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BEYOND DEAD RECKONING: MEASURES OF MEDICAL INJURY BURDEN, MALPRACTICE LITIGATION, AND ALTERNATIVE COMPENSATION MODELS FROM UTAH AND COLORADO

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INTRODUCTION

In the three decades since Guido Calabresi's landmark study of accidents,¹ interest in the empirical examination of tort law has flourished. Torts, unlike many branches of law, is particularly amenable to quantitative analysis. Torts usually involve discrete, identifiable events that feed into large, accessible repositories of information. Jury verdict reports, administrative data from liability insurers, and measures of injury rates across specific sectors all provide rich opportunities for measurement. Researchers from diverse disciplinary backgrounds—including law, economics, statistics, management, public health, psychology, operations research, and political science—have taken advantage of these data sources, and have begun to sketch a fairly detailed picture of the relationship between injuries, claims, compensation, and behavioral responses

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1. See GUIDO CALABRESI, *THE COSTS OF ACCIDENTS: A LEGAL AND ECONOMIC ANALYSIS* (1970).

to litigation.²

Three approaches to the empirical study of torts predominate. The first approach is concerned with the consequences of litigation. How do the type, volume, and, severity³ of litigation affect the behavior of individuals, organizations and markets? The deterrence function of tort law is often examined within this framework; for example, in studies that measure the effect of litigation on (would-be) tortfeasors' safety practices.⁴ Other studies in this category test the impact of accident litigation on prices of and demand for services in particular sectors,⁵ workers' wages, and the financial stability of firms.⁶

A second approach, probably the one most widely pursued in empirical analyses of tort law, focuses on the performance of the tort system in a narrower sense. It involves measurement of outcomes directly related to the litigation process.⁷ Commonly used measures include the speed and consistency of resolution, differential success rates among litigants, jury decision-making, and the impact of litigant characteristics, such as the defendant's wealth, on the outcomes of cases.⁸ The defining feature of the observations that form the basis

2. See generally STEPHEN J. CARROLL ET AL., NO-FAULT APPROACHES TO COMPENSATING PEOPLE INJURED IN AUTOMOBILE ACCIDENTS (1991); PATRICIA M. DANZON, MEDICAL MALPRACTICE: THEORY, EVIDENCE, AND PUBLIC POLICY (1985); DON DEWEES ET AL., EXPLORING THE DOMAIN OF ACCIDENT LAW: TAKING THE FACT SERIOUSLY (1996); JAMES K. HAMMITT & JOHN E. ROLPH, LIMITING LIABILITY FOR AUTOMOBILE ACCIDENTS: ARE NO-FAULT TORT THRESHOLDS EFFECTIVE? (1985); DEBORAH R. HENSLER ET AL., COMPENSATION FOR ACCIDENTAL INJURIES IN THE UNITED STATES (1991); Michael J. Saks, *Do We Really Know Anything About the Behavior of the Tort Litigation System—and Why Not?*, 140 U. PA. L. REV. 1147 (1992).

3. "Severity," as it is used here, refers to the dollar magnitude of payments in claims where the plaintiff obtains such payments, whether by settlement or court judgment.

4. See, e.g., DEWEES ET AL., *supra* note 2; MICHAEL J. MOORE & W. KIP VISCUSI, COMPENSATION MECHANISMS FOR JOB RISKS: WAGES, WORKERS' COMPENSATION AND PRODUCT LIABILITY (1990); Henry W. Herzog & Alan M. Schlotman, *Valuing Risks in the Workplace: Market Price, Willingness to Pay, and the Optimal Provision of Safety*, 72 REV. ECON. & STATISTICS 463 (1990); W. Kip Viscusi, *Liability for Occupational Accidents and Illnesses*, in LIABILITY: PERSPECTIVES AND POLICY (Robert Litan & Clifford Winston eds., 1988).

5. See, e.g., STEVEN GARBER, PRODUCT LIABILITY AND THE ECONOMICS OF PHARMACEUTICALS AND MEDICAL DEVICES (1993).

6. See, e.g., *id.*; JAMES S. KAKALIK ET AL., COSTS OF ASBESTOS LITIGATION (1983); W. KIP VISCUSI, FATAL TRADEOFFS: PUBLIC AND PRIVATE RESPONSIBILITIES FOR RISK (1992).

7. The litigation process should be interpreted broadly here to include alternatives to litigation, such as arbitration and mediation, along with standard conduits to litigation such as liability insurance companies.

8. For examples of studies in each of these areas, see Randall R. Bovbjerg et al., *Administrative Performance of No-Fault Compensation for Medical Injury*, 60 LAW & CONTEMP. PROBS. 1 (differential success rates); Randall R. Bovbjerg et al., *Valuing Life and Limb in Tort: Scheduling "Pain and Suffering"*, 83 NW. U. L. REV. 908 (1989) (consistency); James S. Kakalik, *Just "Speedy" and Inexpensive?; Judicial Case Management Under the Civil Justice Reform Act*,

of performance, or process-related, analyses of tort law is entry into the system; thus, the relevant data surface contingent upon the filing of a lawsuit, or when a claim is made to a private body, such as a commercial insurer, or to a public one, such as a workers' compensation agency.

A third approach addresses the relationship between the underlying rates of actionable (or potentially actionable) harms, on the one hand, and claim filing behavior and litigation, on the other. Because the harms are not necessarily earmarked by entry into the legal system, no tidy store of data points exists. Rather, investigators must use population-based methods⁹ to detect the "incidence" and "prevalence" of injuries at their source—locations such as highways, hospitals, the home, and the workplace.¹⁰ In pursuing these methods, investigators tend to borrow heavily from primary data collection techniques developed in other disciplines, particularly epidemiology and empirical economics.

The infrequency of most injuries in the general population means that large study samples must be drawn, which quickly drives up data and labor requirements, and with them, the price tag for research projects. But population-based studies remain the only way in which a complete picture of access to and use of the legal system can be assembled; they are unique in their ability to evaluate the compensation and deterrence functions of tort law by taking account of its full audience—actual, as well as prospective, users. The two leading examples of such studies, to date, have employed different data collection strategies. Deborah Hensler and her colleagues studied accidental injuries in the United States by surveying nearly 26,000 households.¹¹ The Harvard Medical

80 JUDICATURE 184 (1997) (speed and consistency); Robert MacCoun, *Inside the Black Box: What Empirical Research Tells Us About Decisionmaking by Civil Juries*, in VERDICT: ASSESSING THE CIVIL JURY SYSTEM 137, 155-56 (Robert E. Litan ed., 1993) (jury decision-making); Frank A. Sloan & Chee Ruey Hsieh, *Variability in Medical Malpractice Payments: Is the Compensation Fair?*, 24 LAW & SOCIETY REV. 997 (1990) (consistency); Neil Vidmar, *Empirical Evidence on the Deep Pockets Hypothesis: Jury Awards for Pain and Suffering in Medical Malpractice Cases*, 43 DUKE L.J. 217 (1993) (litigant characteristics).

9. "Population-based" methods are concerned with investigation of the frequency, distribution and determinants of specific events (e.g., an injury, claim, or verdict) as they occur in the real world. Generally, population-based studies proceed by drawing a sample from a larger population, usually in a random manner, investigating the events of interest in the sample, and then drawing inferences about the population from the findings. These methods are central to the field of epidemiology—the study of disease patterns in communities—where population-based analysis, relying heavily on the mathematical theory of probability, has developed steadily since the mid-Nineteenth Century. See CHARLES H. HENNEKENS & JULIE E. BURING, EPIDEMIOLOGY IN MEDICINE 3-13 (1987).

10. As these terms are used in epidemiology, "prevalence" refers to the proportion of individuals in a population who have the disease of interest at a given point in time. "Incidence" refers to the number of new events or cases of the disease that develop in a population of individuals during a specified time interval. See *id.* at 57.

11. See HENSLER ET AL., *supra* note 2, at 13.

Practice Study searched medical records for documented evidence of iatrogenic injury, reviewing information on more than 30,000 episodes of care.¹²

A significant portion of the empirical analysis of tort law reported to date has centered on the medical malpractice system. A review of the malpractice literature reveals numerous examples of each of the three investigational approaches outlined above.¹³ For example, one recent study of malpractice liability reforms tested the effect if laws that had narrowed physicians' exposure to suit, finding that such laws appeared to reduce hospital expenditures without increasing mortality.¹⁴ Analyses of insurance company records have found that compensation reasonably follows negligent injury,¹⁵ while several studies of courtroom verdicts have suggested that juries make reasonable assessments of damages in malpractice litigation, even agreeing with independent expert assessments.¹⁶

Reasons for the focus on medical malpractice are not difficult to find. First, it accounts for an appreciable share of the tort litigation: excluding automobile accident litigation, medical malpractice accounts for approximately thirteen percent of the tort caseload and eighteen percent of cases that proceed to trial.¹⁷ Second, public and political unrest about malpractice spiraled along with claims rates in the mid-1980s,¹⁸ raising its profile as a public policy issue and rousing the interest of research funding agencies. Third, and perhaps most significantly, quantitative research into medical malpractice appears to have ridden a wave of enthusiasm generated by scholars from two major empirical movements of the last decade—health services research and “law and economics”—converging, and stumbling upon an area of mutual interest. Justifiably, both camps claim important perspectives.

Despite an outpouring of malpractice analyses, the Harvard Medical Practice Study (“HMPS”), completed in 1991, stands as the sole population-based study

12. See Howard H. Hiatt et al., *A Study of Medical Injury and Medical Malpractice*, 321 *NEW ENG. J. MED.* 480, 481-82 (1989); see also Troyen A. Brennan et al., *Incidence of Adverse Events and Negligence in Hospitalized Patients: Results of the Harvard Medical Practices Study I*, 324 *NEW ENG. J. MED.* 370, 370 (1991).

13. For overviews of empirical work in medical malpractice, see DEWEESE ET AL., *supra* note 2, at 95-187; FRANK A. SLOAN ET AL., *SUING FOR MEDICAL MALPRACTICE* (1993); PAUL C. WEILER, *MEDICAL MALPRACTICE ON TRIAL* (1991).

14. See Daniel Kessler & Mark McClellan, *Do Doctors Practice Defensive Medicine?*, 111 *Q.J. ECON.* 353, 386 (1996).

15. See Henry S. Farber & Michelle J. White, *A Comparison of Formal and Informal Dispute Resolution in Medical Malpractice*, 23 *J. LEGAL STUD.* 777, 778 (1994); Mark I. Taragin et al., *The Influence of Standard of Care and Severity of Injury on the Resolution of Medical Malpractice Claims*, 117 *ANNALS INTERNAL MED.* 780, 783-84 (1992).

16. See, e.g., Thomas B. Metzloff et al., *Empirical Perspectives on Mediation and Malpractice*, 60 *LAW & CONTEMP. PROBS.* 107, 116 (1997).

17. See CAROL J. DE FRANCES ET AL., U.S. DEP'T OF JUSTICE, *CIVIL JUSTICE SURVEY OF STATE COURTS, 1992: CIVIL JURY CASES AND VERDICTS IN LARGE COUNTIES 2* (1995).

18. See WEILER, *supra* note 13, at 2-5.

in this area.¹⁹ No doubt the principal explanation is cost. Because of the sample size demands and the need to obtain specific information on each injury and claim, the resource requirements for population-based studies are generally prohibitive.²⁰

From 1995 to 1998, we had the opportunity to conduct a research project in Utah and Colorado designed to test the HMPS results in a new environment. This Article overviews the results of those studies and explores some policy implications. Part I recaps the intellectual and methodological heritage of our study. Part II describes important changes in the health care system and peculiarities of the New York study that made repetition of a large-scale study of iatrogenic injury worthwhile. Part III gives a brief account of the origins of our study. Part IV outlines each of the four main areas of analysis that comprised the Utah-Colorado Medical Practice Study ("UCMPS"): incidence of medical injury; malpractice claiming behavior; the economic consequences of medical injury; and the feasibility of alternative approaches to compensation. We also describe key results from analyses in each of these areas. The final Part summarizes our findings, and discusses their implications for health care policy.

I. A SHORT HISTORY OF POPULATION-BASED STUDIES OF MALPRACTICE

Perhaps the most significant contribution from malpractice research to a general understanding of tort law comes from a series of studies of iatrogenic injury,²¹ its economic consequences, and the resolution of associated claims. The pioneering work was undertaken in California in the late 1970s and early 1980s. Responding to a perceived crisis in malpractice litigation in the mid-1970s, the California Medical Association and the California Hospital Association jointly commissioned a study of medical records to measure rates of injury in hospitalized patients. A team of medico-legal experts, led by Don Harper Mills, reviewed nearly 21,000 records in twenty-three hospitals across the state and found 970 incidents of disability caused by health care management.²² Because the hospitals were carefully selected to be representative of hospitals statewide in terms of size, ownership, teaching status, and region, the findings of the Medical Insurance Feasibility Study ("MIFS") implied that approximately 4.6%, or roughly one in twenty Californians hospitalized in the mid-1970s suffered some sort of iatrogenic injury.²³ One in every one hundred inpatients suffered an

19. See Randall R. Bovbjerg & Frank A. Sloan, *No-Fault for Medical Injury: Theory and Evidence*, 67 UNIV. CIN. L. REV. 53, at 56 n.11 (1998).

20. In year 2000 dollars, the total cost of the Harvard Medical Practice Study was approximately \$4.7 million.

21. Iatrogenic injuries are those caused by the diagnosis or manner of treatment by the physician.

22. CAL. MED. ASS'N & CAL. HOSP. ASS'N, REPORT ON THE MEDICAL INSURANCE FEASIBILITY STUDY (Don H. Mills ed., 1977); see also Donald Harper Mills, *Medical Insurance Feasibility Study—A Technical Summary*, 128 WESTERN J. MED. 360 (1978).

23. See Mills, *supra* note 22.

injury that gave rise to permanent or grave disability.²⁴

These findings were somewhat at odds with the *zeitgeist*. After creeping steadily upward for fifteen years, the frequency of claims against physicians, the size of payments made to plaintiffs, and (consequently) malpractice insurance premiums all rose dramatically through the period 1973 through 1976.²⁵ Resentment of lawsuits, and the "cowboy" lawyers that brought them, was running high, especially among members of the medical profession.²⁶ Thus, MIFS presented an ticklish scenario: injury rates dwarfed claims rates, increases in litigation notwithstanding. But a formal injury-claims comparison was not made. The sponsors of the study shelved it. Aside from a brief technical summary,²⁷ the findings were published only as an in-house document.

In the early 1980s, the so-called malpractice "crisis" had largely subsided, with claims rates nationwide returning to manageable if not quite pre-crisis levels,²⁸ when a RAND economist, Patricia Danzon, picked up the results of MIFS and took the important step of actually comparing the frequency of injury to the litigation rates. Relying on aggregate claims data collected by the National Association of Insurance Commissioners in surveys of private insurers, Danzon estimated that hospital injuries did indeed exceed malpractice claims and, strikingly, they did so by a factor of ten to one.²⁹ Because she was unable to link the injury data collected in MIFS with claims data at the individual patient/plaintiff level, however, it was not possible to measure the extent of overlap between the two populations.

In the midst of a second surge in malpractice claims in the mid-1980s, a group of investigators led by Dr. Howard Hiatt, the former Dean of the Harvard School of Public Health, resolved to undertake a comprehensive evaluation of malpractice litigation in a single state.³⁰ The objective was to answer three questions: 1) How frequently do medical injuries occur in hospitals, particularly the subset of injuries attributable to negligent care? 2) What portion of those injuries give rise to litigation and, conversely, how much litigation proceeds in the absence of such injuries? and 3) what are the economic consequences of medical injuries? The Harvard investigators soon recognized that answering these questions would require a costly and labor intensive study, involving review of medical records, access to malpractice claims files, and interviews with patients.

24. *See id.*

25. *See* DANZON, *supra* note 2, at 58-65; WEILER, *supra* note 13, at 5, 8;

26. Frank P. Grad, *Medical Malpractice and the Crisis of Insurance Availability: The Waning Options*, 36 CASE W. RES. 1058, 1058-59 (1986); David J. Nye et al., *The Causes of the Medical Malpractice Crisis: An Analysis of Claims*, 76 GEO. L.J. 1495, 1495-98 (1988).

27. *See* Mills, *supra* note 22.

28. DANZON, *supra* note 2; WEILER, *supra* note 13.

29. *See* DANZON, *supra* note 2, at 24.

30. For a fuller description of the origins of the study and the team of investigators involved, see the preface of HARVARD MEDICAL PRACTICE STUDY, PATIENTS, DOCTORS, AND LAWYERS: MEDICAL INJURY, MALPRACTICE LITIGATION, AND PATIENT COMPENSATION IN NEW YORK (1990).

Dr. Hiatt secured a significant funding commitment from the New York Department of Health and from the Robert Wood Johnson Foundation to undertake the study.³¹ After three years of design work, the investigators commenced data collection in New York. They assembled a representative sample of fifty-two hospitals from among the more than 300 acute care hospitals in New York, and randomly sampled medical records from those hospitals.³² The study sample was "weighted," that is, specially designed to allow statistical transformation of results from this selection of institutions and records into statewide estimates. Teams of physicians and nurses then reviewed each record, looking for evidence of "adverse events"—defined as injuries caused by medical practice, as opposed to a disease process, which either prolonged the patient's hospital stay or resulted in disability at the time of discharge.³³ When an adverse event was detected, the chart review protocol directed the physician reviewers to judge whether it had been caused by negligence.³⁴ Negligence was defined, in accordance with standard tort criteria, as actual injuries proximately resulting from a treating physician's failure to meet the standard of care expected in his practice community.³⁵

While record review proceeded, the investigators contacted more than twenty insurance companies underwriting malpractice risk in New York for injury year 1984.³⁶ Unfortunately, by the time this process began in 1990, the effects of a second tort crisis in the mid-1980s had been felt. Many insurers had gone into state receivership, having failed as a result of unanticipated increases in expenditures on litigation and settlements.³⁷ This made the task of identifying claims quite arduous. Nonetheless, investigators successfully created a database of nearly 68,000 malpractice claims filed between 1974 and 1989.³⁸

Patients were then linked to claimants using software programs designed to maximize the possibility of identifying matches between individuals.³⁹ The matching algorithms allowed for errors and differences in name spelling, then tested the veracity of candidate matches by referring to the descriptive

31. See *supra* note 20.

32. For a full description of the HMPS sampling methodology, see *supra* note 30.

33. More than 200 reviewers were employed in the chart review process.

34. Physician reviewers separately registered their confidence in both the causation and the standard of care components of negligence on a six-point scale: 1, little or no evidence medical management caused the event; 2, slight evidence; 3, not quite likely (less than 50:50 but a close call); 4, more likely than not (greater than 50:50 but a close call); 5, strong evidence; and 6, virtually certain evidence. The threshold for both determinations was a confidence score of four or greater.

35. See W. PAGE KEETON ET AL., PROSSER & KEETON ON THE LAW OF TORTS § 30, at 164-65 (5th ed. 1984).

36. See HARVARD MEDICAL PRACTICE STUDY, *supra* note 30, at 7-10 to 7-24.

37. See PAUL C. WEILER ET AL., A MEASURE OF MALPRACTICE: MEDICAL INJURY, MALPRACTICE LITIGATION, AND PATIENT COMPENSATION 64-65 (1993).

38. See *id.*

39. See HARVARD MEDICAL PRACTICE STUDY, *supra* note 30, at 7-24 to 7-27.

information in the patient and claimant databases. In this way, investigators were able to identify which patients, from those whose medical records were examined in the chart review, were involved in litigation.

Finally, a survey of individuals who had suffered adverse events was conducted to gather information on the economic consequences of the injuries.⁴⁰ This survey occurred more than four years after the injury itself to allow a reasonable assessment of the repercussions of the injury to be made. But unfortunately the respondents' ability to recall actual costs appeared to be significantly impaired by the time elapsed. The site team applied unit cost estimates to information obtained in the surveys to assess overall costs of injury.⁴¹

The results of the HMPS have been widely reported.⁴² The investigators detected a slightly lower rate of adverse events than had been found in MIFS. Approximately 3.7% of patients hospitalized in New York in 1984 were estimated to have suffered a medical injury associated with their stay.⁴³ Just over one quarter of those injuries was due to negligence. Relatively benign-sounding percentages in epidemiological analysis often create shock value when "up-weighted" to total numbers of injuries, an extrapolation that was not possible in the MIFS because of its non-representative sampling design. In the HMPS, however, investigators were able to estimate that approximately 100,000 New Yorkers suffered medical injuries in 1984, 13,000 of which resulted in death.⁴⁴ Negligence gave rise to approximately 20,000 disabling injuries and 7000 deaths.⁴⁵

These alarming statistics have become the chief legacy of the HMPS. For the first time, the burden of morbidity and mortality from medical injuries was widely publicized.⁴⁶ This attention, in turn, helped to spawn interest in error measurement and prevention—one of the most vibrant fields of inquiry in health services research today.⁴⁷ Efforts to understand medical error, however, remain largely contained within a frame of analysis concerned with improving quality of clinical care. Commentators and researchers involved in the study of error—many of them clinicians—typically view the law's role with disdain and

40. See WEILER ET AL., *supra* note 37, at 117-31.

41. See William G. Johnson et al., *The Economic Consequences of Medical Injuries*, 267 JAMA 2487 (1992).

42. For a summary of published articles from HMPS through 1993, see WEILER ET AL., *supra* note 37, at 155-75.

43. See Brennan et al., *supra* note 12, at 370.

44. See *id.*

45. See *id.*

46. See, e.g., *Errors by Doctors in Hospitals Tracked Drug Problems, Wound Infections Cited*, Chi. Trib., Feb. 7, 1991, at C3; *New Study of Hospitals Finds Inadequate Care*, SAN FRAN. CHRON., Feb. 7, 1991, at A2; *New York Study Shows Poor Care in Hospitals Is Leading to Injuries*, N.Y. TIMES, Feb. 7, 1991, at B4.

47. See, e.g., Lucian L. Leape, *Error in Medicine*, 272 JAMA 1851 (1994); Lucian L. Leape et al., *Promoting Patient Safety by Preventing Medical Error*, 280 JAMA 1444 (1998).

pay it little attention. Few have explored legal means for deterring accidents.⁴⁸

The patient safety movement's orientation away from scrutiny of the legal system is problematic, given the solid evidence from HMPS that the tort system was failing in both its compensation and deterrence functions.⁴⁹ In total, approximately 3600 malpractice claims relating to injury year 1984 were made in New York.⁵⁰ A comparison to the 27,000 negligent adverse events arising in that year produces a negligence-to-claims ratio of 7.5—not much smaller than the gap identified by Danzon a decade earlier. Even when the injury sample is narrowed to a subset of more “valuable” tort claims—those involving serious injury to patients less than seventy years old—a ratio of five to two persists.⁵¹

But HMPS analysis of litigation analysis went a step further by matching specific claims to specific injuries. This exercise shed new light on the dimensions of the disconnection between claims and injuries: not only did few documented instances of negligent injury give rise to claims, the majority of claims that were initiated did not appear to be grounded in identifiable instances of negligence. Investigators estimated that, among the 3600 claims in New York relating to injury suffered in 1984, more than one-half arose from instances in which there was neither negligence nor any identifiable injury and one-third arose from instances of injury but no negligence; only one-sixth responded to “true” negligent incidents.⁵² We have previously described this paradoxical relationship as simultaneously lopsided and mismatched.⁵³ Paul Weiler draws an analogy to a traffic officer ticketing random drivers who are not violating traffic laws while allowing many violators to pass.⁵⁴ That many patients who suffer medical injury go uncompensated by tort litigation was not an altogether surprising finding; “under-claiming” in liability insurance programs had been well recognized in other areas.⁵⁵ The prevalence of over-claiming, however, was new information, as was the insight that claims were largely settled on the basis

48. See, e.g., Bryan A. Liang, *Error in Medicine: Legal Impediments to U.S. Reform*, 24 J. HEALTH POL. POL'Y & L. 27 (1999).

49. See WEILER ET AL., *supra* note 37, at 77-134.

50. See A. Russell Localio et al., *Relation Between Malpractice Claims and Adverse Events to Negligence: Results of the Harvard Medical Practice Study III 1991*, 325 NEW ENG. J. MED. 245, 248 (1991).

51. WEILER ET AL., *supra* note 37, at 71.

52. Localio et al., *supra* note 50, at 248.

53. See David M. Studdert et al., *Negligent Care and Malpractice Claiming Behavior in Utah and Colorado*, 38 MED. CARE 250 (2000).

54. See WEILER ET AL., *supra* note 37, at 75. Note, however, that this phenomenon does not necessarily lend support views about greedy personal injury lawyers and vexatious plaintiffs. “[I]t is more likely due to the fact,” Weiler argues that “that (previously ill) patients and their lawyers have a difficult time identifying in advance valid claims that demonstrate that something went wrong in treatment.” Paul C. Weiler, *Fixing the Tail: The Place of Malpractice in Health Care Reform*, 47 RUTGERS L. REV. 1157, 1162 (1995).

55. Richard Abel, *The Real Tort Crisis—Too Few Claims*, 48 OHIO ST. L.J. 443, 443-48 (1987).

of severity of injury, not the degree of negligence.⁵⁶

This dysfunctional situation clearly implies that compensation and deterrence objectives are not fully realized by malpractice law.⁵⁷ The claims-negligence mismatch also makes it difficult to understand how there could be any sharp or effective deterrence signal associated with malpractice litigation. Heuristics may play an important, salvaging role. HMPS investigators were surprised to discover that, despite the manifest inaccuracies in general claiming behavior, the malpractice claiming system did appear to command the attention of physicians. Many believed that there was a high probability they would be sued if they negligently injured one of their patients.⁵⁸

However, the only clear evidence of a relationship between malpractice claiming and actual behavioral responses was found at the level of the hospital, and here the important signal was the overall number of medical injuries, not the number of medical injuries actually due to negligence.⁵⁹ This finding intimated that institutions may best be positioned to channel the liability threat and experience toward injury-reduction strategies, an argument made persuasively by several legal commentators⁶⁰ and one that resonates with contemporary organizational theories of safety.⁶¹ Overall, HMPS investigators did not interpret their findings about the dynamics of litigation as supporting the need for ongoing reliance on individually targeted tort litigation to ensure about patient safety.⁶²

II. HMPS TODAY: THE NEED FOR VALIDATION

Why does the HMPS require validation? The most obvious reasons stem from market transitions in the United States. The HMPS studied medical injuries connected to hospital stays in 1984. The ensuing sixteen years have seen tumultuous change in the health care arena. Two changes are particularly troubling to the interpretability of HMPS findings today. One is the emergence of managed care as a force in American medicine. The penetration of managed care in New York in 1984 was minimal. Managed care's rapid rise began in the

56. See Troyen A. Brennan et al., *Relation Between Negligent Adverse Events and the Outcomes of Medical Malpractice Litigation*, 335 N. ENG. J MED 1963 (1996).

57. For a discussion of the obstacles to effective deterrence created by haphazard claiming behavior, see David M. Studdert & Troyen A. Brennan, *Deterrence in a Divided World: Medical Malpractice Law in an Era of Managed Care*, 15 BEHAVIORAL SCI. & THE LAW 21, 26-27 (1997).

58. See Ann G. Lawthers et al., *Physicians' Perceptions of the Risk of Being Sued*, J. HEALTH POL., POL'Y & L. 463, 464 (1992).

59. See Troyen A. Brennan, *The Role of Regulation in Quality Improvement*, 76 MILBANK QUARTERLY 709, 714-16 (1998).

60. See Kenneth S. Abraham & Paul C. Weiler, *Enterprise Liability and the Evolution of the American Health Care System*, 108 HARV. L. REV. 381, 381 (1994); William M. Sage et al., *Enterprise Liability for Medical Malpractice and Health Care Quality Improvement*, 20 AM. J.L. & MED. 1, 17-18 (1994).

61. See JAMES REASON, *HUMAN ERROR* (1990).

62. See WEILER ET AL., *supra* note 37, at 139-149.

late 1980s, not only in New York but also in many regions of the country, and within several years had taken root as a new way of life in the practice of medicine.⁶³ The other market shift concerns proprietary medicine. New York had no for-profit sector of hospital care in 1984. By the early 1990s, for-profit institutions were well established in many markets around the United States, including those in New York.⁶⁴ Thus, managed care and for-profit medicine, and the points of intersection between these two phenomena, have largely transformed the health care industry that existed before 1990. No period of change in American medicine has been more dramatic.⁶⁵ Consequently, as any good student of health services research would point out, there are serious doubts about how representative and relevant the HMPS findings are for modern systems of health care delivery and financing.

It must also be acknowledged that New York has always been a unique state in terms of its health policy and litigation environment.⁶⁶ The Department of Health effectively exerted what was in effect "all-payer" control over reimbursement from the late 1970s until the late 1990s. Complex reimbursement formulae meant that Medicaid patients, and even the uninsured, enjoyed greater access to services in New York than their counterparts in other states. Moreover, any study of New York hospitals must be significantly influenced by the unique health demands and care systems of New York City. Large impoverished areas of the city require teaching hospitals that are heavily subsidized by Medicare graduate medical education funds. The influence of these teaching hospitals is much more pronounced than that of the relatively small tertiary care centers in other states. With regard to litigation, New York is distinctive in ways that could potentially affect the negligence-claims relationship: it is heavily populated, ranks among states with the highest per capita concentrations of lawyers, and is renowned for having consistently high rates of malpractice litigation.⁶⁷ In sum,

63. See generally WALTER A. ZELMAN & ROBERT A. BERENSON, *THE MANAGED CARE BLUES AND HOW TO CURE THEM* (1998); James C. Robinson, *Health Care Purchasing and Market Changes in California*, HEALTH AFF., Winter 1995, at 117; James C. Robinson & Lawrence P. Casalino, *Vertical Intergration and Organizational Networks in Healthcare*, HEALTH AFF., Spring 1996, at 7; C.B. Sullivan & T. Rice, *The Health Insurance Picture in 1990*, HEALTH AFF., Summer 1991, at 104-15.

64. See ZELMAN & BERENSON, *supra* note 63, at 112-15; Gary Claxton et al., *Public Policy Issues in Nonprofit Conversions: An Overview*, HEALTH AFF., Summer 1997, at 9; Robert Kuttner, *Columbia/HCA and the Resurgence of the For-Profit Hospital Business (Part II)*, 335 NEW ENG. J. MED. 446, 449-50 (1996); Jack Needleman et al., *Hospital Conversion Trends*, HEALTH AFF., Summer 1997, at 187;.

65. See TROYEN A. BRENNAN & DONALD M. BERWICK, *NEW RULES: REGULATION, MARKETS, AND THE QUALITY OF AMERICAN HEALTH CARE* 151-74 (1995).

66. See Michael S. Sparer, *Nothing Exceeds Like Success: Managed Care Comes to Medicaid in New York City*, 77 MILBANK QUARTERLY 205, 205-23 (1999).

67. It is noteworthy that these same distinctive features apply to California, the only other state from which comprehensive data on injuries and claims have emerged. For data on attorney concentration, see AMERICAN BAR ASSOCIATION, *MEMBERSHIP RANKING BY STATE* (Aug. 1997).

a number of state-specific factors raise further doubts about whether the findings from New York in 1984 can be generalized to the rest of the United States today.

Issues of generalizability aside, a series of recurring questions have arisen about aspects of the HMPS itself. First, with regard to identification of medical injuries, a number of critics have pointed out that the reliability of judgments concerning injury and negligence are less than stellar.⁶⁸ We hypothesized that one important reason for this was that the HMPS had six different directors of the record review. Each conducted their own training programs in different geographic locations. Fragmented reviewer supervision training may well have had a deleterious effect on the reliability of the reviewer judgments in New York.

Second, questions have persisted about the extent of the gap identified between malpractice claims and medical injuries in the HMPS. Investigators reviewing the records of malpractice insurers have found both that a large proportion of the claims appear to be valid and that independent evaluations of negligence generally accord with decisions about compensation.⁶⁹ We have reservations about whether such evaluations really qualify as independent when made by insurers. Nonetheless, the fact remains that the weight of most other malpractice claims analysis suggests a smaller mismatch between claims and negligence than was identified in the HMPS.⁷⁰

Third, the task of collecting data on malpractice claims in New York proved to be particularly challenging. One obstacle was the volatile malpractice environment in New York in 1984. As many as twenty different companies were

For historical claims rates, see U.S. GENERAL ACCOUNTING OFFICE, MEDICAL MALPRACTICE: SIX STATE CASE STUDIES SHOW CLAIMS AND INSURANCE COSTS STILL RISE DESPITE REFORMS, PUB. NO. GAO/HRD-87-21 (Dec. 1986.)

68. See, e.g., RICHARD ANDERSON, AN EPIDEMIC OF MEDICAL MALPRACTICE? A COMMENTARY ON THE HARVARD MEDICAL PRACTICE STUDY, 27 CIVIL JUSTICE MEMORANDUM (1996), available at <http://manhattan-institute.org/html/cjm_27.htm> (visited July 24, 2000). See also Troyen A. Brennan et al., *Reliability and Validity of Judgments Concerning Adverse Events Suffered by Hospitalized Patients*, 27 MED. CARE 1148 (1989); A. Russell Localio et al., *Identifying Adverse Events Caused by Medical Care: Degree of Physician Agreement in a Retrospective Chart Review*, 125 ANN. INTERNAL MED. 457 (1996). Critics questioning the rates of injuries in New York can also point to the experience of Australian investigators who recently estimated the incidence of injuries in Australia. Using methodology that was very similar to that of the Medical Practice Study, the Australians reported an adverse event rate of over 15%. See Ross M. Wilson et al., *The Quality in Australian Health Care Study*, 163 MED. J. AUST. 458 (1995). The fact that similar methods in another set of investigators hands could produce four-fold differences in injury raised concerns about the viability of results in all studies using the HMPS methods.

69. See Taragin et al., *supra* note 15, at 782; Michelle J. White, *The Value of Liability in Medical Malpractice*, HEALTH AFF., Fall 1994, at 75, 79-80.

70. Note, however, that the discrepancy between the HMPS and previous studies referred to here relates only to the issue of the legitimacy of claims made; only HMPS quantified underclaiming.

underwriting malpractice insurance in New York in 1984.⁷¹ Several went into receivership over the next four years; others merged or were acquired by larger organizations. Such market instability raises significant questions about how comprehensive the review of malpractice claims could have been. A related complication—although one that is certainly not peculiar to New York, then or now—is the long tail on claims resolution.⁷² Fifty percent of the claims analyzed in the HMPS were closed more than 5.5 years after the (alleged) date of the injury and twenty-five more than 7.5 years out.⁷³ After ten years, approximately ten percent of claims still had not closed.⁷⁴ This considerable lag frustrates efforts to understand malpractice claiming behavior.

Fourth, the methods for identifying the costs of injury in New York were based on survey data.⁷⁵ Five to six years elapsed between the date of injury and interviews, in which a sample of patients, or their surviving dependents, were asked about health status and services utilized in the intervening period.⁷⁶ While the gap served the investigators' interests in the gathering information on the full repercussions of injury, it also necessitated reliance on the long-term recall of individuals who had suffered adverse events. Recall biases are a well-documented phenomenon in epidemiological research.⁷⁷

Fifth, HMPS investigators did not have the tools to estimate the cost of different compensation models, or compare these costs to those of the tort system. Consequently, assessments of the economic feasibility of alternative schemes, such as "no-fault" compensation, were crude.⁷⁸ Investigators simply compared the total costs of medical injury to estimated costs of the malpractice system, with some minor modifications, to account for administrative expenses associated with dispensing compensation in a no-fault system.⁷⁹

En mass, this set of defects and unanswered questions is very serious. Before policymakers could reasonably be expected to rely on the HMPS findings, we believed it was necessary to validate the study. In bringing the medical injury statistics up do date, we sought states that differed markedly from New York, both regionally and in terms of their demographic mix. Another important criterion was the existence of a mature health care industry, including a managed care and for-profit hospital presence. To simplify and improve the study of malpractice litigation, we also hoped to find states with relatively stable, monopolistic indemnity insurance markets.

71. See HARVARD MEDICAL PRACTICE STUDY, *supra* note 30, at 7-10 to 7-13.

72. See *id.* at 7-13.

73. See WEILER ET AL., *supra* note 37, at 68.

74. See *id.*

75. See *id.*

76. See Johnson et al., *supra* note 41, at 2488.

77. See HENNEKENS & BURING, *supra* note 9, at 35.

78. WEILER ET AL., *supra* note 37, at 97-109.

79. See *id.* at 106-09.

III. STUDY ORIGINS

In 1995, the Robert Wood Johnson Foundation, under the auspices of an initiative led by Robert Berenson, provided us with a grant to undertake a study similar to the HMPS in Utah and Colorado. We worked closely with the legislatures and dominant physician insurers in these two states. Collaborators provided us with an unprecedented level of access to hospital data systems and malpractice claims. In collecting and analyzing these data, we re-deployed the basic methods of the HMPS, making several design changes and running repairs in places where we thought significant deficiencies existed.

We recently reported results from the Utah-Colorado Medical Practice Study (“UCMPS”) in the medical literature.⁸⁰ However, we have not previously published a comprehensive overview of our findings. The remainder of this Article summarizes our main analyses and results and identifies some of the key policy implications of the UCMPS.

Before turning to that summary, however, a brief word about the political framework in which the study evolved may be helpful. Our interests in conducting the UCMPS extended beyond a desire to validate the HMPS findings. Convinced by the results of the HMPS that a no-fault system of compensation for medical injuries presented a superior alternative to the tort regime, we sought collaborators who might be interested proceeding with no-fault trials. Two remarkable individuals joined us in this effort.

At the time the study commenced, K. Mason Howard was the President of the Colorado Physicians’ Insurance Company (“COPIC”), the major physician insurer in Colorado. Over years of experience with the malpractice system, he formed the view that a no-fault compensation program for medical injuries held out the promise of significant improvement on the status quo. Howard mobilized COPIC’s support behind the Colorado portion of the study, and sparked the interest of nearly all of the key players in that state, including physician groups. Elliott Williams was the architect of the Utah portion of the study. One of the most experienced malpractice litigators in Utah, Williams had read extensively on alternatives to tort litigation, and proceeded to convince many health care leaders in his state that a trial of no-fault compensation was possible. Without the persistence and insight of Howard and Williams, the UCMPS would not have occurred.

In both Utah and Colorado, we met with legislators and health policy opinion leaders in 1994 and 1995. Over the next four years we worked on empirical and theoretical aspects of no-fault design in order to inform the policy debate. We also assisted in preparing draft legislation that outlined a statutory framework for a no-fault system of compensation.⁸¹

80. See Studdert et al., *supra* note 53; Eric J. Thomas et al., *Costs of Medical Injuries in Colorado and Utah in 1992*, 36 INQUIRY 255 (1999) [hereinafter Thomas et al., *Costs of Medical Injuries*]; Eric J. Thomas et al., *Incidence and Risk Factors for Adverse Events and Negligent Care in Utah and Colorado in 1992*, 38 MED. CARE 261 (2000).

81. As originally envisioned by the study consortia, the shift toward no-fault compensation

Unfortunately, enthusiasm for such large-scale tort reform had waned by spring 1998. The policy focus had clearly shifted to the uninsured and consumer protection issues in managed care. Thus, the current system remains intact today, replete with secrecy about malpractice claims and arbitrary divisions between risk management, injury prevention and general quality improvement activities. But despite the fact that UCMPS results have not (yet) affected the organization structure of the tort system in Utah and Colorado, they do provide a third, population-based estimate of the incidence, types, and costs of iatrogenic injury, and the best estimates to date on the economic feasibility of a no-fault alternative for medical injury compensation.

IV. RESULTS OF THE UTAH-COLORADO MEDICAL PRACTICE STUDY

A. The Health Burden of Medical Injury

The UCMPS essentially replicated the methods used in the HMPS. Our validation goals demanded that the pool of injuries detected in the mountain states be directly comparable with those from New York. As we have noted, however, the reliability of judgments by record reviewers—both adverse event and negligence determinations—was a major focal point of methodological critiques that followed release of the New York findings.⁸² Drawing upon knowledge gained from work in the interim on “inter-rater reliability”⁸³ and ongoing analyses of the New York experience, we made several modifications to the review process. Most notably, reviewer-training practices were revamped and we instituted a series of quality checks on physician-reviewers’ judgments.

Like the HMPS, sampling work was focused at two levels: the hospitals and the records themselves. There were 112 eligible hospitals in the two states of which thirteen were selected in Utah and fifteen in Colorado. The group selected consisted of two major teaching hospitals (one from each state) and eight minor teaching hospitals (two from Utah and six from Colorado). Four, for-profit hospitals, from each state were also included. From among all discharges in calendar year 1992 at these hospitals, we then sampled 15,000 medical records—5000 in Utah in 10,000 in Colorado.

The medical records were sampled randomly. However, the guiding objectives of UCMPS meant that it was not appropriate to select participating hospitals in a purely random manner. Rather, we sought to load the hospital sample with institutions that would be expected to play key roles in the development of a no-fault insurance plan in each state. Nonetheless, our

was to proceed differently in each state. In Utah, the scheme would be introduced incrementally, beginning with several large hospitals. Colorado was to move more rapidly toward statewide replacement of tort with no-fault, and the participation of patients and physicians was to be mandatory, although some “grand-fathering” was recognized as necessary to accommodate claims relating to injury dates that preceded the effective date of no-fault legislation.

82. See ANDERSON, *supra* note 68.

83. E.g., Localio et al., *supra* note 68.

sampling design preserved the opportunity to “up-weight” results to produce the kind of statewide totals that had attracted so much interest in New York. Moreover, several mitigating factors allowed us to honor basic statistical rules of representativeness with the participating hospitals and to avoid sampling bias. First, as had been done in New York, we classified all eligible hospitals into strata based on their size, location, type of ownership, and whether or not they were teaching hospitals. At least one hospital from each stratum was then invited to participate in UCMPS. Second, none of the invited hospitals refused to participate. Third, we had no prior knowledge of adverse event rates in any of the eligible hospitals.

We made few alterations to the nurse component of the two-stage review process used in New York. Teams of nurses scanned all records searching for one of nineteen different referral criteria. These criteria encapsulated common markers of injury, such as the occurrence of unexpected events during the hospital stay or unplanned readmissions.⁸⁴ The same screening criteria had been used in the HMPS and demonstrated high reliability and validity.⁸⁵

On the other hand, the physician review procedures underwent two significant modifications. First, the training procedures were streamlined and consolidated. Only two investigators, Dr. Thomas and Dr. Brennan, trained the physician-reviewers; this was carried out in a single series of sessions in both states. Thus, to the extent diffuse reviewer training programs introduced variation into the New York findings, it was largely eliminated in Utah and Colorado.

Second, we designed a series of targeted, quality control strategies for the physician review based on knowledge gained during the HMPS about aspects of the process that were associated with unreliable judgments. One strategy addressed “outlier” reviewers. Much of the disagreement between reviewers in the HMPS was shown to have occurred among physicians who had markedly low and high adverse event detection rates.⁸⁶ Accordingly, physicians whose adverse event detection rate was two or more standard deviations below or above the mean for reviewers in their state had their charts re-examined by the investigators. If ten percent or more of the records classified as adverse events by the original reviewer were found not to fit the study definition of adverse events, all of the charts of the offending reviewer were re-assigned for fresh review.

Another quality control strategy involved investigator verification. By inspecting a clinical summary of each adverse event identified in record review, investigators checked to ensure it met the study definition of an adverse event. False positives were eliminated. A similar process was undertaken to verify

84. The longitudinal nature of the medical records allowed nurses and physician-reviewers to make this type of inquiry. However, one methodological limitation of the study is that an adverse event marker such as unplanned readmission was not observable if the patient returned to a different hospital or to an outpatient facility.

85. See Localio et al., *supra* note 50, at 245-46.

86. See Localio et al., *supra* note 68, at 462.

negligent adverse events, although investigators also had some opportunity here to address false negatives. Because the adverse event determination delineated the pool of cases eligible for reviewers' subsequent judgments about negligence,⁸⁷ physician and attorney members of our team were able to comb that pool of injuries to ensure that none had been overlooked as having been due to negligence.⁸⁸

Our final strategy was aimed at testing the general reliability of the review process. It involved re-review of a random sample of 500 records referred by nurses to physicians. The re-review showed eighty-four percent agreement among reviewers.

Figure 1⁸⁹ overviews the results from the review process. We completed review of 4943 (98.9%) of the 5000 sampled records in Utah and 9757 (97.6%) of the 10,000 records in Colorado. Of these records, Utah nurse reviewers referred 854 records (17.2%) for physician review and their counterparts in Colorado referred 2014 records (20.1%). Physicians reviewed ninety-eight percent of the referred records. The rest were categorized as missing.

The profile of patients included in our study closely resembled the general population of patients discharged from each state's hospitals in 1992. For example, the mean age of the patients whose records we reviewed was 38.9 years; the mean age of all patients discharged from Colorado and Utah hospitals was 38.2 years. These results help to confirm that our sampling technique achieved representativeness, at least across key sociodemographic characteristics.

Physician-reviewers identified a total of 169 adverse events in Utah and 418 adverse events in Colorado.⁹⁰ When these totals are up-weighted to the state populations, they yield estimates of 5614 adverse events among hospitalized patients in Utah in 1992, and 11,578 in Colorado. We estimated an adverse event rate of 2.9% in both states, a remarkable similarity considering that medical records were reviewed by completely different teams of physicians in each state. In Utah, 828, or 32.6%, of the adverse events were judged due to negligence, whereas in Colorado the figures were 3179 and 27.5% respectively.

For purposes of exploring types of adverse events we pooled the results.

87. Use of adverse event criteria is an appropriate and conservative method for delineating candidate negligent adverse events because "causation" and the presence of substantive injury, the crux of the adverse event judgment, are also pivotal criteria in the legal definition of negligence. KEETON ET AL., *supra* note 35. The other key component of that definition, evidence that the injury was due to substandard care, was initially addressed by reviewers, and then revisited by investigators.¹

88. This iterative process bears some resemblance to that used to decide the issue of negligence in court, wherein multiple physician testimonies are weighed. Moreover, a 10-year follow-up of the Harvard Medical Practice Study found that, in all but three of 46 litigated cases, reviewers' judgments of negligence correlated closely with expert assessments subsequently made by insurers. See Brennan et al., *supra* note 56, at 1967.

89. See Figure 1, *infra*.

90. See Figure 1, *infra*.

Table 1⁹¹ shows the up-weighted figures for each leading type of event, and the proportion of injuries that involved negligence and permanent disability. The most prevalent injury type was adverse events connected to surgery, accounting for approximately half (44.9%) of adverse events across both states.⁹² Nearly one third of these were the result of technical complications in the operation. Only 16.9% of surgical adverse events involved negligence. Approximately the same proportion resulted in permanent disability.

Drug-related adverse events were the next most prevalent group. They accounted for more than one-third of the balance of injuries. The four most common classes of drugs involved were antibiotics (24.9%), cardiovascular agents (17.4%), analgesics (8.9%), and anticoagulants (8.6%). Strikingly, more than one third of all drug-related adverse events detected were due to negligence. The mistakes that led to these instances of substandard care included prescription of the wrong drug (20.9%), prescription of the wrong dose (7.9%), and prescription of a drug to a patient with a known allergy to that drug (5.7%).⁹³

Compared to findings from New York, iatrogenic death was a relatively rare occurrence in the mountain states. Only 6.6% of adverse events resulted in death, although the death rate was slightly higher (8.8%) among negligent adverse events. In total, 439 patients hospitalized in Utah and Colorado in 1992 died due to negligent care; another 160 victims of negligence suffered grave or major disability.

These mortality statistics certainly shock. They confirm the existence of an epidemic of potentially preventable iatrogenic death in the United States. However, they present a considerably less bleak picture than emerged from New York eight years earlier. When extrapolated to the United States population, iatrogenic deaths detected the HMPS suggested there were nearly 200,000 deaths a year due to adverse events, whereas the UCMPS suggests no more than 65,000 deaths. The difference widens when it comes to negligent adverse events: 120,000 negligent deaths nationwide versus less than 25,000, extrapolating from the HMPS and the UCMPS rates respectively. This fivefold difference in deaths due to negligent care is particularly striking.

There are several explanations. First, by the time we initiated the UCMPS we had become aware of a growing literature suggesting that severity of injury tended to inappropriately color judgments about quality of care.⁹⁴ Therefore, during reviewer training, we dealt specifically with the need to differentiate the injury severity from the judgment of causation or negligence. Second, the standard of medical care may simply have been better in Colorado and Utah in

91. See Table 1, *infra*.

92. For a detailed analysis of the surgical adverse events identified in UCMPS, see Atul A. Gawande et al., *The Incidence and Nature of Surgical Adverse Events in Colorado and Utah in 1992*, 126 SURGERY 66 (1999).

93. These percentages relate to the proportion of drug-related events due to negligence, not drug related adverse events in general.

94. See, e.g., Rodney A. Hayward et al., *An Evaluation of Generic Screens for Poor Quality of Hospital Care on a General Medicine Service*, 31 MED. CARE 394 (1993).

1992 than in New York in 1984.⁹⁵ Third, we cannot, of course, rule out the possibility that limitations in the methods we used, principally chart review, at least partly explain disparities between the two studies.⁹⁶

But despite the differences noted above, the story that emerges from comparison of results of the HMPS and UCMPS is chiefly one of tremendous similarity. Beginning with the overall adverse event rate itself—there is actually no statistically significant difference between the proportion of hospital discharges that give rise to adverse events (3.7% versus 2.9%)—inter-study analyses across a variety of different measures show that the UCMPS findings essentially reinforce those from the HMPS. For example, the proportion of operative adverse events is remarkably stable between studies. Slightly more than one-half of all negligent adverse events in both studies occurred in the emergency department, and a very high proportion of all adverse events attributed to emergency physicians were judged to be due to negligence (70.4% in New York and 52.6% in Utah and Colorado). This is likely a result of the challenging environment in the emergency department in which critical human factors, such as uncertainty, changing plans, high work load, and multiple concurrent tasks are brought to bear on health professionals in the emergency room.

However, not all studies of medical injury mirror the UCMPS and HMPS findings. In August 1995, to much public clamor, the Australian government announced results from the Australian Quality in Health Care Study (“QAHCS”). Ross Wilson and colleagues estimated that 16.6% of admissions to Australian hospitals were associated with adverse events, fifty-one percent of which were considered preventable.⁹⁷ Having consulted with QAHCS investigators throughout their study, these results surprised us because the Australians also drew a sample from 1992, identical in size to UCMPS, and then closely modeled their methods, as we had, on those developed during HMPS. Yet they detected nearly six times more adverse events than the UCMPS did. A closer analysis of the respective study methods and samples showed that several relatively straightforward adjustments were necessary to allow direct comparability.⁹⁸

95. For a discussion of this possibility, see Troyen A. Brennan, *The Institute of Medicine Report on Medical Errors - Could It Do Harm?*, 342 N. ENG. J. MED. 1123, 1124 (2000).

96. For a recent critique of questionable role of reviewer consensus, see T.P. Hofer et al., *Discussion Between Reviewers Does Not Improve Reliability of Peer Review of Hospital Quality*, 38 MED. CARE 152 (2000).

97. See Wilson et al., *supra* note 68, at 458, 470. QAHCS investigators did not make determinations about negligence. Instead, physician-reviewers were asked to determine whether each adverse event detected was “preventable,” defined as “an error in management due to failure to follow accepted practice at an individual or system level.” “Accepted practice” in this definition was taken to be “the current level of expected performance of the average practitioner or system that manages the condition in question.” *Id.* at 461.

98. See Eric J. Thomas et al., *A Comparison of Iatrogenic Injury Studies in Australia and America II: Context, Methods, Casemix, Population, Patient and Hospital Characteristics* (unpublished manuscript, 2000).

However, such adjustments still only reduced the disparity to a fourfold difference.⁹⁹

Our results are also quite different from those obtained by Lori Andrews and colleagues in Illinois.¹⁰⁰ Using ethnographic measurement techniques to track adverse events occurring in "real time," they found rates of 17.7% in one university teaching hospital. However, fairly major differences between sampling and other aspects of the methodologies used in the Andrews study and the UCMPS limit their comparability.¹⁰¹

In summary, the UCMPS produced results similar to its predecessor in New York. Approximately, three percent to four percent of hospitalizations appear to give rise to adverse events. Insofar as these adverse events are the results of errors in care-givers behavior, they follow similar patterns. In other words, not much appears to have changed from 1984 to 1992 in terms of the role of human factors in medical injury causation. Together, the two studies provide overwhelming evidence that the burden of iatrogenic injury is large, enduring, and an innate feature of hospital care in the United States.

B. The Relationship Between Malpractice Claims and Medical Injuries

An important component of the UCMPS, like the HMPS the before it, was to link the medical injuries identified in record review to malpractice claims. Thanks to the more stable claims environment in the mountain states, the task was significantly less onerous than had been the case in New York. Claims files were more detailed and readily accessible, and there were several dominant indemnity insurers. In Utah, we collected malpractice claims data from the state's major commercial insurer, the Utah Medical Indemnity Association, and two important self-insurers, Intermountain Health Care and the University Hospital. Together these entities are responsible for close to eighty percent of physician liability insurance policies written in Utah annually.

The malpractice insurance market in Colorado is dominated by the Colorado Physicians' Insurance Company ("COPIC"), which covers approximately three-quarters of insured physicians. One other commercial insurer, The Doctors' Company, and two self-insured institutions, Kaiser Permanente and the University Hospital, write most of the remaining policies. All four entities participated in our study which allowed us access to claims data from more than ninety percent of the physician liability insurance market in Colorado. This unprecedented level of cooperation by insurers, some of them business competitors, was largely due to the advocacy efforts of Howard and Williams.

As in the HMPS, we used computer-matching techniques to identify patients

99. *See id.*

100. *See* Lori B. Andrews et al., *An Alternative Strategy for Studying Adverse Events in Medical Care*, THE LANCET, Feb. 1, 1997, at 309, 309.

101. Chief among these differences is the fact that Andrews and colleagues focused on surgery—the area in which we had detected the highest rates of adverse events in the general hospital population we examined.

from the medical record review who filed malpractice claims during or after 1992.¹⁰² In addition to name, we used a range of demographic characteristics to test for matches, including date of birth, date of alleged injury, hospital, admission date, and discharge date. We began with fairly generous assumptions about the possibility of coincident identities. For example, ranges on birth dates were used, as were multiple phonetic variations on each name. We then moved through a process of eliminating false positives by closely inspecting each candidate match. Finally, after narrowing the candidate list to those sampled patients who had filed claims, a physician investigator compared the information in the relevant claims file to the record review documentation to ensure that the claim actually related to an episode of care examined during the record review.

We identified eighteen malpractice claims arising from records that we had reviewed, eight in Utah and ten in Colorado. Seven of the eighteen matched claims involved allegations of negligence relating to surgical procedures. Six claims involved allegations of a failure to diagnose or treat. Of the remaining five claims, three related to perinatal medical management and two related to miscellaneous primary care treatments.

The low number of matches was anticipated, given the relatively small sample size of both medical records and claims in the UCMPS, as compared to the HMPS. It meant that statistically significant differences between members of the matched group and the full sample of patients we studied in chart review were impossible to detect. Nonetheless, as Table 2¹⁰³ shows, the two groups appeared to diverge along several important dimensions: the matched or claimant group was slightly younger (mean of thirty-six years of age versus forty years of age years), a larger proportion was covered by private health insurance (seventy-percent versus fifty-two percent), none was uninsured, and only one was a Medicare beneficiary. As one would expect, adverse event and negligent adverse event rates were higher among the matched group than in the general medical population. (These were, after all, the select few patients who were motivated to sue.) However, the negligence rates, as determined *ex ante* by UCMPS record reviewers, were not as high as many might demand from an efficient, effectively functioning malpractice system. Of the eighteen matches, only four involved identifiable instances of negligence. Moreover reviewers had not even flagged the occurrence of an adverse event in ten of them.¹⁰⁴

102. For details of the software packages used and the algorithms that underlie the matching techniques, see generally M.A. Jaro, *Probabilistic Linkage of Large Public Health Data Files*, 14 STATISTICS IN MEDICINE 491 (1995); T.B. Newman & A.N. Brown, *Use of Commercial Record Linkage Software and Vital Statistics to Identify Patient Deaths*, 4 J. AMER. MED. INFORMATICS ASSOC. 233 (1997).

103. See Table 2, *infra*.

104. Eight of the 10 claims adjudged not to involve an adverse event on record review did not meet fundamental adverse event criteria. In the two cases that did meet these fundamental criteria, but were then adjudged not to be adverse events, physician reviewers found only slight to modest evidence (score of two) that management caused the injury in question. Of the eight claims judged to involve adverse events, reviewers were virtually certain that an adverse event had

Table 3¹⁰⁵ summarizes the relationship between negligent adverse events and claims across the four states in which population-based analyses of malpractice have been conducted over the past twenty-five years. The statistics shown in the table combine results from the record review and matching studies with information on claims volume in each state, and tell a remarkably consistent story about the claims-negligence dynamic.

The figures in Row 1 set the scene by illustrating the markedly different litigation environments that prevailed in the four states at the time of each study. California and New York were experiencing frenetic claims activity, whereas the situation in Utah and Colorado was relatively calm at the time of the medico-legal measurements in UCMPS. The high litigation rates on the East and West coasts are no doubt partly attributable to the medical malpractice "crises" that unfolded in the mid-1970s and mid-1980s. However, California and New York are distinctive in other ways that could affect claims, incidence of negligence, and negligence-claims dynamics: both are heavily populated, they are among the states with the highest lawyer to population ratios,¹⁰⁶ and both are renowned for having consistently high rates of malpractice litigation.¹⁰⁷

Row 2 of Table 3¹⁰⁸ restates findings from chart review: it illuminates that fact that volume of litigation has no significant bearing on the incidence of malpractice. Nor do litigation rates appear to affect accuracy of claiming, as shown in Row 4. However, fewer claims and steady negligence rates must mean that, what we have called, the malpractice gap narrows. Row 3 shows that the degree to which instances of substandard care outstrip claims that allege the same is less in Utah (ratio of 5.1 to 1) and Colorado (ratio of 6.7 to 1) than it was in the high litigation states of New York (ratio of 7.6 to 1) and California (ratio of 10.0 to 1). Taken together, the data in Table 3¹⁰⁹ suggest that the dysfunctional characteristics of the medical malpractice system—most notably, its *adequacy* and its *accuracy*—have a resilience over time and across jurisdictions when viewed through an epidemiological lens.

Two caveats are in order. First, regardless of the similarity in methods between the studies that generated these comparative data, any conclusions about inter-temporal and cross-regional trends must be tempered by an acknowledgment that these are not truly longitudinal data. Because we have no evidence that the disconnections observed between negligent injury and claiming behavior existed in the mountain states in earlier periods, we are unable to infer that it is insensitive to overall rates of claims, and stable across time and regions

occurred in five (score of six), they found strong evidence in two (score of five), and one was a borderline call (score of four). In the four claims judged negligent adverse events, reviewers either found strong evidence or were virtually certain of their judgment.

105. See Table 3, *infra*.

106. See AMERICAN BAR ASSOCIATION, *supra* note 67.

107. See UNITED STATES GENERAL ACCOUNTING OFFICE, MEDICAL MALPRACTICE: SIX STATE CASE STUDIES SHOW CLAIMS AND INSURANCE COSTS STILL RISE DESPITE REFORMS (1986).

108. See Table 3, *infra*.

109. See Table 3, *infra*.

of the country. However, our findings certainly lend plausibility to the argument that the findings from Utah, Colorado, New York, and California are a reasonably reflection of the situation in other states.

Second, just as claims or process focused studies can say little about the relationship between the epidemiology of negligence and claims, a population-based study like the UCMPS is not specifically designed to evaluate the performance of the malpractice system once a claim is initiated.¹¹⁰ There is some evidence to suggest that the malpractice system deals appropriately with the claims it receives.¹¹¹ Viewed as an omniscient perspective above the hospital floor, however, news of those system strengths may, to misquote the Gershwin brothers, sound like a sore case of "nice recompense if you can get it."

Which victims of negligence might express this sentiment, and what prevents them from "naming" their loss, "blaming" a provider or institution for it, and "claiming" compensation?¹¹² These questions led directly to the second set of analyses in our study of malpractice litigation. The raw comparison in Table 2¹¹³ between the claimants in our sample and the general study population hinted at important socio-demographic differences, especially in the age and insurance coverage. But to tease out the true association between whether or not individuals claim and their socio-demographic characteristics, it is necessary to use multivariate regression techniques.¹¹⁴

To understand what characteristics were associated with claiming in the HMPS, investigators had undertaken multivariate comparison of the fifty-one claims matched to chart reviews in that study with a specially selected group of "controls" from the larger study sample.¹¹⁵ But despite having nearly three times more claimants to work with than the UCMPS, the meager sample size limited the kind of analyses that were possible. Specifically, HMPS investigators could not measure factors that influenced claiming behavior *among patients who had suffered negligence* because only eight of the fifty-one fell into this group. In order to gather information on this population, and circumvent the sample size

110. See White, *supra* note 69, at 75-87

111. For an excellent summary of these studies, see MEDICAL MALPRACTICE AND THE AMERICAN JURY: CONFRONTING THE MYTHS ABOUT JURY INCOMPETENCE, DEEP POCKETS, AND OUTRAGEOUS DAMAGE AWARDS (1997). *But cf.* Brennan et al., *supra* note 56, at 1963-67.

112. William L.F. Felstiner et al., *The Emergence and Transformation of Disputes: Naming, Blaming, Claiming . . .*, 15 LAW & SOC'Y 631, 635-37 (1980-81).

113. See Table 2, *infra*.

114. Regression analysis is a statistical approach widely used in the social sciences to explain or predict the variability of a "dependent" variable (in this case, a patient's claimant status) using information about one or more "independent" variables" (e.g. age, gender, race etc.) Multivariate regression refers to analyses that use three or more independent variables. The principal advantage of regression techniques is that they allow researchers to examine the relation between a dependent variable and each independent variable while simultaneously "holding constant" the effect of the other independent variables. DAVID G. KLEINBAUM ET AL., APPLIED REGRESSION ANALYSIS AND OTHER MULTIVARIATE METHODS 36-40 (1988).

115. Helen R. Burstin et al., *Do the Poor Sue More?*, 270 JAMA 1679 (1993).

problem, we pursued a new analytical approach. We sought to take advantage of the wealth of information gathered in the UCMPS on 157 patients who were found to have suffered negligence but had not sued by comparing them to individuals who had sued for injuries allegedly suffered in 1992. Information on the latter group was obtained directly from insurers.

The differences hinted at in comparison of the matches with the general study population were borne out in multivariate analysis (Table 4).¹¹⁶ Predictably, people who did not claim despite having suffered negligence were more likely to have suffered minor injury (odds ratio ["OR"] 6.3; ninety-five percent confidence interval ["CI"], 2.7 to 14.9). Non-claimants were also much more likely to be Medicare recipients (odds ratio [OR], 3.5; ninety-five percent confidence interval [CI], 1.3-9.6), Medicaid recipients (OR, 3.6; ninety-percent CI, 1.4-9.0), seventy-five years or older (OR, 7.0; 95% CI, 1.7-29.6), and low income earners (OR, 1.9; ninety-five percent CI, 0.9-4.2).

As a result of work done in the HMPS, Burstin and colleagues had suggested that, when negligently injured, the elderly and the poor were less likely to sue for negligence.¹¹⁷ Other studies have yielded conflicting answers to this question¹¹⁸ and there is anecdotal evidence of a popular perception that the reverse is true, a perception which may well influence medical practice patterns.¹¹⁹ Our study lends weight to Burstin's suspicions.

How can the strong association between the sociodemographic factors we identified and underclaiming be explained? Financial incentives provide one explanation. Economic theories of tort law suggest that individuals who are poor, or who do not earn income, whether or not they are poor, will be less likely to sue.¹²⁰ Malpractice litigation is rarely initiated without attorney involvement, hence a prospective litigant's ability to claim typically hinges on an attorney's willingness to take on their case. Because the financial return accruing to plaintiffs' attorneys in tort cases is generally linked to the size of the award through contingency fees,¹²¹ and lost income typically forms a significant component of malpractice awards, a plaintiff's lawyer would tend to maximize

116. See Table 4, *infra*.

117. See Burstin et al., *supra* note 115, at 1679.

118. See generally U.S. CONGRESS, OFFICE OF TECHNOLOGY ASSESSMENT, DO MEDICAID AND MEDICARE PATIENTS SUE PHYSICIANS MORE OFTEN THAN OTHER PATIENTS? (1992); U.S. GENERAL ACCOUNTING OFFICE, PUB. NO. GAO/HRD-87-55, MEDICAL MALPRACTICE: CHARACTERISTICS OF CLAIMS CLOSED IN 1984, at 27 (1987); OPINION RESEARCH CORPORATION, AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS, HOSPITAL SURVEY ON OBSTETRICAL CLAIM FREQUENCY BY PATIENT PAYER CATEGORY (1988); Mark Sager et al., *Do the Elderly Sue Physicians?*, 150 ARCH. INTERNAL MED. 1091 (1990).

119. See LuAnn Dubay et al., *The Impact of Malpractice Fears on Cesarean Section Rates*, 18 J. HEALTH ECON. 491 (1999).

120. See generally WILLIAM H. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF TORT LAW (1987); STEVEN SHAVELL, ECONOMIC ANALYSIS OF ACCIDENT LAW (1987).

121. See generally HERBERT M. KRITZER, THE JUSTICE BROKER: LAWYERS AND ORDINARY LITIGATION (1990).

his own income by choosing to act for clients with ongoing sources of income.¹²² (Indeed, the costs of costs of bringing a claim may simply exceed the damages recoverable.) The elderly and the poor are particularly unlikely to generate income. Moreover, any income they do generate is less likely to be "lost" because of a decline in physical capacity occasioned by negligent injury. In addition, the size of any award to elderly patients will usually be constrained by their shorter life expectancy. Some elderly may also have trouble recognizing that they have suffered a medical injury, much less substandard care.

Other factors that we did not account for in our statistical analysis may also play a role in defining the non-claimant group. For example, a lower level of education, an inability to discern the occurrence of a negligent injury, a shorter life-expectancy, and the absence of third-party advice are all factors potentially related to both the distinctive characteristics of members of the non-claimant group we identified and their failure to bring suit. Regulatory barriers may also restrict the opportunity for poor patients to secure legal representation. For example, federal law prevents legal services attorneys, often the only attorneys available in poor neighborhoods, from taking on "fee generating" work such as malpractice, except in extenuating circumstances.¹²³ In addition, older, poorer patients may be simply more reluctant to sue than wealthier patients.

Whatever the true underlying cause of patients failure to claim despite having suffered negligence, the critique leveled at the efficacy of the current malpractice system is the same: factors other than individual merit appear to play a strong role in determining who uses the malpractice system and who receives compensation from it. These concerns should be understood in the context of our more general findings that claims lag well behind the incidence of negligent injury, and the two are seldom connected in the current system.

We believe these results generally validate the findings of the HMPS. As noted earlier, our biggest fear was that the New York data, gleaned from a somewhat unstable tort environment, would not be reflective of state malpractice litigation. This appears not to be the case. A significant gap exists between medical injuries and malpractice litigation, although it is probably not as large today as it was in the mid-1980s.

How generalizable are our measures of malpractice litigation to other states? By the end of the second tort crisis in the late-1980s, a mature industry of malpractice litigation had emerged. The number of plaintiffs' firms engaged in malpractice litigation in most metropolitan areas had stabilized. Also, most defense attorneys retained by insurance companies had ten to fifteen years of experience in this type of litigation. Over the course of the 1990s, we have seen the same sets of defendants' and plaintiffs' attorneys battling over similar cases.

122. See John C. Coffee, Jr., *Understanding the Plaintiff's Attorney: The Implications of Economic Theory for Private Enforcement of Law Through Class and Derivative Actions*, 86 COLUM. L. REV. 669, 678 (1986); Barry R. Furrow, *Medical Malpractice and Cost Containment: Tightening the Screws*, 36 CASE W. RES. L. REV. 985, 1022 (1985-86).

123. See 45 C.F.R. § 1609 (1999); Molly McNulty, *Are Poor Patients Likely to Sue for Malpractice?*, 262 JAMA 1391, 1391-92 (1989).

Claim rates have changed relatively little, although the average size of verdicts and settlements is increasing at a moderate rate.¹²⁴ This industry stability suggests to us that the UCMPS findings are likely to reflect the prevailing situation in most states.

C. *Economic Burden of Medical Injury*

Health service researchers faced with identifying the costs of medical injuries in the general population have two options.¹²⁵ They may survey injured individuals and use information about ongoing disability, health care utilization, and the range of restrictions a person's injury has imposed to calculate costs attributable to the injury. Alternatively, they may ask experts to estimate costs based on their experience and available information about the injured individual and the nature of the injury itself.

Using the former approach, the HMPS reported that adverse events among patients hospitalized in New York in 1984 led to \$3.8 billion in total health care costs.¹²⁶ This figure implied total national costs of slightly more than fifty billion dollars in 1984.¹²⁷ After carefully weighing a mix of considerations, including residual reservations from the HMPS about potential recall biases, resource constraints, and the ethical complexities associated with re-contacting patients with knowledge in hand both about injuries they had suffered and causes of those injuries, we chose to use experts' judgments in the UCMPS.

We began by creating a summary of each adverse event was created by having two physician-investigators, Thomas and Brennan, review the eleven-page form onto which physician reviewers had transcribed information about both the patient and the injury. These physician review forms included a narrative of the adverse event, various sociodemographic details about the patient, including occupation type, and a rating of severity of the disability made by the physician reviewers and confirmed by investigators.¹²⁸ To calculate disability, investigators first reviewed the adverse event summary and estimated the patient's disability, time off work, and lifetime health care utilization based on their own expert

124. See PHYSICIAN INSURER'S ASSOCIATION OF AMERICA, CLAIM TREND ANALYSIS (1997) (unpublished data on file with authors).

125. A third option may potentially exist for studies aimed at measuring injury costs in "closed" populations, such as workers compensation systems: investigators may gather information on lost wages and medical costs from administrative databases. For a methodology that approaches this technique see, e.g., MARK A. PETERSON ET AL., COMPENSATING PERMANENT WORKPLACE INJURIES: A STUDY OF THE CALIFORNIA SYSTEM (1997). Given the diffuse nature of administrative data sources that would generally collect cost information on injuries, however, this approach is infeasible in studies of injuries in general populations.

126. See Johnson et al., *supra* note 41, 2489.

127. See Thomas et al., *Costs of Medical Injuries*, *supra* note 80, at 255.

128. We used the used the National Association of Insurance Commissioners Severity of Injuries Scale. See NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS, MALPRACTICE CLAIMS: FINAL COMPILATION (M. Sowka ed., 1980).

judgment. Health care utilization estimates included number of inpatient days, outpatient visits, home health visits, physical and occupational therapy sessions, nursing home stays, and medication and medical supplies likely to be occasioned by the injury, as distinct from whatever other underlying illnesses or diseases the patient may have been suffering at the time. Next, four experienced malpractice claims adjusters from Utah and six from Colorado reviewed the case summaries and made their own estimates on each of the same measures. The investigators and adjusters then met to discuss the results and reach a consensus where there were disagreements.

Disability and health care utilization estimates were converted into dollars by applying unit costs drawn from a range of sources. The Census Bureau's Current Population Survey ("CPS") was used to identify mean annual income for each injured patient, taking into account their age bracket, gender, and occupation.¹²⁹ In some cases, the latter was missing from the physician review form so only gender and age were used. We emulated real earnings growth by inflating income at an annual rate of 0.7%.¹³⁰

When the injuries suffered were permanent and disabling, or the patient died due to an adverse event, we estimated lost income up to the expected age of death or seventy-five, assuming that earnings would be negligible after the age of seventy-five. Life expectancy was estimated by returning to CPS data. Some adjustments were made for life expectancy, given that many patients had adverse events as part of other co-morbid illness. The study investigators jointly estimated life expectancy for those individuals we doubted would recover sufficiently to reach average life expectancy. We also controlled for labor participation rates by using CPS data on labor force participation. Fringe benefits were assumed to be equal to twenty-seven percent of gross income and were added if a patient suffered permanent disability or death.¹³¹

In addition to lost wages, we estimated lost household production to account for the fact that some adult patients would be unable to perform household duties such as childcare, cooking, and cleaning because of their injuries.¹³² Here, we used a replacement costs method, calculating the amount it would have cost to hire someone else to perform the task. We relied on the precedent of Utah's no-fault automobile insurance system to value such household production at twenty dollars per day, a paltry sum, but consistent with per diem figures used in other independent research in this area.¹³³

129. See BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, STATISTICAL ABSTRACT OF THE UNITED STATES 1994 (114th ed. 1994).

130. See ECONOMIC REPORT OF THE PRESIDENT 332, tbl. B-45 (1996).

131. See BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, EMPLOYER COSTS FOR EMPLOYEE COMPENSATION (1992).

132. In the case of adverse events resulting in death, it was also necessary to apply some of the finer points of labor economics and make a deduction from the household production figure; the deduction represents the amount that deceased individuals would have spent on personal expenses, such as food and clothing, had they not died.

133. See, e.g., W. KEITH BRYANT ET AL., COLLEGE OF HUMAN ECOLOGY, CORNELL

Health care costs were more straightforward to estimate. We derived average payments for inpatient days from health insurers in each state. Physician fees were based on a survey of physicians in the western United States.¹³⁴ Pharmaceutical costs could be estimated by using the average wholesale price for drugs, obtained from the Red Book of pharmaceutical prices.¹³⁵ We employed Medicaid average per patient payments to nursing homes for those patients for whom admission to long-term care was projected.¹³⁶

Each of these key expenditure items, lost wages, lost household production, and health care costs, were then incorporated into an economic consequences model. We multiplied the population weight of each patient, determined by the sampling scheme, times the economic consequences calculated for that patient's adverse event. We discounted to 1996 dollars for future costs, using a real interest rate of 2.75%. Finally, data for the two states were combined in the interests of achieving more stable estimates.

The total economic consequences of all adverse events estimated to have occurred in Utah and Colorado in 1992 were \$661.9 million, as shown in Table 5.¹³⁷ A subset of all adverse events judged to have been preventable accounted for nearly one-half of this total, or \$308.3 million.¹³⁸ Postoperative complications and adverse drug events were the most expensive type of adverse events, with the former giving rise to \$232 million in costs and the latter, \$213.7 million.

The largest share of the total was accounted for by health care costs. More than \$348 million was spent on treatment resulting from adverse events suffered in hospitals in the two states in 1992. (Lost household wages were the second highest component, accounting for \$160.9 million.) Surprisingly, one-half of these health care costs were attributable to nursing home care expenditures. Inpatient hospital costs absorbed the next largest portion (forty-one percent), followed by non-intensive care bed days (thirty-one percent) and intensive care (ten percent). In total, the health care costs of adverse events in Utah and Colorado that accrued in outpatient settings, inclusive of nursing home costs,

UNIVERSITY, THE DOLLAR VALUE OF HOUSEHOLD WORK (1992).

134. See Mark Crane, *What Your Colleagues Are Charging*, 69 MED. ECON. 190, 191-217 (1992).

135. See MONTALVE, RED BOOK: MEDICAL ECONOMICS DATA (1992).

136. See HEALTH CARE FINANCING ADMINISTRATION, U.S. DEP'T OF HEALTH AND HUMAN SERVICES, PUB. NO. 03354, STATE DATA BOOK ON LONG-TERM CARE PROGRAM AND MARKET CHARACTERISTICS (1994).

137. See Table 5, *infra*.

138. Using similar methods to those used by Wilson and colleagues in the Australian study of adverse events, see Thomas et al., *supra* note 98, Thomas and Brennan rendered a judgment about the preventability of each adverse event. This process was separate from and subsequent to identification of the adverse events themselves in record review. Like negligence, and the adverse event judgment itself, preventability judgements were recorded on a six-point confidence scale, see *supra* note 33 and accompanying text. Similar implicit judgment methodologies have been used by other researchers to judge preventability of adverse events. See, e.g., David W. Bates et al., *Incidence of Adverse Drug Events and Potential Adverse Drug Events*, 274 JAMA 29 (1995).

were nearly twice as large as the inpatient costs. This finding is all the more remarkable when one considers that adverse events suffered in the inpatient setting were the focus of the UCMPS.

When extrapolated to the thirty-three million discharges from American hospitals in 1992, our estimates put annual costs of adverse events nationwide at approximately thirty-eight billion dollars. This is smaller, although not greatly dissimilar, to the fifty billion dollar figure derived from patient interviews in the HMPS.¹³⁹ Of course, some of this difference is driven by the slightly higher adverse event rate detected in New York. When adjusted to 1996 dollars and recalculated with UCMPS adverse event rates, the New York data suggest annual costs of \$147 per capita; the UCMPS estimates are \$132 per capita. Some of the residual differential between these figures is explained by the greater severity of injuries in New York. However, the proximity of the two estimates is noteworthy in light of the fact that the studies used two quite different methodologies.

One lesson from our cost analyses concerns the importance of looking beyond inpatient health care costs in estimating the effects of iatrogenic injury. Our estimates suggest that more than sixty percent of total health care costs may be generated outside the hospital. This, in turn, suggests that other studies of adverse event that have focused exclusively on inpatient costs—for example, those undertaken in the field of drug-related adverse events¹⁴⁰—are likely to have missed the full economic implications of the medical injuries they examined. Even UCMPS estimates of outpatient care are appropriately interpreted as a lower bound on these costs for two reasons. First, as noted above, inpatient adverse events were the unit of analysis in our study. Those injuries that transpired exclusively in the outpatient setting would not have been captured. Second, we used average Medicaid payments in each state as an indicator of costs; such payments do not consider out-of-pocket spending or private insurance costs associated with the injuries.

Our findings also provide some targets for improvement. The costliest areas appear to be surgical adverse events, adverse drug events, and those adverse events due to incorrect diagnoses. Front-end expenditures devoted to preventing medical error in these areas could yield savings overall, although precise estimates of the cost trade-offs involved are desperately needed. Thus, the next phase of research into the economic consequences of medical injury may well belong to cost-effectiveness analysts. We believe the input of researchers in this field may well be the key to hastening market-driven quality improvement efforts. But even without the benefit of such analyses, the economic research to date suggests that, as a whole, American hospitals are almost certainly underspending in their efforts to prevent adverse events. More than one-half of the adverse events we detected were judged preventable. If such prevention occurred, it would relieve the U.S. health care system of nearly twenty billion dollars in

139. See Thomas et al., *Costs of Medical Injuries*, *supra* note 80, at 260-61.

140. See David W. Bates et al., *The Costs of Adverse Drug Events in Hospitalized Patients*, 277 JAMA 277 (1997); David C. Classen et al., *Adverse Drug Events in Hospitalized Patients Excess Length-of-Stay Extra Costs Attributed Mortality*, 277 JAMA 301 (1997).

health care costs, or two percent of present health care expenditures.¹⁴¹ A greater investment in prevention strategies is crucial.

D. The Persistent Question: How to Improve Compensation of Medical Injuries?

Many commentators have suggested that alternative approaches to compensating medical injuries should be considered in the United States.¹⁴² An administrative system, somewhat similar to current workers' compensation regimes, that does not make compensation contingent on proof that fault or negligence caused the injury in question, has long been heralded as the best candidate.¹⁴³ But many concerns have been raised about the notion of a pure "no-fault" system, the principal one being that such a system would be inordinately expensive to operate in his country.¹⁴⁴ To some extent, our own findings in the HMPS and the UCMPS about the size of the medical injury problem, and associated costs, may be interpreted as bolstering this argument. Recalling the grand total reported in the previous section, a price tag of more than \$650 million would substantially exceed the resources currently channeled into the medical malpractice systems in Utah and Colorado. According to our best estimates, and those of our collaborators in Utah and Colorado, malpractice premiums paid in those states in 1996 totaled approximately \$60 million and \$100 million

141. See BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, STATISTICAL ABSTRACT OF THE UNITED STATES 1997, Table 155.

142. See generally DANZON, *supra* note 2; Joshua Fruchter, *Doctors on Trial: A Comparison of American and Jewish Legal Approaches to Medical Malpractice*, 19 AM. J.L. & MED. 453 (1993); Clark C. Havighurst & Laurence R. Tancredi, "Medical Adversity Insurance"—A No-Fault Approach to Medical Malpractice and Quality Assurance, 51 MILBANK Q. 125 (1973); Michael A. Jones, *Medical Injury—The Fault with No-Fault*, 83 PROF. NEG. (1987); Jeffrey O'Connell, *No-Fault Insurance for Injuries Arising from Medical Treatment: A Proposal for Elective Coverage*, 24 EMORY L.J. 21 (1975); Geoffrey Palmer, *The Ninth Monsanto Lecture: The Design of Compensation Systems: Tort Principles Rule, O.K.?*, 29 VAL. U. L. REV. 1115 (1995); Michael J. Saks, *Do We Really Know Anything About the Behavior of the Tort Litigation System—and Why Not?*, 140 U. PA. L. REV. 1147 (1992); Carolyn Sappideen, *No Fault Compensation for Medical Misadventure—Australian Expression of Interest*, 9 J. CONTEMP. HEALTH L. & POL'Y 311 (1993); Stephen D. Sugarman, *Doing Away with Tort Law*, 73 CAL. L. REV. 558 (1985).

143. See generally Paul C. Weiler, *The Case for No-Fault Medical Liability*, 52 MD. L. REV. 908 (1993).

144. See Elliott M. Abramson, *The Medical Malpractice Imbroglia: A Non-Adversarial Suggestion*, 78 KY. L.J. 293, 304 (1989-1990); Randall R. Bovbjerg, *Medical Malpractice: Research and Reform*, 79 VA. L. REV. 2155 (1993) (reviewing WEILER ET AL., *supra* note 37); Jerry L. Mashaw & Theodore R. Marmor, *Conceptualizing, Estimating, and Reforming Fraud, Waste, and Abuse in Health Care Spending*, 11 YALE J. ON REG. 455, 486-87 (1994); Michael J. Saks, *Medical Malpractice: Facing Real Problems and Finding Real Solutions*, 35 WM. & MARY L. REV. 693, 704-05 (1994) (reviewing WEILER ET AL., *supra* note 37); Steven D. Sugarman, *1499 Doctor No*, 58 U. CHI. L. REV. 1499-1516 (1991) (reviewing WEILER, *supra* note 13).

respectively.¹⁴⁵

However, this kind of cost comparison is far too simplistic. Medical malpractice litigation compensates lost wages and some of the other losses we accounted for in our economic consequences calculations. But certain medical costs and lost household production are not always addressed in tort awards. Conversely, our totals did not figure in some losses, most notably pain and suffering, that the medical malpractice system includes in awards. But more important than adjustment of these line items is the broader recognition that it is both naïve and misleading to assess the merits of no-fault by imagining a scheme that would attempt to compensate the universe of iatrogenic injury. No such scheme has ever been seriously proposed—indeed, administrative practicalities would render it inoperable.

Given the policy imperatives that motivated the UCMPS, evaluation of the economic feasibility of a practical, workable no-fault scheme was a key study goal from the outset. HMPS investigators had completed some interesting theoretical analyses of the feasibility of a no-fault program for compensating medical injuries, but they did not undertake a detailed assessment of its design or affordability.¹⁴⁶ The leading contribution to design work in medical no-fault systems comes from Bovbjerg and Tancredi, who developed an innovative set of administrative compensation criteria. Designated compensable events (“DCEs”), and their later manifestation, accelerated compensation events (“ACEs”), are criteria used for the purpose of efficiently deciding the question of compensation with certain types of injury.¹⁴⁷ Building on Bovbjerg and Tancredi’s ideas, we investigated design options for a more encompassing scheme. We were attracted to the Swedish Patient Injury Compensation Fund.¹⁴⁸ Sweden has successfully operated the Fund, an administrative compensation program, for the past two decades. The criteria used do not contemplate all adverse events as compensable injuries. Rather, they incorporate consideration of the “avoidability” of the

145. See David M. Studdert et al., *Can the United States Afford a "No-Fault" System of Compensation for Medical Injury?*, 60 LAW & CONTEMP. PROBS. 1, 31 (1997).

146. See WEILER ET AL., *supra* note 37, at 104-09.

147. DCEs are predetermined categories of medical injuries that are identified by medical experts as statistically preventable given appropriate management. Proposals for systematic use of such devices have been termed "selective no-fault": on the one hand, only those medical injuries selected for coverage by professional judgment are included. ABA COMMISSION ON MEDICAL PROFESSIONAL LIABILITY, DESIGNATED COMPENSABLE EVENT SYSTEM: A FEASIBILITY STUDY 8 (1990); Randall R. Bovbjerg et al., *Obstetrics and Malpractice: Evidence on the Performance of a Selective No-Fault System*, 265 JAMA 2836, 2836 (1991); Havighurst & Tancredi, *supra* note 142; Laurence R. Tancredi & Randall R. Bovbjerg, *Rethinking Responsibility for Patient Injury: Accelerated Compensation Events, A Malpractice and Quality Reform Ripe for a Test*, 54 LAW & CONTEMP. PROBS. 147, 149 (1991).

148. See Carl Oldertz, *The Patient, Pharmaceutical and Security Insurances*, in COMPENSATION FOR PERSONAL INJURY IN SWEDEN AND OTHER COUNTRIES 51 (Carl Oldertz & Eva Tidefelt eds., 1998).

injury—a notion we have previously described in detail.¹⁴⁹ Avoidability essentially turns on whether the physicians could reasonably have acted in a way that would have averted the injury at issue. Thus, it closely approximates the preventability judgments to which we subjected all adverse events detected in the UCMPS as part of the economic analyses.¹⁵⁰

We hypothesized that designing a no-fault program around compensation criteria that incorporated an avoidability/preventability component would demarcate a generous, yet manageable, body of medical injuries as eligible for compensation. In conceptual terms, the size of the pool of injuries contemplated lies between all adverse events (i.e., pure no-fault) and negligent adverse events (i.e., the malpractice system).¹⁵¹ We further hypothesized that compensating all avoidable adverse events would not be prohibitively expensive. It was anticipated that the costs would in fact be comparable to those of the tort system because expenditures associated with the increased number of awards in our model would largely be offset by administrative savings and the use of slightly more modest awards than those parceled out in litigation.

Some stakeholders in Utah and Colorado indicated at the outset that a model that did not include pain and suffering would be politically untenable. Most administrative compensation schemes do not address pain and suffering, primarily because they do not rely on juries, and quantum of non-economic losses has largely been understood as a jury determination.¹⁵² Previous analysis of jury verdict data by Bovbjerg and colleagues provided us with an opportunity to obtain “average” non-economic awards made to plaintiffs within specific age and disability strata.¹⁵³ To include consideration of the costs associated with other components of a reasonable compensation package—including lost wages, lost household production, and health care costs—we replicated calculations from our economic consequences analyses.

Use of the Swedish avoidability criteria yielded estimates of the total compensation budget, including projected administrative costs, which were significantly lower than the total injury costs obtained in our earlier analysis of the economic consequences of medical injury. Costs are further decreased if an eight-week disability (or “deductible”) period is added as a prerequisite to accessing compensation¹⁵⁴ In Utah, the total for compensating the Swedish

149. Studdert et al., *supra* note 145, at 104-09.

150. We had found that approximately one-half of the adverse events were preventable, roughly double the number that could be attributed to negligence. *See supra* note 138.

151. *See* Studdert et al., *supra* note 145, at 8.

152. *See* MICHAEL L. BROOKSHIRE & STAN V. SMITH, *ECONOMIC/HEDONIC DAMAGES: THE PRACTICE BOOK FOR PLAINTIFF AND DEFENSE ATTORNEYS* 161-66 (1990); Steven P. Croley & Jon D. Hanson, *The Nonpecuniary Costs of Accidents: Pain-and-Suffering Damages in Tort Law*, 108 HARV. L. REV. 1785, 1837-41 (1995).

153. Randall R. Bovbjerg et al., *Valuing Life and Limb in Tort: Scheduling Pain and Suffering*, 83 NW. U. L. REV. 908, 937 (1989).

154. A deductible or threshold period eliminates relatively minor injuries from the pool of injuries eligible for compensation. It also has the benefit of channeling available funds to victims

compensable events with an eight-week disability period, inclusive of pain and suffering, lost wages and household production, and health care costs was \$76.8 million.¹⁵⁵ In Colorado, the costs were almost exactly \$100 million.

Table 6¹⁵⁶ compares of the affordability of candidate no-fault schemes by comparing their cost to estimates of the cost of the current medical malpractice system in each state. In Utah, one approach to compensation under consideration during the UCMPS proposed use of Swedish compensable events, a \$100,000 cap on pain and suffering, a four week disability period, no household production, and sixty-six percent wage replacement. The estimated costs of such a program, after addition of administrative and birth injury costs, would be \$54.9 million. In Colorado, the preferred model also involved use of Swedish compensable events, an eight-week disability period, and did not include household production. Our calculations suggested total system costs of \$102.4 million for Colorado.

Thus, our cost estimates for the Swedish-style systems in Utah and Colorado compare favorably to the tort system: at \$54.9 million, the Utah model would cost approximately the same as the tort system, while at eighty-two million dollars, the Colorado model would actually be expected to reduce the costs of compensating medical injury by eighteen million to twenty-eight million dollars annually. To keep these estimates in perspective, it is worth noting that in 1992, our study year, total personal health care expenditures were \$3.8 billion in Utah and \$9.4 billion in Colorado.¹⁵⁷

Table 7¹⁵⁸ shows the "ratcheting" effects of removing household production and pain and suffering, items that some policy makers may believe are dispensable. The table also shows how the number of beneficiaries shifts with the selection of different deductible periods. For example, the number of patients eligible for compensation in Colorado decreases from 5919 to 1604 with use of a four-week deductible period, and to 973 with an eight-week period. Proportionally similar decreases occur in Utah when these time thresholds are applied.

More generally, Table 7¹⁵⁹ illustrates the modular nature of the various components of the compensation package. Policymakers could use these methods

whose losses that are least likely to be covered by other sources of coverage, such as sick pay for time lost from work. See Theodore F. Haas, *On Reintegrating Workers' Compensation and Employers' Liability*, 21 GA. L. REV. 843, 891-95 (1987). In addition, we have previously noted that application of a disability threshold can be expected to confer administrative, as well as financial, benefits. Disentangling the harmful consequences of the original illness from those attributable to the medical injury itself is a problem that is most acute in the immediate post-treatment period. See WEILER ET AL., *supra* note 37, at 101-03.

155. These figures are in discounted 1996 dollars. For a detailed explanation of these calculations, see Studdert et al., *supra* note 145, at 26 (Tab. 2).

156. See Table 6, *infra*.

157. See Katherine R. Levit et al., *State Health Expenditure Accounts: Building Blocks for State Health Spending Analysis*, 17 HEALTH CARE FIN. REV. 201, 231 Tab. 11 (1995).

158. See Table 7, *infra*.

159. See *id*.

to project the costs of high priority components in a compensation plan and to test the budgetary impact of adding or eliminating other components. Decisions about the trade-offs involved across dimensions—the number of patients eligible for compensation, for example, and the importance of household production to awards—could play out in public and legislative debates around appropriate uses of scarce resources. Of course, such decisions go to the central problem of distributive justice in compensation.

Estimates such as those made the UCMPS inject some operational realities into the debate about distributive justice. The view often espoused by plaintiffs' advocates is that when a medical injury occurs because of the negligence of a physician or hospital, it should be compensated and compensated generously. As we have seen, however, the present system comes nowhere close to realizing this ideal. It is quite haphazard and fails to compensate many worthy individuals. Moreover, our analyses demonstrate that distributive justice is further undercut by systematic differences along socio-demographic lines in the enjoyment of what compensation the malpractice system does provide.

But even when inefficiencies and inequities in the compensation process are reduced, the central problem of distributive justice remains: how should scarce resources be allocated?¹⁶⁰ An administrative compensation scheme cannot circumvent this difficult question. But it would allow stakeholders to agree upon eligible injuries and obtainable remedies in advance, which should promote equity, predictability and efficiency in the distribution process. In other words, an important feature of such a system would be to make more explicit the criteria used for the allocation and distribution of resources used to compensate medical injury. At some level, explicit rationing must enter the fray, in the form of decisions to exclude household production losses, for example, or exclusion of injuries that caused disability lasting less than eight weeks. But we believe this approach is preferable to the implicit rationing that occurs by virtue of the fact that many victims of medical injury cannot or do not obtain compensation for their injuries from the Byzantine tort system.

Another advantage of a no-fault approach that warrants mention is that, if carefully designed, it could eliminate much of the adversarial nature of medical malpractice litigation.¹⁶¹ We were astonished to find that physicians in Sweden actively participate in sixty to eighty percent of the claims that are made, helping their patients complete and file the relevant forms.¹⁶² Compensation appears to be culturally ingrained there as a matter of social justice, not as an admission of provider guilt or negligence. At its best, the injury compensation process in Sweden supports, rather than conflicts, with the health care professional's

160. See, e.g., AMARTYA SEN, *INEQUALITY REEXAMINED* (1995); Arti Kaur Rai, *Rationing Through Choice: A New Approach to Cost-Effectiveness Analysis in Health Care*, 72 *IND. L.J.* 1015 (1997).

161. See Bovbjerg & Sloan, *supra* note 19, at 71-72. See generally David M. Studdert et al., *The Jury Is Still in: Florida's Birth-Related Neurological Injury Compensation Association After a Decade*, 25 *HEALTH POL. POL'Y & L.* 469 (2000).

162. See Studdert et al., *supra* note 145, at 6.

commitment to the patient and to excellence in medical practice.

CONCLUSION

The main objectives of the UCPMS were to test the results of the HMPS in a new health care environment and to explore the feasibility of a no-fault system for compensating medical injury. With support from the Robert Wood Johnson Foundation, cooperation from hospitals, physicians and malpractice insurers in Utah and Colorado, and the efforts of numerous collaborators, these objectives were achieved. Overall, the UCMPS lent strong support to the iatrogenic injury rates, economic calculations, and malpractice patterns estimated in New York nearly a decade earlier. The UCMPS findings were no carbon copy, however. For instance, we found significantly lower iatrogenic death rates in Utah and Colorado. We also gained fresh insights into the burden of iatrogenic injury by investigating previously understudied areas, such as the resources devoted to outpatient services to treat the after-effects of adverse events.

The results of our efforts to conceptualize an administrative compensation scheme based on avoidability criteria and project its costs, provide considerable cause for optimism about the feasibility of a no-fault system. Even before our work was complete, however, it was apparent in both states that the enthusiasm of our collaborators would not be sufficient to transform the no-fault initiative into political action. The 1990s had contravened the predictions of some pundits,¹⁶³ failing to produce the sort of malpractice "crisis" experienced in the preceding two decade. Relative stability in malpractice insurance markets appeared to sap legislative interest in large-scale tort reform.

Thus, it is not without some foundation that skeptics may conclude that the true mission of the UCMPS failed; its empirical findings have not been used to inform meaningful policy reform. We prefer to take a longer-term view of the value of the study. It is our hope that when the political winds shift, a probable occurrence given a history of cyclical interest in alternative compensation approaches in the United States,¹⁶⁴ the UCMPS methods and findings stand ready to be used by other policymakers who become interested in no-fault. Ironically, hints of just such a shift have surfaced at the federal level over the past six months. But rather than being borne of dissatisfaction with the malpractice system as a mechanism for compensating injured patients, interest in malpractice alternatives has been invigorated by a spate of media and political attention directed at error in medicine. In particular, the widely-publicized report, *To Err is Human*, issued by the Institute of Medicine in December 1999, appears to have raised the public awareness about the burden of medical error to a new level.¹⁶⁵

163. See Walter J. Wadlington, *A Medical Malpractice Crisis in 1995?: Some Conceivable Scenarios*, 36 ST. LOUIS U. L.J. 897 (1992).

164. See generally Bovbjerg & Sloan, *supra* note 19.

165. See *TO ERR IS HUMAN: BUILDING A SAFER HEALTH SYSTEM* (L.T. Kohn et al. eds., 1999). For examples of the media attention that surrounded release of the report, see, e.g., Bob David & Julie Appleby, *Medical Mistakes 8th Top Killer*, USA TODAY, Nov. 30, 1999, at 1A; Ellen

The link between no-fault and error reduction is quite compelling. As the report makes clear, many errors fall into the avoidable category and could be reduced if proper error-prevention strategies are put into place. Although the science of error reduction in medicine is in its infancy and much remains to be learned about what strategies work best and how they should be implemented, it is already clear that attention to individual provider judgment and action, hallmarks of the malpractice system, will not be an important ingredient in solutions.¹⁶⁶ On the contrary, there is a growing sense that this orientation feeds the problem. The most promising possibilities for advancement appear to lie in interventions designed to modify the systems in which medicine is practiced, together with ignition of the sort of professional commitment to error-reduction that has developed in certain areas of the airline industry.¹⁶⁷

In addition, we believe that eliminating the specter of litigation would also remove *the* principal barrier to the free flow of information about medical errors. A centrally maintained registry of avoidable events could be an important source of data for those interested in applying continuous quality improvement and epidemiological techniques to prevent errors. A no-fault compensation authority could assume this function, but it is incompatible with the current structure of the medical malpractice industry. At present, most medical liability insurers maintain their research in a manner heavily geared toward defense objectives. There is no overarching classification scheme and error-related aspects of individual claims are ignored, unless directly related to the question of negligence. Thus, it is virtually impossible to undertake cross-insurer comparisons of medical malpractice claims and no single insurer has a sufficient number of claims to support serious epidemiological analysis. A central registry, maintained with an administrative compensation scheme, would solve these problems. It could also be designed to integrate human factor analysis and other classifications that are helpful to error-prevention technologies and be updated as the science evolves.

This is certainly a very hopeful scenario for the integration of error prevention with an administrative compensation scheme. But an avoidability-based compensation scheme could provide an enormous boost to error reduction efforts by aligning the foci of the compensation and quality improvement systems and centering attention on precisely those injuries that are eradicable.¹⁶⁸

Goodman, *In Hospitals, to Err Is Human, to Fess Up Is Necessary*, BOSTON GLOBE, Dec. 9, 1999, at A23; Robert Pear, *Group Asking U.S. for New Vigilance in Patient Safety*, N.Y. TIMES, Nov. 30, 1999, at A1.

166. See Donald M. Berwick & Lucian L. Leape, *Reducing Errors in Medicine: It's Time to Take This More Seriously*, 319 BRITISH MED. J. 136 (1999).

167. See generally Robert L. Helmreich, *On Error Management: Lessons from Aviation*, 320 BRITISH MED. J. 781; Leape, *supra* note 47. Evidence that progress in reducing the burden of iatrogenic illness lies in these directions has begun to accumulate. See Brennan, *supra* note 94.

168. See Liang, *supra* note 48.

**FIGURE 1. OVERVIEW OF THE RECORD REVIEW
PROCESS IN COLORADO (CO) AND UTAH (UT)**

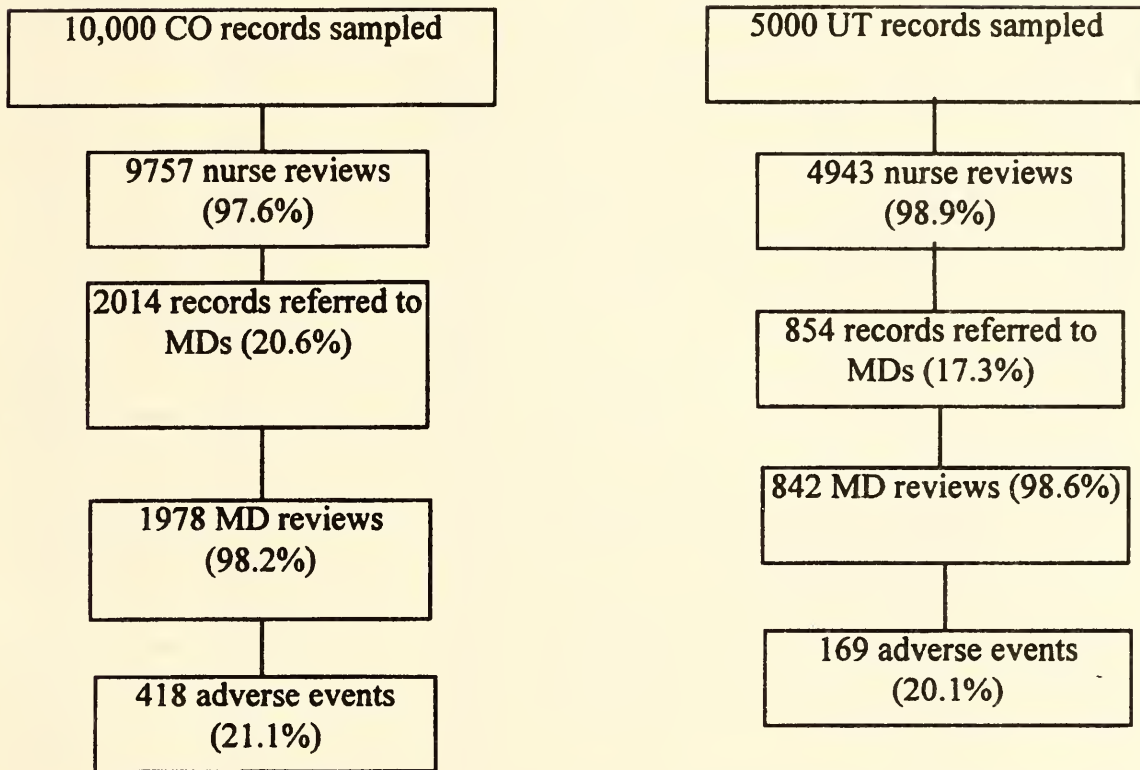


TABLE 1. TYPES OF ADVERSE EVENTS

Type	Adverse Events	(%) [*]	% of AEs with Negligence
Operative	7715	(44.9)	16.9
<i>Technical</i>	2309	29.9	23.6
<i>Bleeding</i>	1319	17.1	9.8
<i>Wound infection</i>	877	11.4	20.8
<i>Non-wound infection</i>	775	10.0	7.5
Drug	3325	(19.3)	35.1
<i>Antibiotic[*]</i>	828	24.9	6.8
<i>Cardiovascular agent</i>	579	17.4	38.9
<i>Analgesic</i>	297	8.9	33.3
<i>Anticoagulant</i>	286	8.6	25.1
Medical procedure	2315	(13.5)	15.3
Incorrect or delayed diagnosis	1181	(6.9)	93.8
Incorrect or delayed therapy	736	(4.3)	56.8
Post-partum	620	(3.6)	25.5
Neonatal	532	(3.1)	25.3
Anesthesia-related	226	(1.3)	32.7
Falls	220	(1.3)	65.8
Fracture-related	66	(0.4)	0
Other	256	(1.5)	59.9
Total	17,192		

* Percentages shown for the subtypes of Operative and Drug-related adverse events represent proportions of the total number of adverse events in the relevant category (i.e., 7715 and 3325, respectively)

TABLE 2. DESCRIPTIVE CHARACTERISTICS OF MATCHED AND STUDY SAMPLES

Patient Characteristics	Claimants matched to study sample	Study sample
No. of subjects	18	14,700
Female	10 (55%)	9,077 (61%)
Non-white	3 (16%)	3,197 (22%)
Mean age	36 ± 21	40 ± 27
Median household income	30,000	--
Adverse events *	8 (44%)	587 (4%)
Negligent adverse events †	4 (22%)	161 (1%)
Payer †		
Medicare	1 (5%)	3,767 (26%)
Medicaid	3 (15%)	2,223 (15%)
Uninsured	0 (-)	891 (6%)
Private/other	13 (75%)	7,703 (52%)
Disability †*		
Minor	1 (25%)	279 (48%)
Significant	5 (62%)	238 (41%)
Major	2 (13%)	49 (8%)

* Statistical difference between matched claimants and study sample at $p < 0.05$ level using Fisher's exact and Wilcoxon tests, as appropriate.

† Payer categories may not add to 100% due to missing values.

‡ Adverse events only.

TABLE 3 RELATIONSHIP BETWEEN NEGLIGENT ADVERSE EVENTS AND CLAIMS.

Relationship	Utah 1992	Colorado 1992	New York 1984	California 1976
Claims per 100 physicians per year	7.1	7.3	14.0	17.4
Negligent adverse event rate (per 100 discharges)	0.90	0.80	1.00	0.79
Ratio of negligent adverse events to claims	5.1	6.7	7.6	10.0
Probability claim follows negligent adverse event	2.5%		1.5 %	--

TABLE 4. MULTIVARIATE ODDS OF FAILURE TO CLAIM DESPITE NEGLIGENCE BY SOCIO-DEMOGRAPHIC CHARACTERISTICS (COLORADO, INCIDENT YEAR 1992)

Characteristics	Non-claimants compared to all claimants (<i>n=109 and 256, respectively</i>)
Female	1.4 (0.8-2.6)
Patient age [‡]	
< 18 yrs	1.0 (0.3-3.3)
45 to 64 yrs	1.7 (0.8-3.6)
65 to 74 yrs	2.2 (0.6-7.3)
≥ 75 yrs	7.0 (1.7-29.6) *
Payer [§]	
Medicare	3.5 (1.3-9.6) *
Medicaid	3.6 (1.4-9.0) *
Uninsured	2.0 (0.7-5.8)
Income	
Poor	2.0 (0.8-5.3)
Low income	2.0 (0.9-4.2) †
High income	0.8 (0.3-1.8)
Disability [¶]	
Minor	6.3 (2.7-14.9) *
Significant	1.7 (0.8-3.9)

* $P < 0.05$.

† $P < 0.1$

‡ Reference group was patients aged 18 to 44 yrs

§ Reference group was privately insured

|| Reference group was middle income

¶ Reference group was major disability

**TABLE 5. COSTS OF ADVERSE EVENTS AND PREVENTABLE
ADVERSE EVENTS IN UTAH AND COLORADO
(THOUSANDS, DISCOUNTED TO 1996 DOLLARS)**

	All Adverse Events (%)	Preventable Adverse Events (%)
Health care costs	348,081 (53)	159,245 (52)
Lost wages	160,946 (24)	63,309 (20)
Lost household production	152,862 (23)	85,828 (28)
Total	661,889 (100)	308,382 (100)

TABLE 6
AFFORDABILITY OF PREFERRED NO-FAULT MODELS IN UTAH AND COLORADO
(MILLIONS, DISCOUNTED TO 1992 DOLLARS)

State	Estimates of Preferred No-Fault Models	Current Malpractice System Costs
Colorado	\$ 82.0 [†]	\$ 100-110

* Based on use of Swedish compensable events; \$100,000 cap on pain and suffering; four week disability period; no household production; 66% wage replacement.

† Based on use of Swedish compensable events; eight-week disability period; no household production.

TABLE 7
ECONOMIC CONSEQUENCES OF SWEDISH COMPENSABLE EVENTS
(MILLIONS, DISCOUNTED TO 1992 DOLLARS)

	Utah	Colorado
Any Disability	(N=2,940)	(N=5,919)
Total	\$90.90	\$128.88
Less Household Production	\$60.38	\$90.55
Less Household Production and Pain & Suffering	\$27.16	\$38.51
 <i>>4 Weeks Disability</i>	 (N=1,465)	 (N=1,604)
Total	\$82.55	\$84.23
Less Household Production	\$52.42	\$52.99
Less Household Production and Pain & Suffering	\$25.22	\$21.21
 <i>>8 Weeks Disability</i>	 (N=889)	 (N=973)
Total	\$76.78	\$87.44
Less Household Production	\$45.96	\$52.18
Less Household Production and Pain & Suffering	\$20.96	\$19.97