RISK FACTORS FOR HOSPITAL MALPRACTICE EXPOSURE: IMPLICATIONS FOR MANAGERS AND INSURERS

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I

INTRODUCTION

The professional liability system has been criticized for a wide variety of reasons, including its inefficiency and tendency to increase the costs of medical care.[1] The system, however, can embody socially beneficial incentives;[2] that is, liability for malpractice claims may encourage providers to improve their performance to reduce future claims expense.

It is not certain, however, whether our system in fact provides incentives for improved performance. If malpractice claims are perceived as essentially random, then the system serves merely to compensate the injured party but offers no incentives for medical care providers to reduce the risk of poor patient outcomes. However, if specific risk factors that predict malpractice exposure can be identified, then managers and insurers can act upon them to reduce the risk and cost of claims.

Thus, while the notion that our liability system encourages improved performance may have some intuitive appeal, arguments for it should be based on good evidence of risk factors that explain variations in malpractice

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1. See, for example, Jeffrey O'Connell, *Neo-No-Fault Remedies for Medical Injuries: Coordinated Statutory and Contractual Alternatives*, 49 L & Contemp Probs 125, 125-27 (Spring 1986); Frank A. Sloan & Randall R. Bovbjerg, *Medical Malpractice: Crises, Responses, and Effects*, Health Ins Ass'n Am Res Bull 24-32 (May 1989); Stephen Zuckerman, Christopher F. Koller & Randall R. Bovbjerg, *Information on Malpractice: A Review of Empirical Research on Major Policy Issues*, 49 L & Contemp Probs 85, 106-09 (Spring 1986); Randall R. Bovbjerg, *Reforming a Proposed Tort Reform: Improving on the American Medical Association's Proposed Administrative Tribunal for Medical Malpractice*, 1 Cts, Health Sci & Law 19, 19 (1990).

2. See, for example, John E. Rolph, *Some Statistical Evidence on Merit Rating in Medical Malpractice Insurance*, 48 J Risk & Ins 247, 255-59 (1981).

loss experience. This paper presents evidence of such risk factors for a sample of California hospitals in the mid-1980s.

A. The Problem with Incentives in Existing Professional Liability Insurance

Given the uncertainty surrounding the occurrence of a liability claim and the large potential losses associated with some claims, it is understandable that insurance would develop to spread the risk. However, by pooling risk, insurance dilutes the incentives arising from malpractice claims for providers of health care to prevent adverse events. Thus, while insurance provides a benefit to providers by spreading their risk, this protection has a social cost in the attenuation of economic incentives to improve performance.[3]

The malpractice liability insurance industry recognizes the incentive effects of first-dollar coverage and the attendant "moral hazard."[4] Thus, in order to create some incentives for good performance, a balance is often struck between complete risk bearing by the provider and complete risk shifting to the insurer. A simple mechanism for this balance is the use of a deductible, whereby the hospital assumes all or a portion of the risk for claims of less than a certain dollar amount, and the insurer provides coverage for larger claims, which occur less frequently.[5] Experience rating of premiums is another device that is used.[6] In such cases, the premium in subsequent years reflects prior experience. Finally, risk shifts to the health care provider if hospital chains or affiliated institutions self-insure or establish a captive insurer.[7]

The problem with this balancing approach is that it is not based on specific risk factors. Hospital malpractice insurance policies recognize some general factors, but not other, more specific risk factors. For example, premiums for hospital policies are often based on beds or average daily census, thus reflecting the number of patients "exposed."[8] Other general categories of procedures, such as surgeries or deliveries, may also be factored into the premiums. Insurance premiums,[9] however, tend not to be adjusted for other

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3. See Patricia M. Danzon, *Medical Malpractice: Theory, Evidence, and Public Policy* 121 (Harvard U Press, 1985); Frank A. Sloan, Randall R. Bovbjerg & Penny B. Githens, *Insuring Medical Malpractice* 300 (Oxford U Press, 1991).

4. See Danzon, *Medical Malpractice* at 119-22 (cited in note 3).

5. Id at 122-24.

6. See id; Blaine F. Nye & Alfred E. Hofflander, *Experience Rating in Medical Professional Liability Insurance*, 55 J Risk & Ins 150, 150-51 (March 1988); Frank A. Sloan, et al, *Medical Malpractice Experience of Physicians: Predictable or Haphazard?*, 262 J Am Med Ass'n 3291, 3296 (1989); Sloan, Bovbjerg & Githens, *Insuring Medical Malpractice* at 299 (cited in note 3).

7. See James R. Posner, *Trends in Medical Malpractice Insurance, 1970-1985*, 49 L & Contemp Probs 36, 42-44 (Spring 1986).

8. See US Gen Acct'g Office, *Medical Malpractice: Insurance Costs Increased but Varied Among Physicians and Hospitals* 38, 43-44 (September 1986) (GAO/HRD-86-112) ("GAO, *Insurance Costs Increased*").

9. See Premium Rating Structure of California Hospital Association (November 1986) (CHAIS/MIS 010 11/86).

factors, such as the types of services offered, staffing patterns, or objectively measured outcomes.

The principal difficulty with relying on the general incentives in the current system is that they provide relatively little usable information for hospital management. To the extent risk is borne by an insurer, there is little reason to alter behavior. However, even in the extreme case in which a hospital is completely self-insured, the information content implicit in claims may be difficult to distinguish from "random noise." For example, in the sample of hospitals reported on below, the average number of claims per hospital per year was 7.4. A hospital administrator could not detect that the number of claims in a certain area is higher than expected. The current system also imposes substantial time lags. The costs associated with adverse outcomes may take years to be adjudicated.[10] If a problem is then recognized, substantial additional time may be needed to correct the problem or close the unit.

In sum, a more risk-sensitive approach to setting premiums may provide insurers with a marketing advantage. If certain factors are associated with increased risk of malpractice claims costs, insurers could lower their premiums for hospitals with low-risk characteristics and raise them for hospitals with high-risk characteristics. More importantly, however, such an approach provides clear incentives for influencing hospital behavior before patients are injured. For example, if anticipated average costs associated with a new specialized unit are identified as add-ons to an annual policy, decisions can be made prospectively. Thus, if hospital directors knew that the addition of a certain type of special care unit would add substantially to the hospital's malpractice premium, a proposal to add such a unit might be evaluated more carefully.

The reallocation of premium costs to the class of higher risk institutions is a step toward increasing the incentives associated with malpractice costs and reducing the risk shifted to insurers. Its effects are potentially quite different from those of a simple increase in deductibles, since the incentives for hospitals to change behavior will be greater; that is, unlike deductibles, where premiums are related to the average loss experience of all policyholders, this approach bases premiums on individualized and particularized risk factors.

B. Selecting Potential Risk Factors

This study was designed as an initial test of the hypothesis that risk factors could be identified that help explain the variability in hospital malpractice claims. Ideally, such risk factors would be correlated with either the increased frequency or the magnitude of claims.[11] The variables considered fall into four groups: (1) the type of hospital; (2) the presence and volume of selected

10. See US Gen Acct'g Office, *Medical Malpractice: Characteristics of Claims Closed in 1984*, 33 (April 1987) (GAO/HRD-87-55) ("GAO, *Characteristics of Claims*").

11. See Sloan, Bovbjerg & Githens, *Insuring Medical Malpractice* at 297-99 (cited in note 3).

specialized services; (3) staffing and organizational patterns; and (4) objective measures of patient outcomes.

1. *Hospital Type.* Hospital type may be a risk factor for several reasons. For example, children's hospitals have case mixes substantially different from those of general acute care hospitals. Because all their patients are children, often with severe problems, the malpractice claims lodged against them are also likely to be larger than average. Similarly, teaching hospitals may treat more severely ill patients. The ownership of the hospital may also affect either the occurrence or the size of claims. There is often a perception that the quality of care is worse in public and proprietary hospitals than in voluntary hospitals.[12] Of course, the relation between quality of care and malpractice claims is unclear.[13]

2. *Presence and Volume of Specialized Services.* A second set of potential risk factors is that associated with the presence of selected types of services. For example, a 24-hour emergency room will influence the volume and nature of emergency cases seen at the hospital; this, in turn, may affect the number and size of malpractice claims. Likewise, many hospitals do not offer maternity services, and, therefore, they would not be at risk for claims arising from deliveries. The presence of a high-risk obstetric care unit may place the hospital at even greater risk of a suit because of the greater potential for a poor outcome among high-risk deliveries.

Various measures of hospital size or patient volume are also likely to affect claims experience. Clearly, a hospital with an average of 250 patients per day will probably have more claims than a hospital with twenty-five patients a day. This is a simple scale effect, and malpractice insurers typically quote premiums in terms of dollars per average daily census or per bed.[14] The effect of size, however, is complicated by the relationship between hospital volume and patient outcomes. There is substantial evidence that for some procedures and diagnoses, hospitals with relatively few such patients have higher rates of deaths or complications.[15] This suggests that, while larger hospitals will typically have more claims, their claims rate may be lower than one would expect based just on size if they have more experience than usual with certain types of patients. Thus, one may find a separate effect independent of the average number of patients in the hospital for factors such as the number of deliveries, the number of surgical procedures, outpatient visits to emergency rooms and other sites, and intensive care unit days.

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12. See Stephen M. Shortell, *Physician Involvement in Hospital Decision Making*, in Bradford H. Gray, ed, *The New Health Care for Profit: Doctors and Hospitals in a Competitive Environment* 91-92 (Nat'l Acad Press, 1983).

13. See Danzon, *Medical Malpractice* at 19-24 (cited in note 3); Rolph, 48 J Risk & Ins at 247 (cited in note 2); Don H. Mills, *Medical Insurance Feasibility Study—A Technical Summary*, 128 W J Med 360, 362-64 (1978).

14. See GAO, *Insurance Costs Increased* at 43-44 (cited in note 8).

15. See Harold S. Luft, et al, *Hospital Volume, Physician Volume, and Patient Outcomes* 97-108 (Health Admin Press, 1990) ("*Hospital Volume*").

3. *Staffing and Organizational Patterns.* Hospital staffing and organizational patterns may also be risk factors. For example, one might expect that hospitals with a higher percentage of board-certified medical staff would have fewer claims. This might be the case for two reasons, even though the focus is on claims against the hospital, rather than the physician. First, in many instances the hospital is named as a defendant in suits in which the primary allegation is against the physician. Second, board-certified physicians may demand higher-quality support staff in the hospitals in which they practice.[16] Another possible organizational risk factor may be the use of a physician who is paid to serve as liaison between the medical staff and the hospital management rather than a reliance on voluntary hospital-medical staff communications.[17] Different patterns in support staffing may also affect outcomes. For example, higher ratios of nurses per patient may result in better outcomes.

4. *Patient Outcomes.* Thus far, all the potential risk factors have dealt with measures of either the structure or the operation of the hospital, rather than with direct measures of patient care quality. However, instead of focusing on structural characteristics, which at best may be necessary but not sufficient for high-quality medical care, one may also consider patient outcomes directly. It is plausible that malpractice claims are associated with higher rates of poor outcomes, but this hypothesis has not, to our knowledge, been previously tested. A study reviewing hospital medical records found that approximately 90 percent of all potentially compensable events do not result in a malpractice suit.[18] While this indicates that most instances of poor quality do not result in a suit, this does not eliminate the possibility of a positive association between poor patient outcomes and malpractice claims.

Patient outcomes depend on many factors, including the patient's general medical condition, the attendant risk of the treatment, and the skill of the physician and hospital-based providers.[19] While the likelihood of patient or family dissatisfaction may depend on outcomes, it is likely that before a suit is lodged, some consideration is given to the other potential explanations for a poor outcome. Thus, a poor patient outcome for a low-risk case may be more likely to result in a suit than a similarly poor outcome for a very high-risk case. Unfortunately, severity adjustments for patient outcomes are not yet well developed, and there are no reliable and valid measures of risk-adjusted outcomes at the hospital level.[20] It is possible, however, to develop risk-

16. These linkages are, of course, hypothetical. Sloan, et al, found that in some cases board-certified physicians were actually more likely to have suits filed against them. Sloan, et al, 262 J Am Med Ass'n at 3296-97 (cited in note 6). Conversely, others have found mortality rates to be lower in hospitals with a higher percentage of board-certified physicians. See, for example, Arthur J. Hartz, et al, *Hospital Characteristics and Mortality Rates*, 321 New Eng J Med 1720, 1722 (1989).

17. See Ann Berry Flood, et al, *Effectiveness in Professional Organizations: The Impact of Surgeons and Surgical Organizations on the Quality of Care in Hospitals*, 17 Health Serv Res 341, 350 (Winter 1982).

18. See Danzon, *Medical Malpractice* at 19-29 (cited in note 3).

19. See Luft, et al, *Hospital Volume* at 9-30 (cited in note 15).

20. See Lisa I. Iezzoni, *Illness Measures: Comments and Caveats*, 28 Med Care 757, 760 (1990).

adjusted measures for selected groups of patients. We have used such approaches in examining the relationship between volume and outcome across large numbers of hospitals.[21] Other researchers have developed similar approaches.[22]

II

DATA AND METHODS

Because of the exploratory nature of the investigation, we focused our attention on data available from public sources for a reasonably large number of hospitals. This approach eliminated the need for permission from each hospital, with the attendant likelihood that agreement to participate might be related to self-perceived risk associated with a poor record of malpractice claims. The data for this study were derived from several sources and linked for analytic purposes. The major data sets used were: claims files from a large insurance carrier; the American Hospital Association ("AHA") annual survey of hospitals;[23] discharge abstract data from the California Office of Statewide Health Planning and Development;[24] and linked birth and death certificate information provided by the Maternal and Child Health Database at the University of California at Santa Barbara.[25]

A. Characteristics of Malpractice Claims Data

Throughout this discussion, we have focused on risk factors that may affect the occurrence and magnitude of hospital malpractice claims. Obviously, the risk factors and the claims should relate to approximately the same point in time. This means that the claims data should be on an occurrence basis, rather than a paid basis, because settlement of a case may take years or even decades. Data for claims occurring in the period 1984-88 were provided by an insurance carrier covering a large number of hospitals in California.[26]

The data indicated the location of the event and a description of the event. If the claim had been settled, the amount paid was indicated; if not, an estimated payment was placed in reserve. Given the experience of the insurer, the reserve amount should be a reasonable estimate of the ultimate

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21. See generally Luft, et al, *Hospital Volume* (cited in note 15); Jonathan A. Showstack, et al, *Association of Volume with Outcome of Coronary Artery Bypass Graft Surgery*, 257 J Am Med Ass'n 785 (1987); Harold S. Luft, Sandra S. Hunt & Susan C. Maerki, *The Volume-Outcome Relationship: Practice Makes Perfect or Selective Referral Patterns?*, 22 Health Serv Res 157 (1987).

22. See, for example, Mark S. Blumberg, *Risk Adjusting Health Care Outcomes: A Methodological Review*, 43 Med Care Rev 351 (1986); Susan DesHarnais, et al, *The Risk-Adjusted Mortality Index: A New Measure of Hospital Performance*, 26 Med Care 1129 (1988).

23. See Am Hosp Ass'n, *The American Hospital Association Annual Survey of Hospitals* (Am Hosp Ass'n, 1987).

24. See California Office of Statewide Health Planning and Development, Discharge Data Program (1986).

25. Data base compiled for 1985 by the Community and Organization Research Institute at the University of California, Santa Barbara.

26. Data were supplied by the Truck Insurance Exchange and Sullivan, Kelly and Associates, Inc., Los Angeles, California. However, they bear no responsibility for interpretation or conclusions arising from this research project.

cost of the claim. Use of reserve data incorporates additional uncertainty in the estimates, but it also reduces the variability across hospitals and allows an estimate of the full experience for the time period.

To maintain confidentiality, hospital identifiers were not included with the data provided by the insurer. However, information on geographic location and approximate size were provided, which allowed us to match hospitals with similar characteristics using the AHA data. The insurer provided data for the 292 hospitals it covered out of the 476 hospitals in California. Of these, fifty were dropped because a reasonable match could not be identified, or, if a match was made, no data were reported by the hospital to the AHA. (These were usually very small hospitals or those open for only a short time.) In addition, twenty-two hospitals were omitted because they were not short-term general hospitals, and four were excluded because either census or claims figures were implausible. The total number of hospitals included in the analysis was 212. As discussed below in Part IIB, they are reasonably representative of the range of hospitals in the state.

The claims files included all claims covered by the insurer, including nonmedical care events such as "patient's stolen belongings," and events occurring outside the institution, such as at a parenting class held at another location. Such claims were excluded from the analysis. More importantly, malpractice claims are characterized by a large number of relatively small claims and a small number of very large claims. This highly skewed distribution is difficult to incorporate in analytic models; further, if one does attempt to do so, there is a substantial risk that the results will be dominated by one or two hospitals with very large claims.[27] To address this issue, we "capped" individual claims at $100,000 each and noted the number of such claims at each hospital. Total claims amounted to $142,476,167; when limited to $100,000 claims, they totalled $104,765,323. Thus, we have implicitly assigned about 26 percent of claims dollars to a stop-loss pool. While we chose this approach for analytic purposes, it is not unlike that used in the industry in which an insurer reinsures or a hospital self-insures for claims of less than a certain amount.

B. Characteristics of American Hospital Association Data

The AHA conducts an annual survey of all hospitals in the United States regardless of their membership in the association.[28] Over 80 percent of all California hospitals responded to the survey in 1986, and most variables are publicly available. To coincide with the 1984-88 claims data, we used data from the 1986 Annual Survey. Table 1 presents means and standard deviations for the AHA variables for the hospitals included in the analysis and for all California hospitals.

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27. See Jacob Cohen & Patricia Cohen, *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences* 127-28 (Lawrence Erlbaum Associates, 2d ed 1983).

28. See *The American Hospital Association Annual Survey of Hospitals* (cited in note 23).

TABLE 1

MEAN VALUES FOR HOSPITALS INCLUDED IN SAMPLE AND ALL CALIFORNIA ACUTE-CARE HOSPITALS

	Hospitals Included in Analyses (212)		All California Acute-Care Hospitals (467)	
# Beds	181.6	(128.03)*	193.9	(157.56)
Average Daily Census (ADC)	113.0	(92.91)	109.1	(117.58)
# Admissions Per Year	6,527.9	(5,232.75)	6,357.9	(6,628.30)
# Inpatient Days Per Year	41,146.7	(33,967.67)	39,705.4	(42,977.57)
# Intensive Care Beds	21.4	(24.15)	23.4	(27.26)
Intensive Care Unit Census (ICU patient days/365)	13.8	(18.72)	16.8	(22.22)
% For Profit	10.8		31.0	
% Public	8.5		8.1	
% Children's	2.8		1.3	
% with 24-hr Emergency	93.4		76.4	
% with Level 2 Neonatal Intensive Care Unit (NICU)	20.2		15.6	
% with Level 3 NICU	7.0		8.8	
% with MD liaison	20.7		19.2	
% MDs Board Certified	68.1		65.5	
% Medical School Affiliation	14.1		13.9	
% Membership in Council of Teaching Hospitals	5.2		5.4	
# Inpatient Surgeries Per Year	2474.0	(2,103.27)	2355.5	(2,210.65)
# Ambulatory Surgeries Per Year	1683.5	(1,281.85)	1596.7	(1,596.73)
# ER Visits Per Year	16,156.6	(11,713.04)	16,349.2	(17,638.31)
# Clinic Visits Per Year	31,871.5	(37,063.90)	33,469.1	(58,619.04)
# Births Per Year	950.3	(1,168.79)	964.6	(1,458.54)
% Patients with Medicaid or No Insurance	23.8		24.2	
% Responding to AHA Survey	82.9		81.6	
Dependent Variables				
# Claims per Year	7.37	(8.76)		
# Large Claims per Year	0.42	(0.62)		
Adjusted Claims Cost per Year	191,133	(249,200)		
Average # of Years Covered	3.78	(1.63)		

* Numbers in parentheses are standard deviations.

The hospitals included in the study are similar in size, admissions, patient days, public ownership, teaching status, and percentage of patients with Medicaid or no insurance coverage. Only a few important differences between the groups are apparent. There were substantially fewer for-profit hospitals in our sample (11 percent versus 31 percent for the state). This may be explained by the fact that members of large for-profit chains are more likely to be insured by the parent corporation. In addition, more hospitals in our sample had 24-hour emergency departments (93 percent versus 76

percent) and level 2 obstetric care units.[29] These differences may arise from the lower proportion of for-profit hospitals in our sample. For-profit hospitals, in general, are less likely to offer such services.[30] Thus, while we are not attempting to generalize our results to the entire population of California hospitals, our sample does include a broad range of hospitals.

C. Outcome Variables

The AHA data are quite straightforward and commonly used in studies of hospital performance. The outcome variables are more novel, although each has been used before.

Since the early 1970s, risk-adjusted perinatal mortality rates for each hospital in the state have been published.[31] These data are developed by linking birth and death certificates so that perinatal deaths are attributed to the hospital of birth, irrespective of where the death occurs. The expected number of deaths for each hospital is derived from its case mix of births by race, gender, birth weight, and number of multiple deliveries. Using the binomial distribution, a Z-score is computed for each hospital.[32] Positive Z-scores indicate higher-than-expected mortality rates (with values of 1.96 or more being significant statistically), and negative scores represent lower-than-expected rates. This Z-score includes a measure of both the extent to which the outcomes for the hospital deviate from the expected value and the likelihood that such deviations are due to chance.[33]

Another type of hospital outcome has been used to examine a variety of research questions. Actual mortality rates have been calculated for a set of four surgical procedures (hysterectomy, cholecystectomy, total hip replacement, and transurethral resection of prostate) and four medical diagnoses (acute myocardial infarction, pneumonia, stroke, and fractured femur) for all patients in California, using discharge data compiled by the California Office of Statewide Health Planning and Development.[34] Rates of general and related complications were also identified for the surgical procedures.[35] Risk equations were computed in which patient characteristics, such as age, gender, and chronic conditions, were used to predict bad

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29. A level 1 obstetric unit provides services for uncomplicated maternity and newborn cases. A level 2 unit provides services for all uncomplicated and most complicated cases and special neonatal services. A level 3 unit provides services for all serious illnesses and abnormalities. See Am Hosp Ass'n, *1985 Annual Survey of Hospitals* 12 (Am Hosp Ass'n, 1986).

30. This was determined from analysis of the 1985 AHA data, id.

31. See Community and Organization Research Institute, *1982-1986 Maternal and Child Health: Data Base Descriptive Narrative* and *1982-1986 Maternal and Child Health: Data Base Statistical Appendix* (University of California, Santa Barbara, July 1990).

32. The binomial distribution was used to calculate the probability that the observed number of deaths would occur by chance given the expected number of deaths. The normal distribution is then used to convert the probability to a Z-score measured in standard deviation units.

33. See Ronald L. Williams, *Measuring the Effectiveness of Perinatal Medical Care*, 17 Med Care 95 (1979).

34. See Harold S. Luft, et al, *Does Quality Influence Choice of Hospital?*, 263 J Am Med Ass'n 2899 (1990).

35. Id.

outcomes, such as death or complications. These equations were then used to predict bad-outcome rates at specific hospitals, based on each hospital's case mix. In a manner similar to that used by Williams,[36] observed bad outcomes at each hospital were compared with the predicted number of bad outcomes, and Z-scores were calculated. Each surgical procedure, therefore, has a mortality Z-score, a related complication Z-score, and a general complication Z-score for 1984, 1985, and 1986; medical diagnoses have only mortality Z-scores for each year.[37]

In an attempt to summarize the outcome data into a smaller number of variables, a factor analysis was used. Factor analysis is a statistical method in which the correlations among variables are assumed to be due to some common underlying factor or factors.[38] Once a factor is identified through statistical examination of intercorrelations, factor loadings are determined. Factor loadings are, in essence, correlations of each variable with the hypothesized factor or factors, which can be used to calculate factor scores for each observation. These factor scores provide an aggregate measure of common characteristics associated with selected underlying patterns.

Two factors were identified that accounted for 23 percent of the variation in Z-scores.[39] One factor consisted primarily of the complication scores; the other consisted primarily of mortality scores.

D. Exclusions and Other Data Considerations

Particular problems arise when examining data that are known to be somewhat "dirty" and for which it is impossible to check the accuracy of certain variables. For example, one hospital had a reported average daily census of one patient, and three had very large claims totals in quite short periods of coverage. These hospitals had undue influence on the regression results as measured by their calculated leverages.[40] As indicated above, these hospitals were excluded from the analyses because of the strong likelihood of errors in the data, but it is possible the data were, in fact, accurate. Obviously, implementation of any of these findings should be preceded by a replication with additional data.

A second problem arising from these data is associated with the varying time period of coverage. This ranged from a few months to a maximum of the five years comprised within the 1984-88 period. While we present claims on an annualized basis, not all claims are reported immediately, so it is possible that some claims for 1988 have not yet been reported. Claims for 1984 are

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36. See Williams, 17 Med Care at 97-100 (cited in note 33).

37. At the time this analysis was undertaken, 1987 and 1988 data were not yet available.

38. See Jae-On Kim & Charles W. Mueller, *Introduction to Factor Analysis: What It Is and How To Do It* 9-22 (Sage Publications, 1978) (Number 13 in the Quantitative Applications in the Social Sciences Series).

39. Although forty-eight factors were necessary to account for all variation, the first two factors were selected because they accounted for the largest proportion of variation.

40. See Paul F. Velleman, *Data Desk Statistics Guide, Volume II*, at 23.6-23.10 (Quark XPress, 1989).

more likely to be complete or at least reported to the insurer. Obviously, a hospital with five years of coverage will have a range of completeness. Unfortunately, we do not know whether a hospital with only one year of coverage is reporting data for 1984 or 1988, or for some period in between. Furthermore, one might question why a hospital has been covered by this insurer for only a short period of time. Perhaps those hospitals with short spells of coverage are either switching carriers to obtain lower premiums or are being dropped by another carrier because of high claims experience. Thus, even though the focus is on the claims experience per covered year, the number of years of coverage may be a useful variable.

III

RESULTS

We performed several analyses. First, we explored whether the variables thought to have an impact on claims experience actually had a statistically significant effect. Second, we pared down the list of variables to a more parsimonious group that might at some stage be used by carriers to set premiums and by hospital managers to focus their attention on areas of increased risk for claims. Within these two broad groupings, we considered several measures of malpractice-claims experience: first, the total dollars paid or allocated, perhaps with adjustments for very large claims; second, the number of claims; and, third, the number of large claims. The total claims measures indicate the expected cost or exposure. From a management perspective, however, the implications of ten $50,000 claims may be quite different than those of one $500,000 claim, so the number of claims may be an indicator of the frequency of problems. The number of large claims is important because a hospital wishing to self-insure for most costs may still want coverage for the very high-cost claims.

Table 2 presents the regression results for the 212 hospitals using as the dependent variable the adjusted expected claims cost per covered year.[41] The expected claims cost per year includes both paid claims and reserves set aside for unpaid claims. To calculate this variable, we capped each claim at $100,000 and kept count of the number of claims exceeding $100,000 at each hospital. On average, the amount in excess of this figure was $90,140 for each large claim. This amount was then added back into each hospital's total cost for each claim it experienced over $100,000. In other words, instead of attempting to model the highly skewed distribution of claims, we assumed that every claim of more than $99,999 was exactly $190,140. The number of large claims per hospital, however, was unchanged (this varied from zero to fifteen with a mean of 1.82). The total adjusted expected claims figure was then divided by the number of covered years to arrive at the adjusted expected claims cost per year of coverage.

41. The first set of columns presents results for all the variables in the model, whereas the second set of columns includes just a subset of the variables.

TABLE 2

REGRESSIONS ON ADJUSTED CLAIMS COST PER YEAR OF COVERAGE

	Full Model		Parsimonious Model	
	Coefficient	t-ratio	Coefficient	t-ratio
Constant	53,942	0.53	−87,808	2.13*
Average daily census	605	1.56	644	1.89
ICU census	2,655	1.82	2,651	2.01*
Children's hospital	313,116	2.78**	305,252	3.13**
For-profit ownership	110,101	2.24*	109,612	2.36*
Public ownership	7,829	0.14		
Medical school, nonCOTH	−64,407	1.11	−58,788	1.18
COTH member	25,819	0.29		
Births	−10.16	0.45		
High risk NICU, level 2	29,775	0.77		
High risk NICU, level 3	167,358	2.45*	148,788	2.70**
Surgical operations, inpatient	18.13	1.06	16.33	1.08
Surgical operations, outpatient	31.49	1.80	30.40	1.88
Emergency room visits	0.64	0.37		
Other outpatient visits	−0.92	1.58	−0.78	1.54
RNs per average daily census	−4,683	0.12		
Other nurses per average daily census	−48,147	0.59		
Contract physician liaison	−84,456	2.30*	−83,618	2.36*
Percent of medical staff board certified	−38,147	0.37		
Covered years	26,501	2.39*	25,938	2.94**
Covered less than 1 year	15,428	0.25		
Number of cases	212		212	
Adjusted R2	.380		.403	

* $p < .05$
** $p < .01$

A. Hospital Size and Characteristics

The regression results presented in Table 2 provide strong support for the notion that hospital characteristics, such as those included in this model, can help explain malpractice claims experience. In fact, as indicated by the R-square value, they "explained" 38 percent of the variation in annual malpractice claims expense across hospitals. Looking at the first pair of columns in Table 2, average daily census was positively associated with claims costs,[42] with each extra patient implying additional costs of $605,[43] although this coefficient was not statistically different from zero at conventional levels. In contrast, for each additional patient in an intensive care unit ("ICU") on an average day, the claims costs would rise by $2,655. Put another way, a patient-day in an ICU was associated with more than four times the malpractice expense of a patient-day in standard care.

42. The t-ratio is substantially less than 1.96, the value indicating that there is only a 5% chance of observing a coefficient that large when there is no true effect. Smaller t-ratios indicate a greater likelihood that the observed results are merely due to chance.

43. Note that this effect is based on a cost per census or bed filled on a year-round basis, not a cost per patient-day. The cost per day is $605/365 or $1.66 for each patient-day.

Several of the risk factors are categorical variables, meaning that a hospital is either in the category or not. For example, hospitals specializing in pediatric care have additional annual malpractice expenses of $313,116. It is important to note that this characteristic pertains to children's hospitals, not general acute-care hospitals with pediatric units. The high claims risk partly reflects the fact that these specialty hospitals tend to have very high-risk patients; and, if there is a problem with a child, the potential claims may be quite large. There are only six children's hospitals in our data, so these results may be idiosyncratic.

Hospitals with for-profit ownership had malpractice claims of nearly $100,000 per year more than did the reference category, not-for-profit hospitals. Public hospitals had malpractice claims experience essentially the same as the not-for-profits. Two categories of teaching hospitals were also examined. The first level contains those hospitals affiliated with a medical school. The second, more sophisticated level, is indicated by membership in the Council of Teaching Hospitals ("COTH"). Hospitals affiliated with a medical school had lower malpractice costs, and COTH members higher costs, but neither figure is statistically significant.

B. Service and Volume Factors

Given the high dollar amount of claims associated with newborns, we expected the number of births to be associated with increased claims costs. In fact, the number of births had essentially no effect on claims. The presence of a level 3, high-risk obstetric care unit,[44] however, was associated with significantly higher costs of $167,358 per year.

Each inpatient surgical procedure was associated with an expected claims cost of about $18, while each additional outpatient surgical procedure was associated with additional cost of $31.49. Neither figure, however, was significant at conventional levels. Additional emergency room visits had no effect on claims costs. In contrast, other outpatient visits seemed associated with lower costs, although the effect was insignificant.

C. Staffing and Organizational Factors

Staffing and organizational characteristics of the hospitals generally had little effect. Neither the ratio of registered nurses ("RNs") per average daily census ("ADC") nor the ratio of non-RN nursing personnel per ADC had an effect on claims costs. The presence of a contractual arrangement for a physician liaison between the hospital and the medical staff was associated with lower malpractice costs. The magnitude of this effect ($84,456), if borne out in other analyses, suggests that the costs of such an arrangement could be offset in lower risk-adjusted premiums.

As anticipated, hospitals with more years of coverage by the insurer had claims costs higher by approximately $26,501 per year. On the other hand,

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44. For definitions of levels of obstetric care, see note 29.

hospitals with less than a year coverage seemed no different from other hospitals.[45]

D. A More Parsimonious Model

The preceding set of results was designed to test the possible effect of variables plausibly associated with claims experience. While several of the variables had the expected effect and were statistically significant, others were found to have no effect. For the purposes of designing risk-adjusted premiums, the nonsignificant variables contribute nothing and may actually be detrimental.[46] In the second set of columns in Table 2, regression results are presented in which variables from the first regression with t-ratios of less than 1.00 were omitted and the regression re-estimated.

The exclusion of insignificant variables raised the adjusted R-square from .380 to .403, indicating that over 40 percent of the variability in claims costs was explained by the included risk factors. With one minor exception—the number of inpatient surgical procedures—the level of significance for each of the included variables, as measured by the t-ratio, increased. Even though a t-ratio of 1.0 was used as the criterion for inclusion, eight of the eleven coefficients under the "parsimonious model" are significant at conventional levels ($t > 1.96, p < .05$), and the coefficient for ADC is nearly significant.

E. Objective Outcome Measures

Table 3 presents the results of adding our objective measures of patient outcomes to the "parsimonious" equation shown in column 2 of Table 2. An important limitation of this part of our analysis is that the three outcome measures are available only for 111 of the 212 hospitals. This reduction in sample size has two implications. First, with fewer observations it becomes more difficult to detect small but consistent patterns in the face of substantial random variability. Second, the subsample of hospitals is not a random one—observations are dropped for hospitals that had no patients in the subcategories required to form the factor scores or measures of perinatal outcomes. Thus, the smaller and more specialized hospitals are disproportionately omitted. For example, none of the children's hospitals is included in this smaller sample.[47]

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45. Recall, however, that three hospitals appearing to have very short coverage periods and very large claims costs were excluded from the final sample.

46. The problems would arise from, first, the need to collect additional data that are irrelevant and therefore make the whole system more cumbersome, and, second, the possibility that some of the insignificant variables have large coefficients, which add random noise to the premium. That is, a hospital would find its premium being raised or lowered by substantial amounts for characteristics not clearly related to malpractice costs.

47. While the children's hospitals have neonatal-care units, they do not have experience with the adult cases used to form the factor scores for the other patient outcomes, nor do they, in general, offer obstetric services.

TABLE 3

ADJUSTED CLAIMS COST PER YEAR OF COVERAGE
INCLUDING OUTCOME VARIABLES

	Parsimonious Model		Outcome Factor Scores		Perinatal Mortality	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Constant	−127,974	1.79	−126,646	1.74	−126,624	1.73
Average daily census	690	1.19	728	1.25	730	1.24
ICU census	4,338	2.42*	4,227	2.35*	4,242	2.35*
For-profit ownership	96,694	0.92	71,425	0.67	75,122	0.70
Medical school, nonCOTH	−160,522	2.12*	−161,785	2.12*	−165,004	2.13*
High risk NICU, level 3	204,164	2.92**	188,977	2.67**	194,272	2.65**
Surgical operations, inpatient	−3.09	0.14	−0.58	0.03	−0.83	0.04
Surgical operations, outpatient	34.72	1.56	32.15	1.42	32.26	1.41
Other outpatient visits	−0.78	1.13	−0.80	1.16	−0.76	1.07
Contractual physician liaison	−79,222	1.40	−74,307	1.31	−74,447	1.30
Covered years	41,786	2.87**	42,654	2.93**	42,244	2.87**
Factor 1, complications			32,598	1.39	32,698	1.39
Factor 2, mortality			−7,694	0.36	−7,527	0.35
ZPMR, perinatal mortality					5,621	0.30
Number of cases	111		111		111	
Adjusted R2	.363		.363		.357	

* $p < .05$
** $p < .01$

The first pair of columns of Table 3 should be compared with the second pair of columns of Table 2. With the exception of the children's hospital variable, they should be identical except for the loss of observations. In fact, while the general pattern of effects was similar, the coefficients in Table 3 were often less significant statistically, reflecting the reduced number of observations. The second pair of columns in Table 3 adds the two factor scores based on hospital experience with selected groups of patients for 1984-86. The first factor score, which essentially represents complication rates adjusted for patient risk factors, was positively associated with claims experience. The second factor, which represents mortality rates adjusted for patient risk factors, was unrelated to claims experience. In the third set of results, the Z-score based on perinatal mortality adjusted for risk factors was also unrelated to claims costs.

F. Other Measures of Claims Experience

Although the dollar amount of paid losses and reserves set aside against known claims is probably the figure most useful in setting premium rates, risk factors associated with the number of claims per year and the number of large claims may be more useful for hospital management.[48] Table 4 presents the results for these regressions using the full sample of 212 hospitals and the variables included in the "parsimonious" regression of Table 2.

48. Recall that the figures for large claims are based on actual payments or reserves established by the insurer of $100,000 or more, not the plaintiffs' requests.

In many ways, the findings for number of claims per year were quite similar to the costs associated with those claims. Higher overall ADC and ICU census were associated with more claims. For-profit ownership and the presence of high-risk neonatal care were associated with substantially higher numbers of claims, an additional 4.9 and 9.0 claims respectively. These figures should be considered in the context of an average number of claims per year of 8.4. Interestingly, children's hospitals did not have an above-average number of claims per year.

TABLE 4

NUMBER OF CLAIMS AND NUMBER OF LARGE CLAIMS PER YEAR OF COVERAGE

	Claims/Year		Claims > $100,00/Year	
	Coefficient	t-ratio	Coefficient	t-ratio
Constant	−2.104	1.52	−.2160	2.01
Average daily census	.024	2.09*	.0015	1.71
ICU census	.080	1.81	.0048	1.41
Children's hospital	−.384	0.12	.9650	3.80**
For-profit ownership	4.850	3.11**	.1239	1.02
Medical school	1.117	0.67	−.2227	1.71
High risk NICU, level 3	8.979	4.86**	.3015	2.10*
Surgical operations, inpatient	.00078	1.54	.00003	0.64
Surgical operations, outpatient	.00069	1.27	.00009	2.05*
Other outpatient visits	−.00004	2.61**	−.0000008	0.58
Contractual physician liaison	−1.595	1.34	−.2090	2.27*
Covered years	.794	2.68**	.0600	2.61**
Number of cases	212		212	
Adjusted R2	.455		.339	

* $p < .05$
** $p < .01$

The second set of columns in Table 4 presents the risk factors for the number of claims per covered year with expected costs of $100,000 or more. In contrast to the results with respect to total claims costs and number of claims, for-profit hospitals were no different from voluntary hospitals in the number of large claims. However, children's hospitals, while having an average number of claims per year, were much more likely than other hospitals to have large claims. The presence of high-risk obstetric care units was also associated with more large claims. While the number of inpatient surgical procedures had no effect on the number of large claims, the number of outpatient procedures was associated significantly with the occurrence of large claims. This outcome may reflect the fact that while malpractice claims are often associated with surgery, it is usually in the context of physician rather than hospital liability. However, if an outpatient procedure results in a poor outcome, the hospital may be at greater risk.

IV

DISCUSSION

A. Comments

Given the lack of previously published work on risk factors for hospital malpractice claims, and the relatively simple variables such as ADC used by insurers in setting premiums, we were prepared to find that none of the potential risk factors was associated with claims experience. Furthermore, studies of physician risk factors suggested that the distribution of claims experience is so skewed and so random as to preclude useful analysis.[49] We capped claims at $100,000 each and substituted the average cost of capped claims to improve both our ability to develop estimates and to approximate excess limits insurance pools.[50]

The number of covered years often appeared as a significant variable in the regressions even though the dependent variables were annualized based on the number of covered months. This result suggests that one should first determine exactly when a hospital began and ended coverage and then take into account the number of years from this window of coverage to the cutoff point for inclusion of claims in the data set. The underlying data are available to the insurer, so such an investigation would not be difficult. While doing this, the insurer could transform the data into yearly observations to allow for changes in hospital characteristics over time. This method may improve the predictive power of those variables most likely to change, such as ADC, surgical procedures, and outcomes.

Children's hospitals and those with high-risk obstetric care units had substantially higher claims experience. As there were only six children's hospitals in our sample, these results may not be generalizable. A review of the nature of the individual claims could confirm or refute the apparent association for these hospitals. Likewise, it would be useful to examine only the claims associated with labor and delivery in all hospitals to determine whether hospitals with high-risk units have greater exposure to malpractice claims. It is plausible that they do, even though their care may be better. This apparent inconsistency could arise for several reasons. First, hospitals with level 3 units have much higher numbers of high-risk cases. Thus, even if their rate of claims per high-risk delivery is far below the average, they will have a higher number of claims than the average hospital. Second, the specialized

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49. The distribution of claims across physicians makes it difficult to estimate the importance of risk factors because most physicians are not sued in any particular year, see Patricia M. Danzon, *The Frequency and Severity of Medical Malpractice Claims: New Evidence*, 49 L & Contemp Probs 57 (Spring 1986); Frank A. Sloan, et al, 265 J Am Med Ass'n at 3293 (cited in note 6), and idiosyncratic factors often underlie the filing of a claim. See Danzon, *Medical Malpractice* at 19-24 (cited in note 3); James W. Hughes & Edward A. Snyder, *Evaluating Medical Malpractice Reforms*, 7 Contemp Pol'y Issues 83-85 (1989). Fortunately, from a statistical perspective, hospitals are subject to many more claims per year, so some of the random variability is reduced.

50. The reserves incorporate the insurers' expectations that the case will be lost and about the amount of the award, thus producing an expected value not unlike an actuarial estimate. The difference is that the reserves are based on the insurers' interpretation of each case.

level 3 units may be able to avoid neonatal death, but many of the survivors have long-term disabilities. Because the pregnancy was high-risk, perhaps because of premature delivery, a death may be likely to result in a smaller settlement than would an outcome that left the patient alive but handicapped.

The lack of an association between the perinatal mortality rate and the claims rate is surprising. One possible explanation is that the smaller sample created by the matching of files reduced our statistical power to detect an effect. More importantly, there is little reason in hindsight to expect that hospitals with higher-than-average perinatal mortality rates would have higher total claims. Instead, a more precise test would focus on the hospitals' experiences with claims associated with labor and delivery and newborn care. Also, awards associated with delivery are usually borne by the obstetrician rather than the hospital, even though both may be named in the suit.

We had even weaker expectations for the factor scores as measures of risk, in part because the scores are based on a relatively small sample of procedures and diagnoses. The figures are also based on data pooled over a three-year period, thereby weakening the impact of year-to-year variations that could affect claims. The result for the complication-related factor score, however, suggests a relation between objective measures of poor patient outcomes and claims experience, and thus merits further investigation.

Additional data would allow more careful estimation of the relationship between these risk factors and claims experience. For example, it may be better to estimate the regression using the log of the dependent variables and then retransform the results to unlogged form. Nonlinear effects may also be important. For example, the presence of any outpatient surgery might carry an increased risk of claims, and the marginal effect of additional procedures a smaller effect. Similar nonlinear effects may be present for other variables, but more precise data are needed to test their importance.

In general, as with any exploratory study, these results should be evaluated with some caution. If they were preceded by several similar sets of findings using other data, we could be more confident about their reliability.[51] In spite of these caveats, these results lead to implications for further research, and, if one is willing to assume the findings are replicated by further studies, to policy implications.

B. Policy Implications

The underlying rationale for exploring risk factors associated with malpractice experience is to strengthen incentives to provide better care. As discussed above, first-dollar insurance coverage reduces the hospital's

51. The presence of many statistically significant results does not alter this interpretation. These statistical tests mean that the observed coefficients are unlikely to have been observed by chance if the true coefficients were zero for a population represented by this set of observations. While chance relationships are always a concern, the more substantive question is whether the claims experiences of these California hospitals covered by one large insurer during the mid-1980s are representative of other hospitals in other situations.

incentives to exercise caution and attempt to improve quality. Of course, there is always the threat that coverage may be terminated or premium surcharges may be imposed due to "excessive" claims experience, but even this signal occurs after the fact. Before the termination or surcharge, many hospital administrators may not know that their hospital's experience is abnormal. Although the introduction of substantial deductibles increases the hospital's incentives to improve quality and avoid claims through risk-management activities, these measures are still largely concurrent or retrospective in nature: that is, they take place only after problems are identified.

Structural measures, such as hospital type, presence of specialized facilities, and number of patients, are readily measured and easily incorporated, at least in theory, in setting premiums. Thus, it would not be too large a step for insurers to include these characteristics in setting premiums. To see how risk factors might be used, suppose that the results presented for the "parsimonious regression" in Table 2 are accurate and reliable—that is, such results were replicated in other data sets and with hospitals in other states. For example, suppose a hospital has an ADC equal to the sample average, 113. This yields an incremental premium of 113 $\times$ \$644 = \$72,772. Each year of coverage adds \$25,938, so a hospital with 3.7 covered years (the average for the sample) would add \$95,971, for a subtotal of \$168,743. Combining this number with the negative intercept (-87,808) yields a premium of \$80,935, assuming the hospital has none of the other characteristics.[52]

Some hospitals in the sample perform no surgical procedures; this is far from common, however, so assume that this "average" hospital has 2,474 inpatient procedures. This would add \$40,400 to the annual premium cost (2,474 $\times$ \$16.33). Moreover, the hospital administrator should pass on the additional \$16.33 cost in the operating room charge. Outpatient procedures are more discretionary and carry nearly twice the malpractice premium cost. An average outpatient procedure load would add \$51,178 to the annual premium (31,871.5 $\times$ \$30.40). While an experience-rated hospital would bear this cost, the administration probably has no estimate of such additional expense when deciding to offer such services.

Some practices, on the other hand, can reduce malpractice costs. The development of contractual relationships and a physician liaison between the medical staff and the hospital could reduce premiums by \$83,618. Obviously, merely signing a contract and placing a nameplate on the door are not associated with lower malpractice risks. The insurer and the hospital management would have to determine what really distinguishes effective from ineffective liaisons. Whatever it is, the cost difference is substantial. Likewise,

52. The negative intercept seems implausible, but it would be relevant only for hospitals with values of zero for all the other variables in the regression, including ADC, years of coverage, and surgical operations. In fact, the effect of the negative intercept is to reproduce the minimal claims experience of very small hospitals.

the development of active nonemergency outpatient care is associated with lower malpractice costs. While a savings of $0.78 per visit is small, the cost of a visit is also relatively small; and with an average of 31,872 visits per year, the savings are substantial ($24,860). Perhaps more significantly, outpatient services lower, rather than raise, malpractice costs.[53]

Each additional occupied bed in an intensive care unit on a year-round basis would increase premium costs by $2,651. While intensive care units may be necessary for the average hospital, 14 percent of our sample had no ICU patients. Moreover, this result may suggest that more appropriate use of the ICU may lead to some savings without putting at risk those patients really in need of intensive monitoring.[54]

The clearest discretionary variable is the presence of a high-risk obstetric care unit. This variable is associated with additional malpractice costs of over $148,000 per year. While substantial, this type of lump sum cost may be appropriate.[55] It places a hurdle in front of hospitals considering the development of such a unit without reasonable expectations of a large number of patients. Large level 3 units could spread this extra cost over many patients, so the marginal premium is small relative to the other costs associated with staffing such a unit.

The implicit premium surcharge of $109,612 for proprietary hospitals is different from the others; it is unclear why this has been observed. Much more research is needed to understand why for-profit hospitals experience more claims and claims expense, even after controlling for the other factors. If it is due to poorer quality control or other organizational factors, attention should be focused directly on these factors. If, however, it is based on greater ease of winning cases against for-profit institutions because of jury bias, other remedies going well beyond hospital self-help and experience rating are appropriate.[56]

This discussion is intended to show how information on risk factors might enable hospitals to avoid services and activities associated with higher risks while encouraging measures that would reduce the risk of malpractice claims. Such a policy, however, could be carried too far. One would not want all hospitals to shut down level 3 obstetric units, because these have been shown to reduce mortality and morbidity among high-risk infants. Instead, one would use the insurance premiums to deter small, inefficient units that may also have worse-than-average outcomes while encouraging those hospitals able to deliver high-quality perinatal care. Likewise, the risk adjustments must be based on "real" factors that cannot be manipulated. For example,

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53. We tested whether this effect was associated with lower income clientele by including the proportion of the hospitals' inpatients who are covered by Medicaid or have no insurance. While it may be poorly measured, this variable had no effect on the estimate.

54. See Kim A. Eagle, et al, *Length of Stay in the Intensive Care Unit: Effects of Practice Guidelines and Feedback*, 264 J Am Med Ass'n 992, 996 (1990).

55. We were unable to obtain data to test for a volume effect.

56. On the question of jury bias, see Randall R. Bovbjerg, et al, *Juries and Justice: Are Malpractice and Other Personal Injuries Created Equal?*, 54 L & Contemp Probs 5 (Winter 1991).

the redesignation of a children's hospital as a general acute-care hospital does not change the reality if its case mix continues to consist of very sick children. Again, it may be that for their case mix of patients, children's hospitals have better outcomes than general acute-care hospitals; they merely have a concentration of particularly high-cost cases. Thus, any use of risk factors would have to be tempered with logic and an eye on social goals.

Such an approach need not be implemented at the public level. Malpractice insurance is sold in the private market, and premiums reflecting risk factors may confer a competitive advantage for the seller. For example, if we abstract from loading costs, the standard premium for hospital coverage would be based on only the ADC. The average-size hospital would face a premium of $191,133 per year for coverage.[57] This premium would not be adjusted based on ICU usage, surgical load, or obstetric care units. Suppose a hospital had the average ICU and surgical load, but no outpatient surgery and no high-risk obstetric unit. Assume also that it was not-for-profit and had a physician serving as liaison between the medical staff and the hospital. A carrier with risk-adjusted premiums could offer coverage for such a hospital for only $74,301, or approximately 60 percent less than the non-risk-rated premium.

Risk adjustment implies that some premiums are raised while others are lowered. The carrier offering risk-adjusted premiums would have to raise the premiums for proprietary hospitals, children's hospitals, and those without physician liaisons. It may lose these hospitals as clients; these hospitals will have to seek coverage from other carriers, self-insure, or alter the characteristics that led to their higher claims experience. Some of these characteristics may be unavoidable, as for children's hospitals and providers of level 3 obstetric care. The higher malpractice premiums would then be reflected in higher charges. While this concentrates the costs, it also helps focus attention on the problems in the liability system.

Understanding the role of risk factors in malpractice costs can also allow the hospital administrator to consider the full costs associated with decisions to implement certain programs, such as outpatient surgery. This consideration may reduce the attractiveness of some programs and increase that of others. It may lead to more rational pricing of certain units. It may also lead to more focused risk management to detect and avoid the problems that give rise to lawsuits.

V

CONCLUSION

Our goal in this paper has been to explore whether it is possible to identify certain variables that might serve as predictors of above- or below-average malpractice claims experience. Using claims data from over 200 California hospitals linked to readily available objective measures of hospital

57. This figure is derived from the average loss of all study hospitals. See Table 1.

characteristics and performance, it is possible to identify significant risk factors. These variables usually have plausible coefficients of reasonable magnitudes. If hospital malpractice premiums were adjusted for such risk factors, there would be incentives for hospitals to avoid services and activities associated with increased risk and premiums, and to undertake efforts to reduce risk. If hospital managers knew more about the factors associated with increased risk of malpractice expense, they might be able to lessen that expense. An increased understanding of risk factors would permit better use of the liability system and its associated insurance system to improve the quality of medical care.