannot explain the reduction in malpractice claim frequency in 1976-77. Other factors that probably contributed but cannot be investigated with the available data include a reduction in the flow of injuries as a result of more careful practice and more institutionalized quality control on the part of medical providers faced with a greater risk of being sued, and the working through the system of the backlog in claims that became actionable as a result of the pro-plaintiff trends in common law in the 1960s. Because statutes of limitations are now shorter, similar change in the future should be less destabilizing.
Acknowledgments

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I. INTRODUCTION

The frequency and severity of medical malpractice claims increased dramatically in the late 1960s and early 1970s. According to 1975 Insurance Services Office (ISO) estimates, incurred claim frequency countrywide grew at an average annual rate of 12.1 percent, and paid claim severity grew at 10.2 percent.\(^1\) The increases were even greater in some states: For example, in California, both frequency and severity of claims increased at an average annual rate of just under 20 percent between 1969 and 1974, a cumulative rate of 40 percent per annum.\(^2\) The leading writer of malpractice insurance nationwide reported that in 1969 there was one claim pending per 23 insured physicians, while in 1974 the rate had increased to one per ten insured physicians.\(^3\) Thus the malpractice insurance crisis, which led to premium increases of several hundred percent and/or withdrawal of carriers from the market in many states, was a reflection of a huge increase in the cost of claims.

Perhaps as striking as the growth over time is the enormous variation across states in claim frequency and severity in any year. In 1976 the proportion of claims closed per 100,000 population varied from 1.24 in Maine to 21.99 in Washington, D.C. The number of claims closed per 100 physicians ranged from 0.47 in Maine to 8.81 in California and 9.08 in Idaho.\(^4\)

The increase in malpractice claims has been ascribed to many causes. As the use of medical services increased following the introduction of the Medicare program in 1965 and the concurrent growth in private health insurance, the exposure to iatrogenic "injury" (adverse outcome of medical care) increased. As medical procedures have become more complex and invasive, the risk of serious injury has also increased. However, changes in the volume and type of medical care alone apparently do not account for the growth in claims, since all lines of tort liability have been similarly affected, to varying degrees. The increase in tort litigation in general has been attributed to a

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\(^1\)U.S. Senate Committee on Labor and Public Welfare (1975), hereafter cited as Hearings, p. 203. These estimates are based on frequency of claims incurred for policy years 1966-73 and basic limits of paid loss per claim, excluding loss-adjustment expenses for calendar years 1969-73. For the three-year period 1971-73, frequency increased at 19 percent.

\(^2\)Munch (1978).

\(^3\)Hearings (1975), p. 186.

\(^4\)NAIC (1977), pp. 119 ff.
pervasive increase in litigiousness. Plaintiffs and attorneys of course respond to economic incentives, and indeed, the payoff to suit has increased due to pro-plaintiff trends in common law doctrine. The changes in legal doctrine have raised compensable damages, extended the scope of liability, and reduced the plaintiff's costs of proving negligence.  

In response to the malpractice crisis, many states enacted changes in tort law applicable to medical practitioners. These reforms included measures to constrain the scope of liability, reduce the size of awards, limit the time allowed to file suit (the statute of limitations), limit contingent fees of plaintiff attorneys, and discourage "frivolous" suits by introducing pretrial screening panels and/or arbitration. Since 1976, the frequency of claims has leveled off and has even fallen in some states, notably those with the highest frequency in 1975. Severity has continued to increase, but less rapidly in states that had relatively high awards in 1975. The deceleration of claim frequency has not been confined to medical malpractice, so the extent to which it is the result of tort reforms remains an open question.

This report presents some empirical evidence on the contribution of various factors to the diversity in the frequency and severity of claims across states and over time. This evidence should be useful for determining what future policy changes, if any, may be appropriate and effective. The effect of medical and demographic characteristics and of changes in common and statutory law are measured, using data on claims closed in 1970 and 1975-78. To the extent that variation in claims is due to variation in the frequency and type of medical treatments, tort reform may be inappropriate and/or ineffective. But if variation in claims is due primarily to variation in incentives created by the legal system, tort reforms that reduce these incentives will reduce claim costs. The optimal design of such tort reforms then becomes a crucial issue.

The data show that medical and demographic characteristics, which affect both the frequency of injury and incentives to sue, account for from 30 to 50 percent of the variation across states in claim frequency and severity. Differences in common law doctrine played a significant role in the peak years of the crisis, but their effect declined after 1976. Of the post-1975 tort reforms, only those designed to reduce awards appear to have had significant impact by 1978. However, the absence in these data of measurable effects of the laws designed to reduce claim frequency—in particular the statute of limitations—is certainly

5Changes in doctrine affecting medical malpractice are described in App. A. Changes affecting all lines of tort liability are described in California Commission (1977).
not definitive evidence of their ultimate effect. The average lag in disposition of claims is at least two years, so the 1975-78 claims-closed data do not reflect the full effect on filings.

Although policy analysis is primarily concerned with the efficiency and efficacy of alternative policies, a related issue of growing interest is the way in which public policy evolves. Thus, a secondary question addressed in this report is What determined the extent of tort reform in different states, and what can we infer about the determinants of policy enacted through the legislature rather than the courts?

Section II provides an overview of countrywide trends in claims for different lines of liability insurance and differences among states in malpractice litigation. Section III presents a theoretical model of the frequency and severity of medical malpractice claims, which underlies the empirical analysis. Section IV describes the data and methodological issues. Section V reports the empirical analysis of frequency of claims per capita, average severity per claim, and average claim cost per capita. Section VI analyzes the determinants of the post-1975 tort reforms. Section VII summarizes the findings and policy implications. Appendix A describes the main post-1975 tort reforms. Appendix B describes two previous studies of claim frequency and shows why the conclusions reached here differ from earlier conclusions.
II. TRENDS IN CLAIM FREQUENCY AND SEVERITY

COUNTRYWIDE COMPARISON ACROSS LINES

The only data available for comparing trends in different lines of tort litigation are those on claims incurred, by policy year, reported by the ISO.¹ The advantage of these data over claims-closed data by calendar year (which are used in the subsequent analysis) is that incurred claims include both closed and open claims, and an estimate of claims not yet filed ("incurred but not reported"). Incurred claims therefore present a more current picture of trends in claim filings and the data are not distorted by changes in the rate of disposition of claims.

The disadvantage of incurred-claims data is that, because of the lags between filing and closing of claims, reported frequency and severity incorporate a mix of hard data and insurers' projections.² The claim experience available as of the date of the estimate is "developed" to create a projection of ultimate experience, using development factors derived from past experience. Because the projection component is larger for lines with a long "tail" (lag between filing and disposition of claims), such as medical malpractice and product liability, and in more immature (recent) policy years, the estimates for these lines are less reliable. Projection is also relatively more important for severity than frequency, because of the lag. Since projections are based on past experience, they are accurate only as long as trends are stable over time.

Frequency

Figures 1 and 2 show trends in frequency and severity of claims for the lines and policy years for which data are available. There are two series of data on frequency of claims against physicians and surgeons. The first, which reflects the information available to ISO as of April

¹As the main rating bureau for the property liability insurance industry, ISO collects data on loss experience from member companies, adjusts for trends, and publishes advisory premium rates. The fraction of the market reported to ISO varies by line and by state. These data are therefore not comprehensive, nor are they necessarily representative of the entire industry.
²For a detailed account of how ISO calculates incurred claim frequency and severity, see Hearings (1975).
1975, shows a mid increase in frequency in 1966-70, followed by rapid acceleration in the early 1970s. The average exponential growth rate over the entire period is 12 percent, but the average for 1971-73 is 19 percent. The second series reflects information available as of March 1980. It shows an increase for policy years 1971-75, followed by a decrease which leads to an average exponential growth rate over the period 1971-78 of -0.3 percent. Thus, the earlier projections greatly overestimated claim frequency for the late 1970s. Claims against hospitals, for which only the 1980 estimates are available, show a similar but more extreme mid-decade peak than claims against physicians and surgeons.

Product liability bodily injury claims and manufacturers' and contractors' bodily injury claims show similar but less extreme mid-decade peaks. Automobile bodily injury and physical damage claims
were essentially stable throughout the period, with average annual trends of $-0.5$ percent and $-0.9$ percent respectively, for 1973-80.\footnote{The automobile data are on a calendar-year basis but are comparable with policy-year data for other lines because lags in filing automobile claims are negligible.}

Thus, while the increase in medical malpractice claim frequency appears to have been more extreme than in other lines, it was not atypical. The extent to which the appearance of greater volatility of medical malpractice is an artifact of the greater reliance on development factors, because of the long tail of this line, cannot be determined with the data available.

**Severity**

For all lines, the steady upward trend in claim severity throughout the decade outpaced the general rate of inflation. In 1971-78, the
average incurred cost per claim against physicians and surgeons increased at 12.4 percent per annum, compared to 18.9 percent for claims against hospitals. Comparable trends for product liability bodily injury and physical damage claims were 19.4 percent and 12.1 percent respectively; increases for automobile bodily injury and physical damage were 14.1 percent and 15.6 percent.\(^4\)

It is important to note that to the extent that the drop in frequency reflects an elimination of minor claims, observed average severity will increase, due to the change in mix of claims, although there may be no increase in severity for a given type of injury.\(^5\)

**MEDICAL MALPRACTICE COMPARISON ACROSS STATES**

Table 1 summarizes trends in the frequency and severity of malpractice claims closed, using state means as the unit of observation. The averages differ from those in the countrywide comparison, which effectively weights each state mean by the population in that state. Because the distributions are highly skewed and data-reporting errors may bias the extremes, both means and quantiles are reported.

**Frequency**

Between 1970 and 1975, the median average annual rate of growth in claim frequency was between 20 and 30 percent.\(^6\) Between 1975 and 1976, total claims fell from 23,240 to 17,683, with a median rate of decrease of 27 percent, although paid claims fell only 14 percent. In 1977, total claims fell to 15,556, with a median decrease of 9 percent for total claims and 11 percent for paid claims. In 1978, total claims rose to 17,238, with the median increase around 2 percent; there was no change in paid claims. Throughout the period, states starting at relatively low frequency had more rapid claim growth, so that the

---

\(^4\)Product liability figures are for manually rated classes.

\(^5\)The average lag from filing to disposition increased from 18 months for claims closed in 1975 to 25 months for claims closed in 1978. This may reflect a reduction in the filing of minor claims, which close relatively quickly, and/or longer lags in disposition, possibly due to uncertainty created by changes in the law.

\(^6\)The data underlying these estimates are described in Sec. IV. The growth rate between 1970 and 1975 reported in Table 1 is probably upwardly biased by as much as 30 percent because the 1970 sample is incomplete. For 1975-78, claim counts in some years for some states may be incomplete (NAIC, 1977, p. 116). Since data were only collected for July-December 1975, the 1975 frequency estimate used here is twice this six-month count.
Table 1

FREQUENCY AND SEVERITY OF MEDICAL MALPRACTICE CLAIMS:
STATE MEANS, LEVELS, AND GROWTH RATES

<table>
<thead>
<tr>
<th>Item</th>
<th>Year</th>
<th>Mean</th>
<th>Median</th>
<th>25th Percentile</th>
<th>75th Percentile</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claims per 100,000</td>
<td>1970</td>
<td>2.76</td>
<td>2.56</td>
<td>1.99</td>
<td>3.27</td>
<td>.35</td>
<td>8.86</td>
</tr>
<tr>
<td>population</td>
<td>1975</td>
<td>10.04</td>
<td>8.98</td>
<td>6.42</td>
<td>12.14</td>
<td>3.34</td>
<td>44.38</td>
</tr>
<tr>
<td>1977</td>
<td>6.09</td>
<td>5.81</td>
<td>3.92</td>
<td>7.52</td>
<td>1.72</td>
<td>13.78</td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>6.23</td>
<td>5.81</td>
<td>3.98</td>
<td>7.89</td>
<td>1.40</td>
<td>17.44</td>
<td></td>
</tr>
<tr>
<td>Growth rate&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1975/70</td>
<td>33.2</td>
<td>28.7</td>
<td>20.8</td>
<td>38.4</td>
<td>8.1</td>
<td>79.7</td>
</tr>
<tr>
<td>Growth rate&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1976/75</td>
<td>-26.3</td>
<td>-27.4</td>
<td>-42.6</td>
<td>-5.7</td>
<td>-70.8</td>
<td>31.1</td>
</tr>
<tr>
<td>1977/76</td>
<td>-8.9</td>
<td>-9.3</td>
<td>-21.3</td>
<td>3.3</td>
<td>-57.6</td>
<td>121.0</td>
<td></td>
</tr>
<tr>
<td>1978/77</td>
<td>7.8</td>
<td>2.0</td>
<td>-15.0</td>
<td>26.2</td>
<td>-59.5</td>
<td>124.4</td>
<td></td>
</tr>
<tr>
<td>Paid claims per 100,000</td>
<td>1975</td>
<td>3.64</td>
<td>3.10</td>
<td>2.12</td>
<td>4.58</td>
<td>.96</td>
<td>18.59</td>
</tr>
<tr>
<td>population</td>
<td>1976</td>
<td>2.81</td>
<td>2.67</td>
<td>1.73</td>
<td>3.62</td>
<td>.37</td>
<td>8.16</td>
</tr>
<tr>
<td>1977</td>
<td>2.51</td>
<td>2.37</td>
<td>1.47</td>
<td>3.26</td>
<td>.43</td>
<td>6.18</td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>2.68</td>
<td>2.37</td>
<td>1.51</td>
<td>3.44</td>
<td>.52</td>
<td>6.57</td>
<td></td>
</tr>
<tr>
<td>Severity ($)</td>
<td>1975</td>
<td>19.793</td>
<td>16.719</td>
<td>11.186</td>
<td>25.429</td>
<td>2.789</td>
<td>62.120</td>
</tr>
<tr>
<td>1978</td>
<td>36.766</td>
<td>32.550</td>
<td>16.961</td>
<td>49.096</td>
<td>5.267</td>
<td>160.161</td>
<td></td>
</tr>
<tr>
<td>Growth rate&lt;sup&gt;b&lt;/sup&gt;</td>
<td>76/75</td>
<td>67.4</td>
<td>33.8</td>
<td>-12.2</td>
<td>83.3</td>
<td>-92.6</td>
<td>5.75</td>
</tr>
<tr>
<td>77/76</td>
<td>60.8</td>
<td>32.6</td>
<td>-23.5</td>
<td>78.0</td>
<td>-75.0</td>
<td>10.53</td>
<td></td>
</tr>
<tr>
<td>78/77</td>
<td>67.9</td>
<td>25.0</td>
<td>-30.6</td>
<td>76.5</td>
<td>-80.0</td>
<td>15.34</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>1970 sample incomplete.
<sup>b</sup>Growth rate = [(Claims<sub>t</sub> / Claims<sub>t-1</sub>)<sup>1/10</sup> - 1] X 100.
<sup>c</sup>Growth rate = [(Claims<sub>t</sub> / Claims<sub>t-1</sub> + 1] X 100.

frequency range narrowed—the 1975 range was from 3.3 to 44.4, while the 1978 range was only 1.4 to 17.4. Year-to-year changes were highly erratic across states, ranging from a 71 percent decrease to a 124 percent increase. The correlation coefficients between growth rate and initial level are: -0.4 for 1970-75 and 1976-77; -0.3 for 1977-78; and -0.17 for 1975-76. The absolute increase in claims per capita in 1970-75 is positively correlated with the 1970 level (+0.6), but this correlation was reversed to -0.7 for 1976-77 and -0.2 for the following year.

<sup>3</sup>Washington, D.C., was an extreme outlier in 1975, with claim frequency over twice that of California, the second-ranked state.
Severity

Between 1975 and 1978, median severity per paid claim increased at an average annual rate of roughly 30 percent, but the mean exceeded 60 percent. This mean of the state means exceeds the mean countrywide increase because severity in the majority of small states grew more rapidly than that in the few states that accounted for most of the claims. Year-to-year changes in severity are even more volatile than those in frequency, ranging from −90 percent to +1,000 percent. In part, this reflects the small sample of claims and the huge potential range of awards, rather than changes in severity for a given type of injury.8

Severity grew most rapidly in states where the initial level was low, with correlation coefficients between one-year growth rates and initial levels ranging from −0.3 to −0.5.

---

8In 1976, 35 states had less than 100 paid claims.
III. THEORETICAL ANALYSIS OF CLAIM FREQUENCY AND SEVERITY

This section explains the assumptions used in the empirical analysis and shows how the feedbacks and lags between the frequency and severity of claims closed and changes in law complicate the measurement of effects.

OVERVIEW OF THE MODEL

Frequency of Claims

To establish a claim for medical malpractice, a plaintiff must show that he sustained damages during the course of medical treatment; that the treatment violated the standard of due care; and that the injury was causally related to the negligent treatment. The frequency of claims filed therefore depends on the frequency of injury, the standard of care, and the incentives to file.

The number of iatrogenic injuries in any period depends on the frequency and types of medical treatment and the quality of care exercised by medical providers—the greater the frequency of complex, invasive procedures, the higher the rate of iatrogenic injury. The quality of care may in turn be influenced by the risk and cost of being sued, as perceived by medical providers, and by other quality-control systems.

Only a fraction of the total number of iatrogenic injuries are potentially actionable under the negligence system. The standards applied by the courts determine whether a particular injury is considered within the normal risk of acceptable medical care or is attributable to negligence. In general, the courts defer to the customary practice of the profession in defining the standard of care in medical and other professional liability cases. However, by ruling on the admissibility of particular legal doctrines, the courts play an active role in setting

---

1The word injury is used here to denote all adverse medical outcomes, both those attributable to negligent care and those deemed within the normal risk of an acceptable level of care.

2A careful study of iatrogenic injuries in 23 California hospitals, conducted by medical legal experts, concluded that on the average, 17 percent were potentially actionable under the negligence system (CMA/CHA, 1977).

3To the extent that the behavior of the courts is uncertain ex ante, the standard of care defines a probability of proving negligence for each injury.
standards. For example, the abolition of the locality rule substituted a
statewide or national standard as the norm of acceptable practice; the
abolition of charitable and government immunity has exposed
voluntary and government hospitals to suit; the doctrine of respondeat
superior extended the liability of hospitals for the actions of their
employees; and the doctrine of informed consent set new standards for
the responsibility of physicians to inform patients of potential risks of
treatment. On rare occasions, the courts have explicitly overruled
medical custom and applied a cost-benefit calculus to individual
cases.⁴

The stock of potential claims at each point in time depends upon the
discrepancy between the standards currently being applied by the
courts and standards of actual practice in prior years for which the
statute of limitations has not yet run. An extension of liability or
upgrading of standards—for example, a switch from a local to a na-
tional standard of care—tends to add to the stock of potential claims,
since practice that conformed to the old standard but not to the new
becomes potentially actionable. The net addition depends on the stat-
ute of limitations. The increased exposure to liability creates incen-
tives for physicians to conform to the new standard, thereby reducing
the flow of injuries per period. If medical practice adapted immedi-
ately to the standards set by the courts and changes in standards were
never retroactively applied, the number of actionable injuries would
be zero.⁵ If the standards applied by the courts are continually
changing, however, the frequency of claims will be higher: The more
frequent the upgrading of standards, the longer the delay in adapting
medical practice to new standards, which in turn depends on the
incentives for physicians to adapt, and the longer the statute of
limitations.

Only a fraction of the stock of potential claims are actually filed.
The propensity to file is assumed to depend, inter alia, on the probabili-
y of winning, which in turn depends on the standard of care applied
by the courts and on the expected award, which depends on the sever-
ity of the injury, the plaintiff’s age and income, and the law defining
compensable damages. The trend over time in common law has been

⁵Even with static standards, the long-run equilibrium frequency of actionable in-
juries could be nonzero for several reasons. First, if physicians pay less than the full cost
of the damages caused by their negligence (because some injured patients do not sue or
because of liability insurance), incentives are insufficient to eliminate all negligence.
Very crude estimates suggest that at most one in ten potentially actionable injuries
gives rise to a claim. Second, if the courts set standards above the efficient level, it is
cheaper for a physician to pay damages than to comply, even if he pays all resource and
damage costs. Third, even if standards are set at efficient levels for the average physi-
cian, it may be cheaper for the below-average physician to pay damages than to comply.
to extend the categories of compensable damages from tangible "economic loss" (forgone wages and medical expense) to less tangible items, such as loss of consortium and pain and suffering. Since 1975, many states have modified basic tort damage rules for medical malpractice cases by such measures as dollar ceilings, either on the total award or on some component; modification of the collateral source rule, to admit evidence and, in some states, to mandate offset of compensation from other sources against the tort recovery; elimination of the plaintiff's ad damnum; and periodic payment of future damages.

The net payoff to filing a potential claim also depends on the costs of litigation, which depend on such factors as the availability and cost of attorneys and the rules of procedure and evidence. Changes in common law that have eroded traditional defenses and thereby effectively reduced plaintiffs' litigation costs include abolition or modification of the locality rule; allowing medical texts as evidence of customary practice; and expansion of the doctrine of res ipsa loquitur, which shifts the burden of proof to the defendant. To limit the expansion of liability, after 1975 many states shortened statutes of limitations, reinstated some form of locality rule, and limited the application of res ipsa. Other states introduced arbitration or pretrial screening panels, which also may lower costs and hence raise the net payoff to filing.

Finally, the number of claims closed in any year depends on the rate of filings in several prior years and lags in disposition, which may exceed ten years but average around two years.

Average Severity (Award) per Paid Claim

Average severity per paid claim (including court awards and out-of-court settlements) depends on the "true" damages incurred on claims closed with payment and the valuation of these damages by the courts. For each claim, "true" damages depend on the severity of the injury, the plaintiff's age, his actual or potential wage loss, etc. The valuation of these damages by the courts depends on the law of compensable damages, how inflation, discounting, and taxes are handled, and the attitudes of judges and juries. The observed average severity

---

6Between 1950 and 1980, the number of lawyers per capita increased by 70 percent. Nevertheless, mean and median annual earnings of lawyers rose relative to those of other salaried male workers between 1959 and 1969 (Pashigian, 1977, App. B).

7If local physicians are unwilling to testify against each other—the alleged "conspiracy of silence"—it is less costly for the plaintiff to obtain expert testimony when there is no locality rule.

8The net effect of these alternative forums is highly uncertain a priori, since they may change expected recoveries as well as costs (Ebener, 1981).
per paid claim could rise or fall in response to an increase in this implicit value per unit damages, because an increase in implicit value raises the expected net payoff on all potential claims and therefore attracts claims with true damages or probability of winning that were too low to have been worth filing prior to the increase. Thus differences in average severity across states understate differences in implicit value per unit damages because the composition of the claim universe changes in response to a change in that value.

**Claim Cost per Capita**

Claim cost per capita is simply the product of severity per paid claim and frequency of paid claims per capita. It is included in the empirical analysis to show the net effect of variables that affect both frequency and severity.

**Changes in Law**

The discussion so far has treated legal rules as exogenous determinants of the frequency and severity of claims. In fact, both common and statutory law are influenced by some of the same demographic characteristics that affect the frequency and severity of claims, and by the frequency and severity of claims themselves. An increase in the stock of potential claims may give rise to attorneys specializing in medical malpractice who have a stake in developing pro-plaintiff common law doctrines. At the statutory level, the spate of legislation that followed the 1975 crisis amply illustrates how laws are affected by claim frequency and severity, as well as _vice versa_. Tort reforms are also expected to be more comprehensive and/or passed earlier in states that experienced a high level or rate of increase of insurance premiums and in which the medical profession and insurance industry were relatively cohesive.

**STRUCTURE OF THE MODEL**

The analysis described above may be described formally by a system of equations in which the frequency of claims per capita, severity per paid claim, claim cost per capita, and the post-1975 statutory changes in law are simultaneously determined. The following notation is used:
\( K^* \) = stock of potential claims
\( K \) = claims filed per capita
\( A \) = average severity per paid claim
\( F \) = claims closed per capita
\( L \) = common law and statutory rules of liability, evidence, and compensable damages
\( Y \) = characteristics of medical providers
\( Z \) = characteristics of patient population
\( X \) = characteristics of lawyer population
\( S \) = term of statute of limitations
\( Q \) = quality of medical care
\( r \) = compensation per unit of damages
\( C \) = litigation costs
\( D \) = cost of negligence borne by physicians (deterrent effect)
\( I \) = flow of iatrogenic injuries
\( P \) = malpractice insurance premiums
\( \delta_i \) = fraction of claims closed in \( i\)th year after filing

The rate of iatrogenic injury in year \( t \) depends on characteristics of the medical provider \( (Y) \) and patient \( (Z) \) populations, and on the quality of care \( (Q) \), which is in turn influenced by the perceived cost of negligence \( (D) \) to medical providers:

\[
I_t = [Y_t, Z_t, Q_t(D_t)] .
\]  

(1)

The stock of potential claims in year \( t \) is a function of the injury rate in prior years for which the statute of limitations \( (S) \) has not yet run and the standards applied by the courts \( (L) \):

\[
K^*_t = \sum_{i=t}^{t-S} K^* \left[ I_i, L_i \right] .
\]  

(2)

The frequency of claims filed from the stock of potential claims depends on the expected net payoff, which is determined by legal rules (which affect the probability and cost of proving negligence and which define compensable damages), the cost and availability of legal services, and demographic factors:

\[
K_t = K \left[ K^*, r(L_t), C(L_t), X_t, Z_t \right] .
\]  

(3)

Frequency of claims closed in year \( t \) \( (F_t) \) is some fraction \( (\delta) \) of claims filed in several prior years, depending on delays in disposition:
\[ F_t = \sum_{i=1}^{t-r} \delta_i K_i, \]  

where \( r \), the maximum lag in disposition, may exceed ten years. The mean lag is about two years.\(^9\)

Average severity per claim depends on the types of injuries and hence, indirectly, on medical characteristics; on demographic characteristics such as age and income (which affect damages); on explicit and implicit legal rules that define compensation per unit damages, \( r(L) \); and possibly on the cost, and hence the input of legal services;\(^10\)

\[ A_t = A_{1}[I(Z_t r(L_t))]. \]  

Since claim cost per capita reflects frequency and severity, it depends on all the variables entering Eqs. (4) and (5).

Although in principle both common and statutory law are endogenous, we have explicitly modeled only the post-1975 tort reforms. The propensity to pass these statutes early and/or be more restrictive of plaintiff interest depends on frequency and severity of claims in 1975, the level of malpractice insurance premiums, and medical, legal, and demographic characteristics;\(^11\)

\[ L_{75} = L(F_{75}, A_{75}, P_{75}, Y_{75}, Z_{75}, X_{75}). \]  

\(^9\)Strictly, the \( \delta \) should be treated as endogenous, but the available data do not permit identification.

\(^{10}\)Year subscripts are dropped where the value of a variable over several years is relevant.

\(^{11}\)1974 values of explanatory variables would be more appropriate, but 1975 is the earliest year for which claims data are available.
IV. DATA AND METHODOLOGY

DATA

The data on claims are drawn from two surveys of claims closed by insurance companies in 1970 and 1975-78. The 1970 survey is a weighted random sample of claims closed by 26 insurers that accounted for 90 percent of the market. Because the number of paid claims is very small in some states, severity is not calculated for 1970. The 1975-78 survey covered all insurers writing malpractice premiums of $1 million or more in any year since 1970. Claims against multiple defendants arising from the same incident are consolidated. These data reflect claims filed two years earlier, on average.

Data on common law doctrines adopted prior to 1970 are taken from a survey reported in Dietz, Baird, and Berul (1973). A dummy variable that takes values from 0 to 4 measures the number of the following doctrines recognized: abolition of the locality rule, informed consent, abolition of charitable immunity, and respondent superior. Data on the statute of limitations, before and after any changes, and on other post-1975 tort reforms were compiled by a survey of the relevant statutes. Each law is measured as the number of months prior to December 1978 during which the law was in effect. Thus these values range from 0, if a law was never passed, to 48, if a law was passed in January 1975. The pre- and post-1975 statutes of limitations are measured in years for filing for adults. If there is a discovery rule with no outer limit, the statute of limitations is arbitrarily assigned a value of 10.

Malpractice insurance costs are measured by two variables: the rate filed by ISO for general practitioners for basic limits of coverage, effective March 1975, and the percentage increase recommended by ISO in April 1975. Since ISO specialty and excess limits differentials are uniform across states, the ISO basic rate is a pure index of ISO state

---

1The survey is described in Westat (1973).
2The 128 participating insurers include some of the new medical mutual companies, joint underwriting associations, and hospital captive companies, but not all participated throughout the survey. A dummy variable identifying states with known underreporting was not significant in the regressions. The survey instrument and database are described in NAIC (1977). In both surveys, claims against physicians are probably more fully represented than claims against hospitals because of hospital self-insurance.
3This ignores common exceptions to the basic statute for cases involving minors or fraud and concealment by the physician. For medical malpractice, many states have a discovery rule which tolls the running of the statute until the injury is or "with reasonable diligence" should have been discovered.
differentials. However, since ISO rates are used for only a small fraction of the market, they provide an imperfect index of premiums actually paid.⁴

Data on demographic and medical characteristics were obtained from several sources. Where possible, values as of two years prior to the year of the dependent variable are used, corresponding to the average lag in disposition of claims. All variables are listed in Table 2, together with means, standard deviations, and sources.

ESTIMATION ISSUES

Functional Form

Logarithmic transformations of the two dollar-dependent variables, severity per claim and claim cost per capita, are used for theoretical and empirical reasons. If the effects of random shocks and changes in law are multiplicative rather than additive, then the log transformation is appropriate. Empirically, severity per claim and claim cost per capita are approximately log-normally distributed.⁵ For the frequency of claims per capita, a logistic transformation is used. This yields a closer approximation to a normal distribution than either claims per capita or the log of claims per capita.⁶

Weighting

Because each observation represents grouped data, weighting to account for heteroscedasticity seems appropriate, but without prior knowledge of the error structure, the choice of weighting system entails judgment. For severity per claim and claim cost per capita, each observation is weighted by the number of observations in the underlying sample: number of paid claims and population in the state,

⁴Steves and McWhorter (1975). As a more accurate measure of premiums actually paid, we constructed a measure of state relativities based on a survey of premiums paid by a nationwide sample of physicians in 1975. Premiums paid by individual physicians were regressed on dummy variables indicating medical specialty, coverage limits, and state of residence. These state coefficients thus measure the differential in premiums due to state of residence, controlling for physician specialty and limits of coverage. The survey and data are described in Greenspan (1979). The determinants of premium levels are analyzed in Danzon (1980). This premium measure had lower explanatory power than the ISO variables.

⁵The estimation techniques presuppose that the residuals are normally distributed. Normality of the dependent variable is a rough guide to the normality of the residuals.

⁶Because claims are measured per 100,000 population, the logit formulation is only approximately correct. Since claims per 100,000 is near zero, the error is very small.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Urban</td>
<td>66.8</td>
<td>15.1</td>
<td>% Population in places with population &gt; 25,000 in 1970.</td>
<td>Statistical Abstract</td>
</tr>
<tr>
<td>% Old</td>
<td>.102</td>
<td>.018</td>
<td>% Population over 65.</td>
<td>Statistical Abstract</td>
</tr>
<tr>
<td>MDs per capita</td>
<td>1.21</td>
<td>.412</td>
<td>Total non-federal physicians in patient care per 100,000 population.</td>
<td>AMA, Physician Distribution and Medical Licensure in the U.S.</td>
</tr>
<tr>
<td>1970 laws</td>
<td>2.48</td>
<td>.789</td>
<td>Number of doctrines applied by 1970: locality rule expanded or rejected; res ipsa applied; informed consent applied; charitable immunity rejected.</td>
<td>Dietz, Baird, and Berul (1973)</td>
</tr>
<tr>
<td>1970 statute of limitations</td>
<td>7.76</td>
<td>3.55</td>
<td>Statute of limitations for adults, pre-1975: = 10, if unrestricted discovery period.</td>
<td>LouSELL and WiliAMs</td>
</tr>
<tr>
<td>OLT severity</td>
<td>7.80</td>
<td>.284</td>
<td>Severity per paid claim (owners, landlords, and tenants, bodily injury liability); log.</td>
<td>ISO</td>
</tr>
<tr>
<td>No fault</td>
<td>.32</td>
<td>.47</td>
<td>= 1 if state adopted no-fault automobile; = 0 otherwise.</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Value1</td>
<td>Value2</td>
<td>Description</td>
<td>Source</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>--------</td>
<td>--------</td>
<td>----------------------------------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>1975 statute of limitations</td>
<td>3.52</td>
<td>3.54</td>
<td>Statute of limitations for adults after post-1975 changes, if any; = 10, if unlimited discovery.</td>
<td>Louisel and Williams</td>
</tr>
<tr>
<td>Ad damnum</td>
<td>18.14</td>
<td>17.22</td>
<td><em>Ad damnum</em> eliminated; months pre-December 1978.</td>
<td>Statutes</td>
</tr>
<tr>
<td>Cap</td>
<td>10.22</td>
<td>16.00</td>
<td>Cap on awards; months pre-December 1978.</td>
<td>Statutes</td>
</tr>
<tr>
<td>Collateral source</td>
<td>5.36</td>
<td>13.52</td>
<td>Mandatory offset of collateral compensation; months pre-December 1978.</td>
<td>Statutes</td>
</tr>
<tr>
<td>Fee limit</td>
<td>12.22</td>
<td>17.11</td>
<td>Limit on contingent fees; months pre-December 1978.</td>
<td>Statutes</td>
</tr>
<tr>
<td>Share</td>
<td>64.60</td>
<td>13.21</td>
<td>Market share of leading insurer, 1974.</td>
<td>Steves and McWhorter (1975)</td>
</tr>
<tr>
<td>% Medical society</td>
<td>.601</td>
<td>.128</td>
<td>% Physicians belonging to state or local medical society, 1975.</td>
<td>AMA</td>
</tr>
<tr>
<td>1975 ISO rate</td>
<td>5.73</td>
<td>1.79</td>
<td>ISO rate for Class I physicians as of March 1975; log.</td>
<td>ISO</td>
</tr>
<tr>
<td>ISO Increase</td>
<td>1.45</td>
<td>1.15</td>
<td>% Rate increase recommended by ISO, April 1975.</td>
<td>ISO</td>
</tr>
<tr>
<td>1970 consent</td>
<td>.48</td>
<td>.50</td>
<td>= 1 if informed consent applied by 1970; = 0 otherwise.</td>
<td>Diets, Baird, and Berul (1973)</td>
</tr>
<tr>
<td>1970 respondeat superior</td>
<td>.66</td>
<td>.49</td>
<td>= 1 if <em>respondeat superior</em> applied by 1970; = 0 otherwise.</td>
<td>Diets, Baird, and Berul (1973)</td>
</tr>
<tr>
<td>Lawyers per capita</td>
<td>1.83</td>
<td>1.62</td>
<td>Lawyers per 100,000 population.</td>
<td>ABA Membership Report</td>
</tr>
<tr>
<td>% ABA</td>
<td>58.67</td>
<td>10.36</td>
<td>% Lawyers belonging to ABA.</td>
<td>ABA Membership Report</td>
</tr>
</tbody>
</table>
respectively. For the frequency of claims per capita, the weights are related to but not strictly proportional to the state population, following a formula proposed by Aramiya and Nold (1975). The influence of weighting on estimates for frequency are discussed below and in App. B.

\[ P_{it} = \frac{1}{1 + e^{-\beta X_{it} + \nu_{it}}}, \]

where \( \nu_{it} \sim (0, \sigma^2). \) Then the logit of claim frequency is

\[ f_{it} = \log \left( \frac{F_{it}}{1-F_{it}} \right) = \beta X_{it} + \nu_{it} + u_{it} = \beta X_{it} + \epsilon_{it}, \]

where \( F_{it} = \frac{1}{n_{it}} \sum_{k=1}^{n_{it}} Y_{ik}. \)

Then the variance of \( \epsilon_{it}, \sigma_{\epsilon_{it}}^2, \) is approximately \( \sigma^2 + \left[ n_{it} F_{it}(1-F_{it}) \right]^{-1}. \) An estimate of \( \sigma_{\epsilon_{it}}^2, \) the average state-specific variance over the period 1975-78, is obtained as follows:

\[ s^2 = \frac{1}{4} \frac{1}{50} \left\{ \frac{4}{50} \sum_{i=1}^{50} \sum_{t=1}^{4} f_{it} \beta X_{it}^2 - 4 \sum_{i=1}^{50} n_{it} F_{it} (1-F_{it})^{-1} \right\}. \]

where \( \beta \) is estimated from the unweighted system of four equations, and

\[ \bar{F}_{it} = \frac{1}{4} \sum_{t=1}^{4} F_{it}. \]

Then

\[ \sigma_{\epsilon_{it}}^2 = s^2 + \left[ n_{it} F_{it}(1-F_{it}) \right]^{-1}, \]

is the weight applied to the \( i \)th state. This yields weights ranging from 2.48 to 2.99, whereas weights for claim cost per capita (population) range from 20 to 147, and weights for severity (number of paid claims) range from 2.5 to 34.4. Weighting systems that assign the most weight to the few most populous states tend to yield higher t-statistics, but the main conclusions are not affected by the system used.
Pooling Data

The observations consist of four annual cross sections (five for claim frequency). Serial correlation of residuals is expected, especially for claim frequency where the lag in closing claims induces strong correlation across years. In addition to within-state serial correlation, contemporaneous correlation across states in each year is likely. To allow for an unconstrained autoregressive process with endogenous explanatory variables, we use a three-stage least-squares model, applied to the pooled cross sections. The estimated covariances across years are large for adjacent years but decline over time. To allow for contemporaneous correlation, the intercept for each year is free to vary.

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Superscript 9Estimation from first differences was unsuccessful, presumably because there is little variation in either the independent variables or the coefficients over the short span of years in the sample, and because the autoregressive process is complex.

Superscript 10The pattern is not sufficiently stable to justify imposing a structure on the covariance matrix.
V. EMPIRICAL ESTIMATES

The effects of medical, demographic, and legal characteristics existing prior to 1975 are shown in Table 3, which presents coefficient estimates from systems of pooled, cross-section equations with all coefficients constrained to be equal in all years. Because several of the explanatory variables are highly correlated, coefficients are sensitive to specification. For each dependent variable (frequency, severity, and total claim cost), three specifications are reported. The first includes only medical and demographic factors (physicians per capita, population over 65, and degree of urbanization). The second adds character-

Table 3
FREQUENCY AND SEVERITY OF MALPRACTICE CLAIMS:
PRE-1975 MEDICAL, DEMOGRAPHIC, AND LEGAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Variable</th>
<th>Claim Frequency per 100,000 population; log (F/(1-F))</th>
<th>Severity per Claim (log)</th>
<th>Total Claim Cost per 100,000 population (log)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a) (b) (c)</td>
<td>(a) (b) (c)</td>
<td>(a) (b) (c)</td>
</tr>
<tr>
<td>%Urban</td>
<td>.012 .012 .014</td>
<td>.015 .018 .012</td>
<td>.004 .006 .002</td>
</tr>
<tr>
<td></td>
<td>(3.31) (3.18) (2.85)</td>
<td>(2.94) (2.41) (3.11)</td>
<td>(5.66) (5.02) (5.50)</td>
</tr>
<tr>
<td>MDs per capita</td>
<td>.016 .10 .543</td>
<td>.356 .170 .086</td>
<td>.327 .156 .087</td>
</tr>
<tr>
<td></td>
<td>(4.33) (5.66) (3.35)</td>
<td>(3.15) (1.03) (1.6)</td>
<td>(1.45) (.51) (.29)</td>
</tr>
<tr>
<td>% Old</td>
<td>2.99 3.32 .774</td>
<td>1.81 1.25 .391</td>
<td>6.62 5.65 2.59</td>
</tr>
<tr>
<td></td>
<td>(1.32) (1.42) (3.4)</td>
<td>(1.99) (.70) (.21)</td>
<td>(1.98) (.65) (.25)</td>
</tr>
<tr>
<td>1970 laws</td>
<td>.069</td>
<td>.069</td>
<td>.215</td>
</tr>
<tr>
<td></td>
<td>(2.81)</td>
<td>(2.81)</td>
<td></td>
</tr>
<tr>
<td>1970 statute of limitations</td>
<td>.011</td>
<td>.016</td>
<td>.025</td>
</tr>
<tr>
<td></td>
<td>(.98)</td>
<td>(.98)</td>
<td>(.44)</td>
</tr>
<tr>
<td>OLT severity</td>
<td>-.89</td>
<td>.163</td>
<td>.072</td>
</tr>
<tr>
<td></td>
<td>(1.31)</td>
<td>(1.35)</td>
<td>(.58)</td>
</tr>
<tr>
<td>No fault</td>
<td>-.143</td>
<td>.102</td>
<td>.104</td>
</tr>
<tr>
<td></td>
<td>(1.56)</td>
<td>(1.56)</td>
<td>(.85)</td>
</tr>
<tr>
<td>Lawyers per capita</td>
<td>-.020 -.024</td>
<td>.051 .065</td>
<td>.043 .048</td>
</tr>
<tr>
<td></td>
<td>(.80) (.62)</td>
<td>(1.20) (1.59)</td>
<td>(.42) (.50)</td>
</tr>
<tr>
<td>% ABA</td>
<td>.003 .005</td>
<td>-.008 -.005</td>
<td>-.008 -.003</td>
</tr>
<tr>
<td></td>
<td>(.81) (.125)</td>
<td>(2.53) (1.85)</td>
<td>(.47) (.65)</td>
</tr>
<tr>
<td>R²</td>
<td>.239 .246 .333</td>
<td>.314 .347 .410</td>
<td>.308 .292 .371</td>
</tr>
</tbody>
</table>

NOTE: Odds in parentheses. Coefficients constrained across years: 1970 plus 1975-78 for frequency, 1975-78 otherwise; weighted GLS estimates (see text).

Medical and demographic factors expected to affect the pool of injuries.

Includes (a) plus characteristics of the legal profession.

Includes (a) and (b) plus specific laws.
istics of the legal profession (lawyers per capita and membership in the American Bar Association). The third adds specific laws. Table 4 presents implied elasticities from the third specification. The effects of post-1975 tort reforms are indicated in Table 5, which presents constrained and unconstrained year-specific coefficients for all law variables.¹

Table 4

**PARTIAL DERIVATIVES AND ELASTICITIES**
**DERIVED FROM TABLES 3 AND 5**

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>Claim Frequency per 100,000 pop.</th>
<th>Severity per Claim</th>
<th>Total Claim Cost per 100,000 pop.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Partial Derivative</td>
<td>Elasticity</td>
<td>Partial Derivative</td>
</tr>
<tr>
<td>% Urban</td>
<td>.0009²</td>
<td>.86</td>
<td>.012²</td>
</tr>
<tr>
<td>MDs per capita</td>
<td>.036²</td>
<td>.61</td>
<td>...</td>
</tr>
<tr>
<td>1970 laws</td>
<td>.33²</td>
<td>.33</td>
<td>.069</td>
</tr>
<tr>
<td>1970 statute of limitations</td>
<td>...</td>
<td>...</td>
<td>.016</td>
</tr>
<tr>
<td>No fault</td>
<td>-.0096</td>
<td>-.043</td>
<td>.102</td>
</tr>
<tr>
<td>Informed consent</td>
<td>.018²</td>
<td>-.0096</td>
<td>.102</td>
</tr>
<tr>
<td>Lawyers per capita</td>
<td>...</td>
<td>...</td>
<td>.065</td>
</tr>
<tr>
<td>Respondent superior</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

²Significant at p = .10.
²Significant at p = .05.

**PRE-1975 CHARACTERISTICS**

Medical and Demographic Factors

Variation in medical exposure, as measured by number of physicians per capita, is a significant determinant of claim frequency but not severity. The estimates imply that at variable means, an increase of 100 physicians per capita adds an additional 3.6 claims per capita,¹

¹Constraining coefficients to be equal across years effectively quadruples sample size and thus would increase estimation efficiency if the coefficients were equal in all years. In the reduced-form equations of Table 3, this constraint is not strictly appropriate for variables that affect claims both directly and indirectly through their effect on tort reform. Using an F-test, the hypothesis of equal coefficients could not be rejected.
### Table 5

**Year-Specific Effects of Laws on Frequency, Severity, and Total Cost of Claims**

(Frequency = F, Severity = A, Total Cost = T)

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1970 laws</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>.116</td>
<td>.168</td>
<td>.239</td>
<td>.159</td>
<td>.123</td>
<td>.143 (2.51) (3.14) (2.14) (1.41) (2.81)</td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>T</td>
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<td></td>
</tr>
<tr>
<td>1970 statute of limitations</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>0.028</td>
<td>0.025</td>
<td>0.02</td>
<td>0.035</td>
<td>0.016</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.009</td>
<td>0.054</td>
<td>0.010</td>
<td>0.068</td>
<td>0.025</td>
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<tr>
<td>No fault</td>
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<td>F</td>
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<td></td>
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<td>A</td>
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<td></td>
<td></td>
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<td>T</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Informed consent</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>F</td>
<td>0.202</td>
<td>0.265</td>
<td>0.404</td>
<td>0.314</td>
<td>0.338</td>
<td>0.272 (1.54) (2.51) (3.38) (2.83) (2.57) (3.31)</td>
</tr>
<tr>
<td>T</td>
<td>0.132</td>
<td>0.560</td>
<td>0.340</td>
<td>0.246</td>
<td>0.210</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>T</td>
<td>0.225</td>
<td>0.378</td>
<td>0.278</td>
<td>0.305</td>
<td>0.243</td>
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<tr>
<td>A</td>
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<td></td>
<td></td>
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<td>T</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Collateral source</td>
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<td></td>
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<tr>
<td>A</td>
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<td>T</td>
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<td>Ad damnum</td>
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<td>A</td>
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<td></td>
</tr>
<tr>
<td>T</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fee limit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>0.006</td>
<td>0.020</td>
<td>0.013</td>
<td>0.02</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.013</td>
<td>0.011</td>
<td>0.012</td>
<td>0.011</td>
<td>0.016</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Coefficients from final specifications in Table 3.

<sup>b</sup> Coefficients constrained to be equal in all years.
with an elasticity of 0.6. Thus the 40 percent increase in physicians per capita between 1960 and 1978 could account for a 24 percent increase in claims over this period, a small fraction of the total increase. The elasticity less than unity suggests that marginal medical treatments involve less risky procedures.²

Over the last two decades, the quantity of medical care, as measured by physician visits and hospital admissions, has increased less rapidly than "quality," as measured by nonphysician personnel and other inputs per patient day. High multicollinearity makes it difficult to distinguish the net effects of quantity and complexity or "quality" of medical treatments. The effect of the number of surgeons per capita is not statistically different from the effect of nonsurgical specialists, although countrywide data show a higher frequency and severity of claims against surgical specialties than against nonsurgical specialties. The statistical insignificance of surgeons per capita in these cross-state regressions apparently results from the high positive correlation (0.85) between surgical and nonsurgical specialists per capita. In an attempt to distinguish the effect of complexity or "quality" of medical treatment, two measures of hospital input intensity were included in regressions that we have not reported: average full-time equivalent staff per patient day and the ratio of hospital cost per day to average manufacturing wage, as a proxy for the capital intensity of hospital facilities. These variables reduce but do not eliminate the significance of physicians per capita and do not add to the overall explanatory power.³

This evidence casts doubt on the conclusions drawn in two other studies (Mueller, 1976, and Feldman, 1979) about the effect of medical variables on claim frequency. Mueller finds a positive relation between claim frequency and the proportion of hospitals with complex facilities and concludes that these facilities generate more injuries. Feldman interprets a positive relation between surgical operations and claims per capita as the net effect of surgery rates on claims. Both studies include only a single measure of medical exposure. Since the included measure is positively correlated with other omitted dimensions, its coefficient is upward biased as an estimate of the net effect.

²Consistent with this, there is more variation across states in the number of nonsurgical specialists than in surgical specialists per capita. For nonsurgical specialists per capita, the coefficient of variation is 0.38, the ratio of maximum to minimum is 5.25. For surgical specialists, comparable numbers are 0.22 and 2.88.

³Since roughly 80 percent of reported malpractice claims arise in hospitals, the number of hospital admissions per capita was included as an explanatory variable. Its coefficient was often negative but very sensitive to the specification. This suggests that hospital admissions are not an accurate measure of exposure, in part because of variation in the type of treatment for which hospitalization occurs, depending on the availability of insurance and outpatient facilities.
of that dimension. In particular, the narrow interpretation relating claim frequency to type rather than quality of medical treatment is exaggerated.

Mueller's results are also partly attributable to the use of population weights, which yield estimates dominated by the few most populous states. The effect of outlier states with this weighting scheme is shown in Table B.1 in App. B. For 1970 claim frequency, with weights equal to the state population, surgeon density (per physician) is significantly positive. Application of a Cook's distance test for outliers indicates that California and Florida shift the coefficient estimates by more than 10 percent. When dummy variables for these two states are added, the coefficient of surgeons per physician becomes significantly negative. By contrast, when the Amemiya-Nold weights are used, which assign less weight to the populous states, surgeon density is not significant at conventional levels, with or without dummy variables for California and Florida. This suggests that the higher frequency of claims against surgeons found in countrywide data is in part due to the concentration of surgeons in states which for other reasons have relatively high claim frequency.

Claim frequency and severity are unrelated to the percent of the population over 65 years of age. Since hospital admission rates for persons over 65 are roughly twice as high as those for younger persons and the rate of negligent injury per admission is roughly twice as high for the elderly, the evidence of no significant difference in claim frequency suggests that the probability of an elderly person filing a claim, given a potentially actionable injury, is roughly one-fourth that for persons under 65. This is not surprising. Since compensable damages decrease with age, claims with low potential awards are less likely to receive a positive settlement offer and are less likely to be pursued to verdict, presumably because of the fixed costs of the litigation process.

Although the concentration of medical services in urban areas contributes to the higher claim frequency in these areas, it is far from the sole cause. Controlling for physician density, urbanization is the most significant and, in terms of elasticities, the most powerful predictor of frequency. The elasticity of frequency with respect to the percent of the state urbanized is 0.86. This may in part reflect a supply response

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4CMA/CHA (1977) reports a rate of iatrogenic injury twice as high for persons over 65, but little difference in the proportion of injuries considered actionable under a negligence standard. The positive relation between claim frequency and population over 65 reported in Mueller (1976) is due to the large weight assigned to Florida, which was an outlier in 1970. Either including a dummy variable for Florida or replacing population with Amemiya-Nold weights eliminates the positive coefficient of population over 65 (see App. B).
of claims to the higher verdicts awarded by urban courts. The elasticity of average severity with respect to the percent of the state urbanized is 0.80. As discussed above, this understates the difference in compensation per unit of loss for a specific injury, since higher compensation will induce the filing of more claims with relatively low stakes or probability of winning, which decreases observed average severity.

We were unable to identify any other characteristics of urban environments that influence claim frequency and severity. The urban coefficient is essentially unaffected by the inclusion of number of lawyers and specific laws. Per capita income was also insignificant, after controlling for physician and lawyer densities, although the simple correlations between per capita income and frequency and severity are high. This suggests that income has little net effect on the expected payoff and propensity to sue, given the medical and legal characteristics associated with high income. Other variables that proved insignificant and were therefore not used include the percent of the population on welfare, the employment rate, and court delay.\(^5\)

**Legal Factors**

The number of lawyers per capita has no effect on claim frequency, after we control for physician density and urbanization, and adding lawyer density does not affect the coefficients of the other variables. By contrast, lawyer density is positively related to claim severity, and physician density becomes insignificant when lawyer density is added.\(^6\) These findings suggest that high lawyer density does not in fact indicate lower cost of legal services. Decreased cost of legal services is expected to increase the frequency of suits, but it will not necessarily affect the outcome per case, since the optimum input of legal effort increases on both sides of the case and the effect on case outcomes depends on the symmetry of the judicial production function.\(^7\) As more claims with low stakes and/or low probability of winning are filed, observed severity will fall. Thus the most likely explanation for the positive relation between severity and lawyer density and the lack of effect on claim frequency is that high lawyer density...
density is a response to high demand for legal services and therefore does not indicate lower cost of legal services. Because of this endogeneity bias, i.e., that lawyers move to states where awards are high, even the low estimated elasticity of severity with respect to number of lawyers (0.12) almost certainly overestimates any net effect of number of lawyers on severity. The effects of no-fault automobile laws, discussed below, are consistent with this interpretation. Claim severity is lower in states where membership in the ABA is relatively high, but frequency is unaffected. Whether membership in the ABA itself influences outcomes or merely reflects unobserved factors, such as a relatively conservative legal environment, remains an unanswered question.

Pro-plaintiff common law doctrines adopted prior to 1970 contributed to the higher frequency and severity of claims through the mid-1970s, but their effects show signs of waning by 1978. The four doctrines included in the compound variable, 1970 laws, are abolition of the locality rule, abolition of charitable immunity, admission of informed consent, and respondeat superior. The estimates imply that, on average over the period 1975-78, states that recognized all four doctrines had 53 percent higher claim frequency per capita, 28 percent higher severity, and 86 percent higher total claim cost per capita than states that recognized none of the doctrines. Of the four doctrines, informed consent had the greatest impact, and the impact was larger on frequency than on severity, as expected. Table 5, which reports individual-year coefficients, shows that the effects peaked in 1976 and declined thereafter: States with all four doctrines had 89 percent higher claim frequency and 156 percent higher total claim cost per capita in 1976 than states that recognized none of the doctrines in 1970.

These estimates probably overstate the net causal effect of these specific laws because of correlation with other unmeasured differences in legal doctrine and because of simultaneity bias, i.e., these doctrines tended to be adopted in states which, for other reasons, had relatively high claim frequency. Nevertheless, the hypothesis that the laws had a net positive effect is supported by the pattern of the coefficients over time and their significance after controlling for variables that might be included as predictors in a full simultaneous model. The effects of the pre-1975 statute of limitations are discussed below in conjunction with the post-1975 statutory changes.

At the time of the malpractice crisis, the surge of malpractice litigation was widely blamed on lawyers displaced from automobile litiga-
tion by the passage of no-fault laws. This argument is unpersuasive a priori because most of the tort thresholds were set so low as to constitute little bar to litigation. To provide empirical evidence, we included a dummy variable to indicate states that enacted some form of automobile no-fault law prior to 1975. The constrained estimates are inconsistent, showing a positive effect of no-fault on malpractice severity but a negative effect on claim frequency, with no significant net effect on total claim cost. The individual-year coefficients (Table 5) suggest that these results may be spurious. Any effect of no-fault on the supply price of legal services would be expected to increase frequency more than severity, and in the short run if at all. Thus the coefficients should peak in the mid-1970s and diminish thereafter. In fact, the largest negative coefficient for frequency occurs in 1975, and the second largest positive coefficient for severity occurs in 1978. Even if the constrained coefficients are taken at face value, they imply minimal effects, i.e., that states that adopted no-fault had an 11 percent higher claim severity and a 13 percent lower claim frequency, with no significant net effect on total claim cost per capita.

To test whether trends in malpractice litigation merely mirror trends in litigation in general, measures of the frequency and severity of claims for two other lines—owners, landlords, and tenants (OLT) liability and manufacturers and contractors (MC) liability—were included. The correlations were surprisingly low, and only the most significant, OLT severity, is included here. It is positively related to malpractice severity and average claim cost per capita, negatively related to malpractice claim frequency. The negative relation between claim frequency and observed OLT severity may reflect the filing of more low-valued claims in response to an increased unobserved compensation per unit damages.

EFFECTS OF TORT REFORMS

These data on claims closed in 1975-78 cannot show full long-run effects of reforms enacted in 1975-78 because many of the claims would have been filed before the effective dates of the reforms and hence would be unaffected. Nevertheless, if the reforms significantly reduced the expected payoff to filing, then the number of claims filed, especially claims with low potential recoveries, might be expected to

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9See, for example, Hearings, p. 142.
10These were the only other liability lines for which data were available by state.
fall immediately. Since minor claims settle more quickly, this could in principle reduce claims closed within a year. Thus whether the observed reduction in frequency after 1975 can be attributed to the post-crisis tort reforms is an important empirical question.

Measuring the effects of those reforms poses a problem with no perfect solution. Each state's statutes are complex and unique, but empirical analysis with limited degrees of freedom requires simplification into a few common dimensions. Neglecting differences in detail entails measurement error, which tends to bias coefficients toward zero.\footnote{Measurement error in an explanatory variable biases its coefficient toward zero if it is the only variable measured with error.} In addition to differences in content, the date on which changes became effective differs among statutes. Measuring the laws as months from the effective date emphasizes differences between states passing laws early rather than late and deemphasizes the dichotomy between those that did or did not pass a law. The alternative of using dummy variables for states ever passing a law emphasizes the dichotomy between never passing and passing at some time but ignores all difference in timing among those making a change. Intuitively, the months-in-effect measurement makes more sense if the full impact is felt only with a lag, as is the case for laws affecting frequency of claims, because of lags in disposition. Both alternatives were tried and yielded similar results; the estimates based on months-in-effect are reported here.\footnote{Log of months-in-effect and dummy variables for laws in effect more than 12 months were also tried.} Predicted values of the laws are used to control for simultaneity bias. These variables are included for each year from 1975 on, with the expectation that the coefficients should increase in magnitude and significance over time as the fraction of claims closed subject to the new laws increased. Table 5 reports individual-year coefficients where these approach conventional statistical significance in any year.

Several of the measures designed to reduce awards appear to have had their intended effect. The estimates imply that states enacting a cap effective in January 1975 had 19 percent lower awards, on average, by January 1977.\footnote{0.008 × 24 = 0.192. Obviously this effect does not accumulate indefinitely, but some lag in realizing the full long-run effect seems plausible.} States mandating the offset of compensation from collateral sources in January 1975 had 50 percent lower awards by January 1977, whereas estimates (not reported here) showed no significant effect of laws admitting evidence of collateral compensation without mandating offset. Elimination of the plaintiff's \textit{ad damnum} is estimated to have a significantly negative effect on
total claim cost, but not on frequency or severity. Limits on
contingent fees show some sign of reducing severity and total claim
costs, but the significance level is low. There is no evidence that tort
reforms contributed to the post-1975 reduction in frequency. Contrary
to the expectation that the impact of the reforms would increase over
time, the coefficients tend to be largest in 1976. This casts doubt on
how much of the observed effect is attributable to the laws per se
rather than to changes in attitude that accompanied (and contributed
to) changes in those laws. If so, the observed effects may not be
durable.

The estimates of the effects of the statute of limitations are not
entirely as expected. The statute of limitations was expected to in-
crease claim frequency and hence average claim cost per capita but
have no effect on severity. The estimates imply that the pre-1975
statute of limitations had a significant effect on severity and claim
cost per capita, and a positive but not significant effect on claim
frequency. A plausible explanation is that claims filed long after the
incident involve above-average stakes, because delay increases the
costs of filing and so eliminates proportionately more minor claims.
Because there were fewer than 100 claims per year in many states,
one or two very large claims can dominate average severity. The
effect on claims closed peaks in 1978, reflecting filings in the peak
filing years of 1973-75.

There is no evidence in these data of effects of the post-1975 reduc-
tions in statutes of limitations. Since these changes will operate with
an even longer lag than other tort reforms, less impact is expected to
be evident in 1975-78 closures. In fact, there may be an initial per-
verse effect, if filings are accelerated in response to a shortening of the
statute.

Regressions not reported here failed to show any significant effect
on claim frequency or severity of any of the following post-1975 laws:
voluntary or mandatory pretrial screening panels; arbitration; restric-
tions on informed consent; restrictions on the use of res ipsa; and peri-
odic payment of future damages.

It must be emphasized that these are rough estimates of short-run
effects. The intrinsically small sample size, combined with interstate
variation in characteristics of the law, creates severe measurement

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14Measurement of the pre-1975 statute of limitations is inaccurate to the extent that
the courts in fact recognized a discovery rule even in states where no such rule was
enacted in statute.

15The dominating influence of large claims is illustrated by the fact that 3 percent of
claims account for 50 percent of total dollars paid (Danzon and Lillard, 1982).

16The reported regressions use population weights. In unweighted regression, the
1970 statute of limitations is significant only in 1978.
problems. Further, it is too early for the data to reveal full long-run effects, especially of changes in the statute of limitations. Nevertheless, it is reasonably safe to conclude that while the laws limiting awards have had an immediate effect on severity, neither these nor the other tort reforms can explain the dramatic post-1975 drop in frequency.

17Even if the laws had been in effect long enough for us to observe long-run effects, the estimates from calendar-year claims closed could only be used to project effects on policy-year expected costs if the system were in steady state. Estimates using ISO data on claims incurred by policy years, which should include more current data on claims filed, were unsuccessful.
VI. DETERMINANTS OF THE POST-1975 TORT REFORMS

Legislatures in every state adopted some program of tort reform in response to the 1975 crisis. This section analyzes the factors that determined the extent of this legislation. Again, there is no simple, accurate solution to the problem of reducing great variation in number, stringency, and timing of laws into a few measurable dimensions. We consider four measures: an aggregate of the total number of laws passed (out of a possible twelve), each weighted by the number of months in effect;\(^1\) limits on contingent fees; the reduction in the statute of limitations; and the number of years of the new statute of limitations for adults.

The medical profession and the insurance industry have the most obvious interest in reducing claim costs.\(^2\) The legal profession is expected to oppose legislation designed to reduce the frequency and size of claims or to replace judicial with other forums. Following standard public choice theory, we hypothesize that the power of a lobby is positively related to the number of its members and negatively related to the costs of organization. The numerical strength and organization costs of the medical profession are measured by physician density per capita and the percent of physicians in the state who belonged to the state or local medical society in 1974. Lawyer density per capita measures the numerical strength of the legal profession. The number of insurers active in the state is not known precisely, but as a rough proxy we include the market share of the leading writer in 1974.

The incentives of physicians to lobby for legislation are expected to be positively related to the level and rate of increase of insurance premiums in 1975. We hypothesize that public support of tort reform would increase with the severity of the crisis, as measured by the frequency and severity of claims in 1975. We have also included the

\(^1\) Laws 75 = \(\sum_{j=1}^{12} M_j\),

where \(M_j\) = months prior to December 1978 that the \(j^{th}\) law was in effect. The twelve laws are those discussed in App. A.

\(^2\) If premiums are unregulated, the insurance industry has an interest in reducing the variance but not necessarily the mean of claim cost, since the demand for insurance may rise as expected losses increase. However, by 1975, rate increases were being denied by regulators in many states. Where carriers withdrew from the voluntary market, the industry was required to provide coverage through various mandatory pooling mechanisms, usually with a provision for recouping any losses by a tax writeoff or a surcharge on policyholders in other lines.
number of pro-plaintiff common law doctrines recognized, to test whether the common law and statutory law processes are substitutes or complements.

Table 6 reports three equations for each dependent variable. Each equation includes a different measure of the severity of the crisis: the 1975 level and proposed increase in insurance premiums, the actual frequency of claims closed in 1975, and the predicted frequency. The size and cohesiveness of the medical profession apparently had little impact on the total number or timing of tort reforms. Early passage of a limit on contingent fees was more likely in states with high physician density and a large proportion of physicians belonging to a local medical society, but these effects are not highly significant. Number of lawyers has the expected effect: High density of lawyers

Table 6
DETERMINANTS OF POST-1975 TORT REFORMS

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<thead>
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<td>-3.10 (.18)</td>
<td>4.559 (1.29)</td>
<td>27.03</td>
<td>4.377 (.14)</td>
</tr>
<tr>
<td></td>
<td>(.04) (.51)</td>
<td>(1.29) (.94)</td>
<td>(.51)</td>
<td>(.14)</td>
</tr>
<tr>
<td>1970 laws</td>
<td>3.191 (2.21)</td>
<td>2.763 (2.14)</td>
<td>59.549</td>
<td>.337 (.22)</td>
</tr>
<tr>
<td></td>
<td>(1.84) (3.34)</td>
<td>(2.14) (2.87)</td>
<td>(3.34)</td>
<td>(.22)</td>
</tr>
<tr>
<td>% Urban</td>
<td>.217 (2.23)</td>
<td>.174 (.866)</td>
<td>.001</td>
<td>.337 (.34)</td>
</tr>
<tr>
<td></td>
<td>(.15) (.1)</td>
<td>(.866) (.01)</td>
<td>(.1)</td>
<td>(.34)</td>
</tr>
<tr>
<td>% Medical society</td>
<td>.085 (.23)</td>
<td>.336 (.105)</td>
<td>23.529</td>
<td>-5.061 (.10)</td>
</tr>
<tr>
<td></td>
<td>(.13) (.41)</td>
<td>(.105) (.82)</td>
<td>(1.91)</td>
<td>(1.44)</td>
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<td>1975 premium</td>
<td>.469 (.78)</td>
<td>.186 (.98)</td>
<td>- .466</td>
<td>- .699</td>
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<tr>
<td></td>
<td>(.12) (.41)</td>
<td>(.98) (.82)</td>
<td>(.12)</td>
<td>(.41)</td>
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<tr>
<td>ISO increase</td>
<td>.714 (1.78)</td>
<td>.2852 (.47)</td>
<td>.442</td>
<td>.022</td>
</tr>
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<td></td>
<td>(.13) (.47)</td>
<td>(.47) (.47)</td>
<td>(.47)</td>
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<tr>
<td>Share</td>
<td>-.736 (2.88)</td>
<td>-.206 (.21)</td>
<td>-.737</td>
<td>-.206 (.21)</td>
</tr>
<tr>
<td></td>
<td>(2.46) (.21)</td>
<td>(.21) (.84)</td>
<td>(.84)</td>
<td>(.84)</td>
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<tr>
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<td>-2.358 (.56)</td>
<td>-4.869</td>
<td>-1.07 (.56)</td>
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<tr>
<td></td>
<td>(1.56) (.80)</td>
<td>(.56) (.84)</td>
<td>(.56)</td>
<td>(.80)</td>
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<tr>
<td>Claims per capita, 1975</td>
<td>38.765 (1.14)</td>
<td>94.593 (.40)</td>
<td>-90.854</td>
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<tr>
<td>(actual)</td>
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<td>(1.14) (.40)</td>
<td>(1.14)</td>
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<tr>
<td>Claims per capita, 1975</td>
<td>-23.046 (.92)</td>
<td>-60.540 (.36)</td>
<td>-</td>
<td>-</td>
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<td>(predicted)</td>
<td>- (.80)</td>
<td>- (.36)</td>
<td>(1.91)</td>
<td>(.18)</td>
</tr>
<tr>
<td></td>
<td>(1.91) (1.10)</td>
<td>(1.91) (1.10)</td>
<td>(1.91)</td>
<td>(1.10)</td>
</tr>
<tr>
<td>r^2</td>
<td>.395 (.350)</td>
<td>.318 (.362)</td>
<td>.319</td>
<td>.365</td>
</tr>
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</table>

Because of the lag between filing and closing claims, frequency of claims closed in 1975 may be viewed as predetermined. Predicted values of severity were not significant.
per capita tends to reduce the number of reforms enacted and to reduce the probability of a limit on contingent fees.

The expected sign of the share of the insurance market written by the largest carrier is ambiguous a priori: Concentration implies few firms but a larger stake and lower organization costs per firm. In fact, the number of laws passed is significantly negatively related to the dominant firm's market share, which suggests that the number of insurers with a stake in the market contributed to the number and promptness of tort reform. But if this interpretation is correct, the absence of any significant effect on the statute of limitations is surprising, since a long statute of limitations is a major source of risk to insurers.

States with a high degree of urbanization tended to adopt more numerous and early reforms. Urbanized states also reduced their statutes of limitations by a greater amount, and the revised statutes were absolutely shorter. States with relatively pro-plaintiff common law made more numerous and earlier changes in statutory law, including limits on contingent fees. Since these tort reforms tend to restrict plaintiff rights, this suggests significant differences in the relative power of the various interest groups in affecting law made through the courts and the legislature, respectively.

Perhaps surprisingly, all of the measures of the extent of crisis—level and proposed increases in insurance premiums, frequency or severity of claims—appear to have had only a weak effect on the extent of tort reform, and the effect on the statute of limitations is contrary to expectations. Of the various measures tried, the proposed premium increase in 1975 has the greatest explanatory power. This is not surprising. In the long run, high premiums can be passed through in higher fees for medical services. But in the short run, fees are sticky, so a large premium increase falls more heavily on physicians than does an equivalent total increase spread out over a long period.
VII. CONCLUSIONS

During the 1970s, medical malpractice claims followed a pattern similar to but more extreme than trends in other liability lines. Frequency grew rapidly in the early 1970s but tapered off after 1975, while severity outpaced the rate of inflation throughout the decade. Although the gap between the most and least litigious states has narrowed, in 1978 there remained a 12-to-1 range in frequency of claims per capita and an 8-to-1 range in claims per physician.

Despite the similarity of trends in malpractice litigation and other lines, this analysis of the contribution of medical, demographic, and legal factors to malpractice litigation indicates that factors specific to malpractice have significant explanatory power, whereas measures of litigation in general have little. The growth in medical services since the mid-1960s has certainly contributed to the increase in claims and the persistent diversity among states, but it is not the whole story. An increase of 100 physicians per capita is associated with an additional 3.6 claims per capita per year. There is no evidence that the availability of lawyers in general or their increased availability as a result of the passage of the no-fault law has contributed to claim frequency or total claim cost per capita.

States where traditional common law defenses had been eliminated by 1970 had significantly higher frequency and severity of claims closed through the mid-1970s. The estimates suggest that states that abolished or expanded the locality rule and charitable immunity and adopted informed consent and respondeat superior had claim costs per capita more than twice as high as states that made none of these changes. Of the four doctrines, informed consent and respondeat superior appear to have had the greatest impact. States with long statutes of limitations and/or discovery rules prior to 1975 experienced significantly higher claim costs through 1978.

The single most powerful predictor of claim frequency and severity is urbanization, even after controlling for higher physician and lawyer density in urban states, more pro-plaintiff malpractice common law, and the frequency and severity of claims in other liability lines. Higher awards by urban courts is certainly one factor contributing to the higher claim frequency. We have been unable to identify the other characteristics of urban environments that contribute to higher awards and frequency, but we have determined that more complex medical facilities, per capita income, and welfare and unemployment rates are not significant.
Claim costs per capita are not significantly related to the proportion of the population 65 years of age and over. Since the elderly have roughly four times higher incidence of negligent injury than those under 65, this suggests that their propensity to sue is roughly one-fourth that of persons under 65, in part because compensable loss, and hence the payoff to suing, declines with age.

The post-1975 tort reforms designed to limit recoveries—in particular, dollar caps and mandatory offset of compensation from collateral sources—have apparently significantly reduced the severity of malpractice claims. Because many claims in the sample would predate the reforms and because measurement error is inevitable in reducing multidimensional changes in law to simple variables for quantitative analysis, these estimates of the impact of tort reforms will tend to underestimate their long-run effect. On the other hand, they may be upward-biased by transitory changes in public sentiment at the time of the malpractice crisis. Taken at face value, the estimates imply that within two years of becoming effective, mandatory collateral source offset and caps on recoveries reduced severity by roughly 50 percent and 20 percent, respectively. These effects at the aggregate level obscure very different distributional impacts: Caps on recoveries affect exclusively the few severely injured patients, whereas collateral source offset reduces small awards by a larger proportion than large awards, because medical expenses, which are widely covered by health insurance, constitute a larger fraction of small awards. The policy implications of these and other measures to reduce awards are important topics for future research.

These estimates show no connection between the post-1975 decline in frequency and any of the statutory changes, but this does not justify a conclusion that these laws will have no effect. Because of the lag between filing and closing claims, the data on closed claims for 1975-78 are less likely to show effects of reforms affecting frequency than of those affecting severity; in particular, they will not show effects of shorter statutes of limitations. Average claim cost per capita was higher in states with long pre-1975 statutes of limitations. Therefore, it is reasonable to expect that reductions in these statutes and elimination of unlimited discovery periods will reduce claim costs.

In addition to tort reform, two other factors that may have contributed to the post-1975 decline in claim frequency were suggested but could not be tested. The simplest is that the expansion of tort liability in the early 1970s did indeed reduce the flow of injuries due to negligence. In addition to direct incentives created by the greater risk of being sued, other quality control channels were strengthened, such as state boards of quality assurance, hospital risk control mechanisms, and selective underwriting by insurers.
A second, not mutually exclusive hypothesis is that the pro-plaintiff trends in common law of the 1960s, combined with the long statute of limitations, effectively created a large backlog of potential claims which had either little chance of success or a low expected payoff under the earlier rules. Once this backlog works its way through the system, claim frequency should fall to a new equilibrium level (assuming no further legal changes), which could be higher or lower than the old level, depending on the response of physicians to the new, higher risk of suit. Because statutes of limitations have been reduced, the destabilizing effects of another such pro-plaintiff shift in doctrine would be likely to be less than those of the mid-1970s.

In conclusion, this analysis has several implications for policymakers, insurers, and others concerned with trends in malpractice litigation and the impact of tort reforms. First, significant differences among states will remain as long as medical resources are unevenly allocated. However, the current differential primarily reflects differences in either access or incentives to litigate. While this is partly due to characteristics of urban environments that we have been unable to identify, it also reflects the influence of differences in common and statutory law. By 1978, tort reforms had already reduced the severity of claims. Some further reduction in claim costs may be expected, both directly from reduction in statutes of limitations and indirectly from reduced incentives to sue. The 1976-77 drop in frequency was apparently not due to tort reforms. We cannot say at this point whether it was a temporary lull (perhaps due to transitory attitudes associated with the 1975 crisis) or whether it represents the long-run norm, relative to which the preceding peak was the aberration, perhaps due to the pro-plaintiff shift in common law in the 1960s.
Appendix A

CHANGES IN LEGAL DOCTRINE AFFECTING MEDICAL MALPRACTICE

AD DAMNUM CLAUSE

Thirty-one states\(^1\) prohibit any mention in a claim of the dollar amount demanded in damage. Four states\(^2\) add that this prohibition does not restrict the plaintiff's attorney from requesting a specific sum at trial. One state (Tennessee) reverses the majority position by ruling that the amount of damages sought may appear in the claim but must not be revealed to the jury. Several states provide that at any time after service of pleading, defendant may demand, by special interrogatory, a statement of the amount claimed.

The rationale for the elimination of the *ad damnum* clause in medical malpractice suits is that large claims may encourage prejudicial pretrial publicity, harm the reputations of defendants who are later vindicated, and distract the jury from basing its award solely on the evidence presented at trial.

ARBITRATION

Thirteen states\(^3\) have enacted legislation providing for voluntary binding arbitration of medical malpractice claims. Of these states, four (Alabama, Georgia, North Dakota, and Vermont) will enforce only those arbitration agreements made after the plaintiff claims injury, while the remainder enforce both post- and pre-claim agreements. Puerto Rico, which has no state constitutional guarantee of jury trial in civil suits, provides for mandatory arbitration of malpractice claims.

In states that have no specific legislation allowing arbitration of medical malpractice claims, it may be permissible under a general

\(^1\) Alabama, Alaska, Arizona, Arkansas, California, Colorado, Florida, Georgia, Hawaii, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Missouri, Nebraska, New Mexico, New York, North Carolina, Ohio, Rhode Island, Tennessee, Texas, Utah, Washington, Wisconsin, Wyoming.

\(^2\) Alabama, Kentucky, Missouri, Texas.

\(^3\) Alabama, Alaska, California, Georgia, Illinois, Louisiana, Maine, Michigan, North Dakota, Ohio, South Dakota, Vermont, Virginia.
arbitration statute. But some courts have refused to enforce such agreements because of potentially unequal bargaining power between the parties, particularly where the agreement was signed by the patient before treatment was given. Typically, in states making statutory provision, arbitration agreements must comply with a format, including large print and explicit language, designed to ensure that there has been a knowing waiver by the plaintiff of the right to jury trial. To avoid problems with adhesion or unconscionability, several states rule that signing an arbitration agreement cannot be made a condition precedent to a patient's receiving medical care.

In seven of the states with statutory provision for medical malpractice arbitration, where an arbitration agreement has been signed before or after injury is claimed to have occurred, the plaintiff may rescind within a period of 30 to 60 days after the execution of the agreement or the completion of treatment, whichever comes later.

Alaska, Louisiana, and Ohio have mandatory screening of malpractice claims, as well as provision for arbitration, while Virginia and Maine have voluntary screening and arbitration. Wisconsin, which has mandatory screening, allows parties to stipulate that panel findings shall constitute binding arbitration.

COLLATERAL SOURCE RULE

This rule, which prohibits presentation to the jury of evidence of compensation payable to the tort plaintiff from sources other than the defendant, has been modified or abandoned in medical malpractice suits in sixteen states. Four states make mandatory deduction, by either jury or court, of all forms of collateral compensation received by the plaintiff. One state (Rhode Island) makes such comprehensive deduction discretionary with the court. Three states' rule that deduction is mandatory only where compensation is from a public source, such as Social Security disability payments or Workers' Compensation. Nebraska allows deduction of private medical insurance proceeds at the discretion of the court but credits the plaintiff with all premiums paid for such insurance.

Of the remaining seven states that have no deduction requirement, New York and South Dakota make mandatory presentation to the

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4Alaska, California, Illinois, Maine, Michigan, Ohio, Virginia.
7Ohio, Pennsylvania, Tennessee.
jury of evidence of all forms of collateral compensation, while Arizona and California make such presentation discretionary with the court. Delaware, Kansas, and Washington rule that evidence of compensation from public sources only may be presented at the court’s discretion.

Those legislatures that have modified or abandoned the collateral source rule have done so in the belief that juries charged with awarding damages should have full information as to the plaintiff’s financial resources.

New Hampshire and North Dakota abandoned the collateral source rule in revising their medical malpractice tort law in 1977. Both have since restored the rule, in 1981 and 1980, respectively, in the course of declaring many of their initial revisions unconstitutional. Abandonment of the rule was found objectionable in North Dakota as a denial of due process, and in New Hampshire as discrimination against malpractice claimants in favor of health care providers and their insurers.

CONTINGENCY FEE LIMITS

Seventeen states have enacted laws limiting the size of contingency fees payable to an attorney from the plaintiff’s award. In California, Delaware, New York, Oregon, and Pennsylvania, this is done by means of a prescribed sliding scale with a decreasing maximum percentage payable. In the twelve states with no limits set by statute, the court has discretion to determine reasonable attorney fees, either on its own motion or at the request of the plaintiff or the plaintiff’s attorney.

Two states relate attorney fees to the source of the award. Indiana allows fees of no more than 15 percent of any part of an award above $100,000 which is to be paid from that state’s patient compensation fund. Florida requires that funds paid to the plaintiff from any collateral sources of compensation not be included in the sum of the award on which an attorney’s fee is based.

Fee limitations have been declared unconstitutional in New Hampshire, as interfering with freedom of contract and discriminating against malpractice claimants by making their cases less attractive to the plaintiffs’ bar.

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INFORMED CONSENT

Twenty-three states\(^9\) have attempted statutory clarification of the required elements of informed consent. At issue are both the nature of the information to be given to patients and the type of consent to be obtained from them by physicians. Efforts to define necessary information range from simple statements that it must be that which would ordinarily be given to patients in like circumstances by other practitioners in the same state, to the establishment, in Texas, of a special state Medical Disclosure Panel whose task is to catalog standard treatments and surgical procedures together with detailed instructions for giving information to patients about risks, alternatives, and possible side effects in each instance. In Hawaii, legislation has been enacted providing that the State Board of Medical Examiners shall be responsible for determining the content of information to be given patients.

In no state is failure to inform in itself tortious. In general, there must be a causal relationship between failure to disclose and the plaintiff’s injury. A defense available to the nondisclosing physician is that of professional privilege, which relieves him of the duty to inform where, in his judgment, full disclosure would have a substantially adverse effect on the patient’s health. In Vermont, a physician exercising this privilege must inform a member of the patient’s family, if one is “reasonably available.”

Four states\(^10\) rule that recovery is not allowable for failure to inform where the physician acted in accord with community standards and where a reasonable person would have understood and agreed to the treatment or surgery had he been informed. In such a case, consent is held to be implied, as it is in virtually all states where a physician renders emergency care to an unconscious or otherwise incompetent patient. In four states,\(^11\) plaintiffs bringing suit for physicians’ failure to obtain informed consent have the burden of proving a negative—that a reasonable person, if informed, would not have consented to the treatment or surgery that resulted in his or her injury.

Seven states\(^12\) hold that signed consent will be presumed valid, as informed, in the absence of proof of fraud. Washington sets out, in statutory form, the contents of a proposed standard consent form.


\(^10\)Florida, Maine, North Carolina, Vermont.

\(^11\)Nebraska, New York, Utah, Washington.

\(^12\)Florida, Idaho, Louisiana, Maine, Nevada, Utah, Washington.
MEDICAL MALPRACTICE SCREENING PANELS

Thirty states have passed legislation authorizing the use of screening panels for malpractice claims. Of these, Illinois, Missouri, Florida, Pennsylvania, and New Hampshire have subsequently declared their statutes unconstitutional; Arkansas has abolished its panels under state sunset laws; and Connecticut and Hawaii have very rarely made use of the procedure. Of the remaining twenty-two states with functioning panels, screening is mandatory in all but Delaware, Kansas, Maine, and Virginia.

The findings of thirteen of the mandatory panels are admissible as evidence if a trial de novo is demanded. In Maryland, such findings are presumed correct, while in Massachusetts, the panel determines only the presence of a legitimate question of liability. Of the eighteen states with functioning mandatory panels, ten require screening before the filing of a complaint.

Panels, which typically consist of an attorney, a physician, and a judge or attorney-chairman appointed by the court, are intended to make use of legal and medical expertise to eliminate frivolous actions, to promote settlement of meritorious claims, and to assist in trial preparation. Formality of the hearing varies widely, with delay in processing claims often a characteristic of those using formal rules of evidence and allowing full discovery. Approximately two-thirds of the panels determine liability only, to provide a basis for settlement between the parties, while the remainder also award damages.

Two-thirds of the states with functioning mandatory panels have withstanded constitutional challenges to the screening requirement. Common to four of the successful challenges was the claim that the statutes in question denied reasonable access to the courts, either on their face or in practice because of severe backlogs in the processing of claims. New Hampshire, which most recently struck down its panel legislation, did so on grounds repeatedly rejected in other constitutional challenges that screening of only one class of tort claims constitutes a denial of equal protection, and that the potential litigational advantages conferred on one class of tort defendants by panel requirements give such laws the appearance of special legislation.

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14 Alaska, Arizona, Indiana, Louisiana, Maryland, Massachusetts, Nebraska, New Jersey, New York, North Dakota, Ohio, Rhode Island, Tennessee.

15 Idaho, Indiana, Louisiana, Maryland, Montana, Nebraska, Nevada, New Mexico, North Dakota, Wisconsin.
PERIODIC PAYMENTS

Fourteen states\(^{16}\) have enacted laws allowing payment of large awards to be made by installment, at the discretion of the court or the request of the parties, following the practice in some jurisdictions of permitting such periodic payment of substantial judgments in personal injury, product liability, and other tort actions. The most usual plan is for a lump-sum payment, when the award is for more than $100,000, to cover attorney fees and out-of-pocket and medical expenses, to be followed by fixed monthly payments over a period of years. If the plaintiff dies before full payment has been made, the balance is payable to his estate or beneficiaries, minus sums awarded for future medical expenses or as compensation for future pain and suffering. In some states, payment is for life, as in California, where payments cease upon the plaintiff’s death unless the award was for lost wages in cases where the plaintiff had a duty to support.

Maryland’s legislation suggests the establishment of a trust fund for the plaintiff’s benefit, while Washington provides for the purchase of an annuity plan by the defendant in any action where the plaintiff is found to be totally and permanently disabled. Several states rule that courts must factor future adjustments for inflation into payments, and Alaska directs that wage loss payments be tied to the consumer price index in the area where the plaintiff lives. Payment of interest on the principal sum of an award is subject to taxation. Only Arkansas and Delaware expressly provide for interest payments. Wisconsin and South Carolina provide for mandatory periodic payments where an award is to be paid from patient compensation funds that have been depleted below a specified level.

New Hampshire has declared its discretionary periodic payment legislation unconstitutional as a denial of equal protection, and North Dakota repealed its provision in 1980 when it declared the major part of its medical malpractice legislation unconstitutional.

RES IPSA LOQUITUR

For the application of the common law doctrine of \textit{res ipsa loquitur} in a tort action, the following factual situation must obtain:

(a) The plaintiff’s injury is one which would not have occurred without the defendant’s negligence;

\(^{16}\)Alaska, Alabama, Arizona, Arkansas, Delaware, Florida, Illinois, Kansas, Maryland, Michigan, Oregon, South Carolina, Washington, Wisconsin.
(b) The plaintiff's injury was caused by an instrumentality in the exclusive control of the defendant;
(c) The plaintiff's injury was not caused by any voluntary contributing action by the defendant.

When such a situation is alleged, as when a foreign object such as a surgical sponge or clamp has been left inside a patient's body, the plaintiff may claim that "the thing speaks for itself" and make out a *prima facie* case of negligence for the jury. Under the doctrine of *res ipsa*, the burden of proof then shifts to the defendant to offer evidence that his conduct was not negligent.

However, since many medical injuries are simply unfortunate, rather than the result of negligence, and since physicians are not and cannot be insurers of the success of any treatment, application of the doctrine of *res ipsa* has been held to impose unwarranted evidentiary disadvantages on medical malpractice defendants.

Fourteen states17 have enacted legislation either prohibiting the use of *res ipsa*, or clarifying the circumstances under which it may be used. The majority of these states rule, in various formulations, that the plaintiff has the burden of proof of negligence, and that a necessary element of such proof is that injury resulted from a failure to conform to the accepted standard of care, as established by expert testimony.

Tennessee directs that juries in medical malpractice suits shall be instructed that injury alone does not raise a presumption of the defendant's negligence. Texas limits the use of *res ipsa* to the types of suits where it has been employed by the appellate courts of that state. Delaware, Florida, and Nevada list medical injuries which, if they occur during specified medical or surgical procedures, may be held to give rise to a rebuttable presumption of negligence.

New Hampshire, the only state to rule absolutely that *res ipsa* may not be used in medical malpractice cases, has since declared unconstitutional the entire section of tort law reform that included this prohibition.

**LOCALITY RULE**

In the large majority of states, the uncodified rule is that the applicable standard of care for general practitioners is statewide, while physicians who either hold themselves out as specialists or are board certified as such are to be judged by a national standard. Thus a gen-

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eral practitioner must exercise that degree of learning and skill commonly found among similar practitioners in the same state, while a specialist’s competence must meet the national standard.

However, in at least one state (Washington), the courts have held that the defense of local "standard practice" will be rejected where that practice itself exhibits an inadequate standard of care in failing, for example, to perform simple and inexpensive diagnostic tests.

Of the nine states\textsuperscript{18} that have addressed this topic in statutory form, in some cases defining standards of care for hospitals and other health care providers as well as physicians, only Alabama and Idaho observe the older rule under which a physician’s competence is compared only to that of similar practitioners in his own community. Virginia offers its courts a choice of the local or national standard, "as appropriate."

Some states compare the standard of care "in similar communities" instead of referring to national or statewide practices, and here the similarity of community is based on medical facilities, practices, and advantages, rather than on geography or population.

The locality rule may become important at trials where the area determining the standard of care may, if too restricted, limit the availability of expert witnesses.

\textbf{STATUTES OF LIMITATION}

Thirty-eight states\textsuperscript{19} have changed their statutes limiting the period during which claims for medical malpractice may be instituted. These statutes vary widely in their detailed provisions, notably in those which determine when the limitation period will either begin to run or be tolled. For example, the statutory period may begin either at the moment of injury, or when the injury first manifests itself, or when it ought reasonably to have been discovered by the plaintiff. An alternative approach, in a minority of states, has the limiting period begin at the termination of the course of treatment during which the injury occurred, or at the end of the patient-physician relationship.

Of substantive importance is the discovery doctrine. In states where this doctrine is not recognized, a plaintiff who does not discover an injury attributable to medical malpractice within the limitation pe-


\textsuperscript{19}Alabama, Arizona, California, Colorado, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Dakota, Texas, Tennessee, Utah, Washington, Wyoming.
period is, in theory, barred from subsequently bringing suit. However, case decisions in states without the discovery doctrine often reveal that, in practice, it is recognized. In Washington and Ohio, for example, before the doctrine was formally adopted, courts did permit suits for injury discovered after their statutes had run, sometimes commenting in dicta that the limiting period did not begin until the injury was discovered.

Similarly, in New Hampshire before 1977, when the state revised all of its medical malpractice legislation, lack of codified recognition of the discovery doctrine had been no barrier to recovery after the statute had run. The practice of the court had been to hold that the statutory period did not begin until the plaintiff was not only aware of his injury but had also linked it to the defendant's negligence. The revised 1977 statute codified adoption of the discovery doctrine for the first time but also severely restricted its use to cases where a foreign object was left inside a plaintiff's body. This statute was held unconstitutional in 1981, as a denial of equal protection to malpractice claimants.

Twenty-eight states\textsuperscript{30} of those making changes in their statutes of limitation have adopted the discovery doctrine, and all but Texas and New Mexico have retained it in their new rules. All ten of the remaining states\textsuperscript{31} that were originally without the doctrine have now recognized it. However, eighteen of the original discovery doctrine states, and eight of those newly adopting it, have also enacted legislation providing for an overall time limit. Thus a typical statute in one of these twenty-six states\textsuperscript{32} may provide for a two-year limit from the time of injury, plus a two-year limit from the time of discovery, with an overall limitation of five years from the time of injury, after which no claim may be brought.

A minority of states extend the discovery period, sometimes indefinitely, where a plaintiff has remained unaware of his injury as a result of fraud, misrepresentation, or concealment by health care providers, or where foreign objects have been left inside the plaintiff's body after surgery.

\textsuperscript{30}Alabama, Arizona, California, Colorado, Florida, Georgia, Hawaii, Illinois, Iowa, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Montana, Nebraska, New Mexico, New York, North Dakota, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Dakota, Texas, Utah.


\textsuperscript{32}Alabama, California, Colorado, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Louisiana, Maryland, Missouri, Montana, Nebraska, Nevada, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Tennessee, Utah, Washington.
A majority of states have changed their statutes of limitation as these apply to minors, no longer permitting suit for injury during minority to be brought by claimants when they reach majority. Only in the case of undiscovered injuries in very young children is the basic limitation for adults extended to allow suit to be brought on the child's behalf before, for example, his eighth birthday.

RECOVERY LIMITS

Seventeen states have passed legislation limiting in various ways the amount of compensation recoverable by malpractice plaintiffs. Ten limit only payment from patient compensation funds of large awards in excess of the amount available from the defendant's personal malpractice insurance. Typically such insurance provides for a maximum payment of $100,000, with the patient compensation fund paying any balance up to a limit of $500,000. Eight of the states limiting patient compensation fund contributions to an award do so for any kind of compensation, while the remaining two limit only awards for noneconomic losses. Of the five states that have recovery limits but no patient compensation funds, only one has a limit on the amount payable by the defendant for all types of awards, including those for noneconomic losses and medical costs.

Three states have declared such limits unconstitutional in that they deny equal protection to victims of medical malpractice and are likely to discriminate against those who are most severely injured and most in need of compensation.
Appendix B

EFFECTS OF WEIGHTS ON REGRESSION ESTIMATES OF CLAIM FREQUENCY

Table B.1 shows the effects of different weights on regression estimates of claim frequency in 1970. The specification is not identical to that in Mueller but is sufficiently similar to illustrate the point.

Using population weights, we find that surgeon density (surgeons per MD) and the percent of population 65 or older have positive coefficients in the first equation. A Cook's distance test shows that inclusion of California and Florida has a significant impact on these coefficient estimates.¹

In the second equation, which includes dummy variables for California and Florida, the coefficients of surgeon density and percentage of elderly people are similar in magnitude and significance, but the signs are negative. This suggests that the positive association between surgeon density and proportion of elderly population and claim frequency reported by Mueller is due to the fact that these variables take relatively high values in states that, for other reasons, have relatively high claim frequency and are relatively populous and hence receive considerable weight in population-weighted regressions. In the second pair of regressions, using Amemiya-Nold weights, neither variable is significant at conventional levels with or without controlling for Florida and California.

¹A Cook's distance test identifies observations that shift parameter estimates outside a selected confidence interval (10 percent in this application) around the point estimate obtained using the full sample.
Table B.1

**EFFECTS OF ALTERNATIVE WEIGHTS**

(Dependent variable: Claim frequency \( \log \left( \frac{F}{1-F} \right) \))

<table>
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<th>Variable</th>
<th>Weight, ( n_i ) (( \hat{y}_i ))</th>
<th>Weight, ( \left( s^2 + \frac{1}{n_i \hat{F}_i(1-\hat{F}_i)} \right)^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-8.33 (.35)</td>
<td>-3.39 (.28)</td>
</tr>
<tr>
<td>% Old</td>
<td>4.69 (1.48)</td>
<td>3.03 (.73)</td>
</tr>
<tr>
<td>% Rich</td>
<td>.001 (.77)</td>
<td>.0006 (.57)</td>
</tr>
<tr>
<td>% Urban</td>
<td>.005 (.67)</td>
<td>.008 (.59)</td>
</tr>
<tr>
<td>MDs per capita</td>
<td>.61 (.91)</td>
<td>.53 (.21)</td>
</tr>
<tr>
<td>Surgeons per MD</td>
<td>4.54 (1.64)</td>
<td>-1.04 (-.34)</td>
</tr>
<tr>
<td>% Unemployed</td>
<td>.02 (.28)</td>
<td>.007 (.66)</td>
</tr>
<tr>
<td>1970 laws</td>
<td>.09 (.63)</td>
<td>.09 (.63)</td>
</tr>
<tr>
<td>Lawyers' income:</td>
<td>.17 (.44)</td>
<td>-.19 (-.10)</td>
</tr>
<tr>
<td>California</td>
<td>.34 (2.54)</td>
<td>.32 (.77)</td>
</tr>
<tr>
<td>Florida</td>
<td>1.31 (4.30)</td>
<td>1.07 (.21)</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>.620 (.755)</td>
<td>.478 (.536)</td>
</tr>
</tbody>
</table>
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