Journal of Empirical Legal Studies
Volume 4, Issue 4, 835–860, December 2007

Who Pays for Medical Errors? An Analysis of Adverse Event Costs, the Medical Liability System, and Incentives for Patient Safety Improvement

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Patient safety advocates argue that the high costs of adverse events create economic incentives for hospitals to invest in safety improvements. However, this may not be the case if hospitals externalize the bulk of these costs. Analyzing data on 465 hospital adverse events derived from medical record reviews, we investigated the amounts that hospitals and other payers incurred in medical-injury-related expenses. On average, the sampled hospitals generated injury-related costs of $2,013, and negligent-injury-related costs of $1,246, per discharge. However, hospitals bore only 22 percent of these costs. Legal reforms or market interventions may be required to address this externalization of injury costs.

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This work was funded by a grant from the Commonwealth Fund (Grant 20020530). The original data collection was funded by the Robert Wood Johnson Foundation. All views presented herein are solely those of the authors. The authors gratefully acknowledge programming assistance from Timothy Zeena, research assistance from Carly Kelly, and helpful comments on earlier drafts of the article from Bill Sage and participants at the Columbia Law School Law and Economics Workshop and the 2006 Conference on Empirical Legal Studies.

I. INTRODUCTION

Legal scholars have long been interested in the role of the tort liability system in providing economic incentives for efficient levels of precaution taking to prevent accidental injuries.[1,2] Medical malpractice is perhaps the area of tort law in which this interest has been sharpest, and best informed by empirical evidence.[3] Thirty years of research into the functioning of the medical liability system and its effect on decision making within health-care organizations have led to recognition of the tort system's shortcomings and the extent to which its effects are mediated by other structures of health-care markets and health-care delivery. For example, universal liability insurance without significant experience rating undercuts the deterrent signal sent by lawsuits,[3] and the embeddedness of individual physicians within health-care teams and broader systems of care raises questions about the appropriateness of focusing liability on individuals.[4]

Thus, when thinking about deterrence of injuries due to medical management ("adverse events"), the tort system's contribution must be understood within the broader context of health-care organizational decision making. Over the past several years, patient safety advocates have sought to persuade hospital leadership that the costs of medical malpractice lawsuits, and of adverse events more generally, constitute a strong business reason to invest in safety improvements. Sometimes called the "business case for patient safety," this argument posits that in addition to meeting the ethical and public health imperative to minimize patient injuries, health-care organizations that invest in systems improvements to reduce adverse events will reap a financial return.[5,6,7,8]

A major thrust of this campaign is "paying for safety"—moving purchasers of health-care services to incorporate providers' safety records into their purchasing decisions. This has been advanced through initiatives such as the Leapfrog Group, a consortium of large employers that has pledged to direct the employees they insure to health-care providers that meet certain quality and safety standards.[9,10] A second component of the campaign stresses the financial toll that malpractice litigation takes on institutions and individual physicians. A third component seeks to demonstrate that the costs of adverse events to health-care organizations are both substantial and, to a large extent, avoidable.

Recent research has contributed information about the societal costs of medical injuries.[11,12,13,14] Extrapolating from state-level studies, the Institute

of Medicine estimated the total national cost of preventable adverse events at $17–29 billion per year.[15] Additionally, several studies have estimated adverse event costs at the level of the individual hospital.[16,17,18,19] Zhan and Miller, examining hospital charges associated with adverse events identified using the Agency for Healthcare Research and Quality's (AHRQ's) Patient Safety Indicators, calculated that nationwide excess hospital costs arising from these medical injuries reached $4.6 billion.[18] Bates and colleagues estimated the excess inpatient costs associated with adverse drug events at two large Boston teaching hospitals to be approximately $5.6 million per year, $2.8 million of which was associated with preventable adverse events.[16] Classen and colleagues studied a smaller hospital in Salt Lake City with lower prevalence of adverse drug events and estimated the associated inpatient costs to be about $1 million per year.[17]

Although these studies contribute to public understanding of the total economic burden of medical injuries, they did not address an important dimension of the business case for safety: the extent to which hospitals themselves actually absorb the costs associated with adverse events. Zhan and Miller's findings have been interpreted as "help[ing] hospitals see what kind of return on investment they'll get" from patient safety initiatives,[20] but such statements do not consider hospitals' ability to externalize the costs of injuries. If hospitals are able to shift a large portion of these costs to other parties, then even very high adverse event costs may not generate financial incentives for safety improvement.[21]

A subsequent study by Zhan and colleagues found that for five types of adverse events identifiable in Medicare claims, hospitals absorbed about two-thirds of the extra care costs associated with the injuries, billing Medicare for the remaining third.[22] That study is the first to examine the extent to which hospitals pass on injury costs to third-party payers. Unfortunately, it did not examine injury-related costs other than additional inpatient costs incurred during the initial hospitalization. As the tort system recognizes, these other costs include lost income, lost household production, future medical expenses, noneconomic losses, and other components.

We aimed to examine where the broader range of economic and noneconomic losses associated with medical injuries fall. To determine the extent to which hospitals incur these costs, we analyzed previously collected data on the costs of adverse events in hospitals in Utah and Colorado in 1992. We hypothesized that only a small portion of adverse event costs would be absorbed by hospitals; most would be borne by health insurers, disability insurance programs, and injured patients and their families. This hypothesis

arose primarily from a key empirical insight about the medical liability system: although patients are often injured by medical negligence, only a tiny proportion has their injury costs reimbursed by health-care providers and their insurance companies. Two to three percent of patients injured by negligence file malpractice claims,[23,24] and of these, only about half recover compensation through the litigation process.[25]

The findings of our analysis indicate that the overwhelming proportion of the costs of hospital medical injures are shifted to parties other than the hospital. We conclude that the direct costs of adverse events do not fall on hospitals to a significant enough extent to create strong economic incentives for safety improvement.

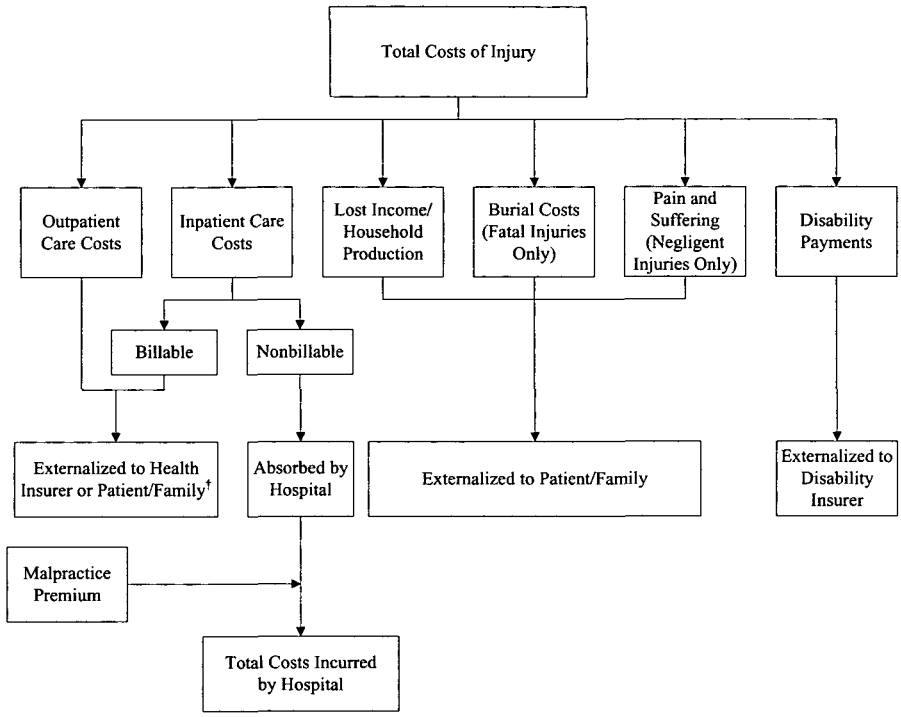
II. METHODS

A. Components of Injury-Related Costs

Our analysis builds on previous work setting forth the broad categories of costs and losses associated with medical injury.[11,14,26,28] The objective of previous studies has been to estimate either the societal economic costs of injuries or the costs that would be compensable through an administrative compensation (or "no-fault") system. Our aim was different: we sought to compare injury-related costs that hospitals generated against injury-related costs that they might be forced to bear through the tort liability system (and that are reflected in the malpractice insurance premiums they pay). Therefore, we included some elements (burial costs, disability payments, and noneconomic loss) not included in some earlier models.[11,14] In common with earlier analyses, our methodology focuses on the losses directly connected to the patient's injury and excludes indirect losses such as negative publicity for the hospital that may follow a serious adverse event.

Our cost model includes both economic and noneconomic loss components (Figure 1). First, medical injuries often necessitate additional health-care services, including intensive care unit days, other hospital days, outpatient physician visits, prescription drugs, medical equipment and supplies, home healthcare, physical therapy and rehabilitation services, and nursing home care. Second, patients may be temporarily or permanently disabled, resulting in lost wages and fringe benefits and lost household production. Third, fatal injuries generate burial costs; we included these expenses because patients' families incur them and can claim them as economic damages in malpractice suits. Fourth, injuries that result in medium-

Figure 1: Components and flow of injury costs.



† Except for portion recouped through malpractice awards, represented by malpractice premium.

or long-term disability may trigger payments by Social Security Disability Insurance or other disability insurance schemes. We deducted disability payments from the economic losses in applicable cases in order to avoid "double counting" of lost income. Finally, for adverse events due to negligence, an amount for noneconomic damages, or "pain and suffering," is generally awarded in successful lawsuits. It was essential to include noneconomic damages among our loss components because our aim was to model the costs that hospitals would be expected to bear through the tort system.

B. Data

We rereviewed data on hospital adverse events in Utah and Colorado extracted from malpractice claims and medical records files in a previous

study. In the original study, trained physicians reviewed records from 14,732 randomly selected hospital discharges from 28 hospitals in 1992 and determined whether an adverse event occurred and, if so, whether it was due to negligence. In cases involving adverse events, two study investigators (internal medicine physicians) independently reviewed the case and judged whether the injury was preventable. Cases about which the investigators disagreed were discussed and reconciled. The economic consequences of each injury were then estimated through a three-step process: (1) one of the study investigators estimated the patient's disability, lost work time, and health-care utilization; (2) one of 10 professional insurance adjusters from the state reviewed a summary of the case and the investigator's estimates and made his or her own estimates of economic losses; and (3) the investigators and adjusters discussed disagreements and reached consensus in each case. From these per-patient costs, statewide total cost estimates were generated.

The sampling, record review, and costing methodologies are described in depth elsewhere.[27,28] The loss elements incorporated into the costing methodology are summarized in Figure 2. We worked from the cost estimates generated in the earlier analysis, but made one significant adjustment to the original methodology: use of more nationally representative data on noneconomic losses. The original analysis generated pain and suffering estimates based on jury verdict data from two states[29] and applied the $250,000 cap on noneconomic damages that was in place in Utah and Colorado during the study year. To increase the generalizability of our estimates to other states, we removed the damages cap assumption and utilized newly available data on verdicts and settlements among 889 paid claims from five liability insurers operating in seven states across the country.[25] Four of these states had some kind of noneconomic damages cap in place during part or all of the study period, but it is not clear how the cap would have affected the 85 percent of claims in the sample that were settled rather than tried.

We divided these claims into 35 groups based on injury severity and patient age (omitting newborn injuries) and calculated the median indemnity award in each group. Because this data set did not separate out economic and noneconomic components of awards, we looked to a separate data set to calculate the median proportion of awards in each age group that was comprised of noneconomic damages. For this purpose, we used data from our previous study of California jury verdicts in malpractice cases from 1985 to 2002.[30] After injuries to newborns were excluded, this yielded noneconomic damages proportions ranging from 60–90 percent and (with the exception of the youngest age group) increasing with plaintiff age. We

Figure 2: Components of injury cost estimates.

Lost earnings

Wages: The 1992 Current Population Survey was used to determine average annual income by patient age, gender, and occupation code. Where no occupation information was available, the gender-and-age-adjusted mean from the Mountain States was used. Lost income was calculated to the end of the injury-related disability, age 75, or the expected age of death, whichever came first. To adjust for unemployment, earnings losses were multiplied by the employment rate for the patient's age and gender group. Earnings were inflated at a real annual rate of 0.7%.

Fringe benefits: Lost fringe benefits were calculated at a rate of 27% of earnings for patients who suffered permanent disability or death.

Lost household production

The loss of the injured patient's contribution toward household duties was calculated to the end of the patient's injury-related disability or the patient's expected death, whichever came first. Household production was valued at $5.03/hour for 27.83 hours/week and inflated at a real annual rate of 0.7%.

Consumption deduction

For patients with fatal injuries, a consumption deduction was subtracted from lost income and lost household production, representing the value of goods not purchased and services not needed. The deduction was derived from Bureau of Labor Statistics equivalence scales, adjusted for household size and inflation, and calculated to the end of the patient's natural life expectancy.

Social Security Disability Insurance (SSDI) deduction

Individuals with a disability lasting 12 months or more would have qualified for SSDI payments. We calculated these at the average rates for Utah and Colorado in 1992, inflated at a real annual rate of 0.7%. We deducted this amount from the individual's economic loss in order to avoid double-counting of lost income.

Health care utilization

All multi-year care costs were inflated at a rate of 5.25% and discounted at a rate of 2.75% per year

Hospital care: Reviewers determined the number of injury-related hospital days in intensive care and non-intensive care. These estimates were multiplied by the average daily charge in the state. Inpatient physician visits were also estimated, and priced based on the median from a physician fee survey from the western region of the United States.

Outpatient physician visits: Reviewers determined the number of injury-related outpatient physician visits. The same physician fee survey was used for the price of each visit.

Rehabilitation / physical therapy costs: Reviewers determined the number of injury-related rehabilitation and physical therapy sessions; this was multiplied by the average session charge for the state.

Nursing home costs: Reviewers determined the number of years in a nursing home (or fraction thereof). Average annual per-patient Medicaid payments to nursing homes for disabled patients were used to estimate costs.

Home health care costs: Reviewers determined the number of home health visits; this was multiplied by the average visit charge for the state.

Drug costs: Reviewers listed the name of each medication required by the injury and the number of months the patient would require each. Drug prices were extracted from the *Red Book* of pharmaceutical prices.

Medical supply costs: Reviewers listed each piece of medical equipment and supplies required by the injury and the number of months the patient would require each. These estimates were multiplied by standard equipment costs per month.

Burial costs

Standard burial costs of $5,000 were applied to all cases involving fatal injuries.

Pain and suffering

Working from a dataset of 889 malpractice claims closed with payment between 1984 and 2004 (median year 1992; both settlements and verdicts included), we omitted newborn injury claims, divided the remaining claims into a 5-by-7 matrix by patient age and injury severity, and calculated median indemnity awards for each cell. We then applied a multiplier to each cell representing noneconomic damages as a proportion of total damages among each age group in a sample of jury verdicts from California from 1985-2002.

applied these proportions to the median indemnity awards in each of the 35 age/severity groups to arrive at our estimates of noneconomic damages.

We also conducted a sensitivity analysis calculating noneconomic damages at a fixed proportion of 35 percent of the median indemnity award

for each group. In a previous review of studies reporting noneconomic and total damages awards, we observed that the noneconomic damages proportions (across all age groups) converged around 35 percent.[31] We opted not to use this estimate for the main analysis because it is not age adjusted and very likely underestimates the proportion for older age groups, who have relatively low economic losses. However, we did use it to examine how the lower estimate of pain and suffering awards would affect our estimates of externalized costs.

The original Utah-Colorado injury data set contained records from 28 hospitals. We eliminated four hospitals because the number of sampled patients in each was small ($N < 100$). We obtained data on the malpractice insurance premiums paid by the remaining 24 hospitals in 1992 by contacting risk managers at each hospital. Of the 24 hospitals, eight could not locate the requested information or declined to provide it, and three were only able to provide the premium from a more recent year. For the latter, we deflated the premium to 1992 dollars. For the former, we imputed premium data by regressing premium data from the other hospitals on several hospital characteristics and using the resulting coefficients to generate predicted values for the hospital's missing data.

We analyzed all sampled hospitalizations except for those of newborns, for which injury-related lifetime cost calculations are highly speculative. Our analysis excluded 23 adverse events for which the original case reviews could not be located. It included 88 adverse events not considered in the earlier costing study: injuries that occurred during hospitalization but were not discovered until after discharge.

We drew additional data on hospital and county characteristics from the American Hospital Association 1992 Survey file, the Centers for Medicare and Medicaid Services' Casemix Index File for 1992, the Bureau of Economic Analysis Regional Accounts Data, and the U.S. Bureau of the Census 1990 Census data. All cost statistics are presented in 2005 dollars, adjusted using the GDP deflator.

C. Cost Internalization and Externalization

Our cost-externalization model (Figure 1) assumed that hospitals incur two main types of direct costs associated with adverse events. First, they may incur unrecoupable costs for extra medical services for which the hospital is unable to separately bill. Second, they make payments related to malpractice claims. The hospital's annual professional liability insurance premium represents the insurer's estimate of the average annual amount of these pay-

ments (plus an additional amount to account for the insurer's uncertainty about this estimate).

Hospitals also incur other kinds of organizational costs associated with medical injuries, such as the cost of maintaining a risk-management office. However, because such costs are probably fairly inelastic to changes in the frequency of medical injuries and malpractice claims, we do not consider them to be potential pillars of a business case for patient safety.

When not internalized by the hospital, the various components of medical injury costs fall on other parties. Health insurers absorb the medical-care costs for insured patients. State and federal income-support programs may incur expenses in cases of long-term disability. But patients and their families bear the brunt of the other forms of economic loss, including lost earnings and lost household production, burial expenses, and medical and nursing-care costs (if the family is uninsured or underinsured).

Using previously calculated estimates of per-patient adverse event costs, modified as described above, we calculated hospital-level costs by aggregating over patients in each hospital. We then calculated the following.

1. Total Costs of Injuries Due to Medical Management in the Hospital

We first analyzed the total costs of the subgroup of 465 adverse events that were caused by medical management during a hospital stay. Conceptually, these represent the injury costs that hospitals were responsible for generating. For 119 of these injuries, the medical management that led to the adverse event occurred during a previous hospitalization. We made the assumption that these patients were readmitted to the same hospital. In reality, some patients were probably readmitted to other hospitals, but the inflow and outflow of injured patients should net out in the aggregate.

2. Injury-Related Costs that Hospitals Incurred

Next, we analyzed the amounts that hospitals had to pay in connection with medical injuries, which included the hospital's malpractice premium and any injury-related-care costs that the hospital was not able to recoup by billing for the services. We determined whether the hospital would likely have been able to bill for additional services by examining the circumstances in which each injury occurred and the insurance status of each patient. Where the patient was rehospitalized due to an injury in a prior hospitalization, we assumed that hospitals could fully bill for services rendered during the required hospitalization. (There may be some cases in which hospitals waive the costs if they are

clearly related to an error in the previous hospitalization, but we made the assumption that this did not occur. We did not have sufficient information to apply the Center for Medicare and Medicaid Services' rule that Medicare will not pay separately for a hospital readmission that occurs within 48 hours of the original admission. Had we done so, our estimate of the proportion of costs externalized might have been slightly lower.)

Where the injury and the related care occurred during the same hospitalization, we assumed that the hospital could bill for the care if the patient's insurer reimbursed on a per-diem basis. Individual insurance company data for each patient were not available; however, the patients' primary insurer type was known (Medicaid, Medicare, private managed care, private fee for service, or uninsured). We determined how these groups of insurers were reimbursing for inpatient services in Utah and Colorado in 1992 by consulting hospital financial experts in those states. We categorized Medicare and Medicaid as fixed payment; managed care private as 25 percent fixed, 75 percent per diem; and nonmanaged care private as 5 percent fixed, 95 percent per diem.

3. Externalized Injury-Related Costs

We calculated the portion of all injury costs that hospitals could externalize to other payers by deducting the incurred costs from the total injury costs.

We calculated each of these cost estimates twice for each hospital, once for all adverse events and once for the subset of injuries attributable to negligence. We upweighted our mean cost estimates to represent the entire group of patients admitted to each hospital by multiplying the mean by the total number of admissions in 1992. Costs on a per-admission basis are presented to permit comparisons across hospitals of different sizes. No weights were required because the sample of patients within each hospital was drawn using simple random sampling.

D. Methodological Limitations

Our study methodology has several limitations. First, although medical record review is considered the "gold standard" for detecting hospital adverse events, it suffers from imperfect interrater reliability and inability to detect undocumented adverse events.[27,32,33] Second, our results are influenced by particular decisions made in the costing methodology. The decision about whether and how to include a noneconomic damages component

is especially important, as our sensitivity analysis demonstrated. We included noneconomic damages only for negligent injuries, based the values on median awards (including settlements) in similar cases, and assumed that noneconomic damages were not capped. Calculating noneconomic damages for all injuries, or using jury verdicts only, would have yielded higher total costs and a higher percentage of costs externalized; applying a cap would have yielded lower total costs.

Third, our analysis is based on data from 1992. There are no data to suggest that rates of adverse events, the average severity of adverse events, or the medical services provided in response to adverse events has changed over time, however.

Fourth, we excluded injuries to newborns from our analysis, yet the malpractice premium data we used include the estimated costs of malpractice suits concerning neonatal injuries. As a practical matter, it is impossible to adjust premium data to exclude this cost component. This limitation means that our estimates may overstate the proportion of injury costs that hospitals internalize.

Fifth, an analytical complexity arises from hospital reimbursement arrangements with globally capitated physician groups. Some such physician groups reimburse the hospital on a per-diem basis, while others pay a fixed amount per episode of care. Typically, the hospital and physician group agree to split any loss incurred by the hospital equally at the end of the year. This means that some of the absorbed costs of injury-related medical care that we attributed to hospitals would actually have been shifted to physician groups. Data limitations prevented us from adjusting for this complexity; however, it is unlikely to have biased our results substantially because there was relatively little global capitation in Utah and Colorado during the study period. Moreover, any bias would run in the direction of understating the amount of cost externalization.

Finally, our analysis did not consider the role of physician malpractice insurance premiums. We theoretically would expect physicians rendering care in hospitals to play a contributory role in most medical injuries that occur in the inpatient setting. Further, we believe that few of the physicians who would have been involved in the hospital injuries in our sample would have had their liability insurance provided by the hospital. Rather, they would have been paying separately for physician insurance policies. Because our study focused on hospitals, these physician premiums were not included as a component of the internalized costs. Had they been included, the proportion of costs externalized would have been lower.

III. RESULTS

A. Sample

The hospital sample was comprised of 11 hospitals in Utah and 13 in Colorado (Table 1). Six were located in rural areas and the other 18 in urban areas. Two were major teaching hospitals, seven were minor teaching hospitals, and 15 were nonteaching hospitals. Seven hospitals were for profit, 12 were not for profit, and five were government owned.

Record review at these hospitals produced a sample of 465 adverse events due to medical management in the hospital, of which 127 were attributable to negligence. Operative injuries were most prevalent in the

Table 1: Sample Characteristics

Hospitals (N = *24*)		*Medical Injuries* (N = *465*)†	
State		Prevalence	
Utah	11 (46%)	All injuries	465/12,435 (4%)
Colorado	13 (54%)	Negligent injuries	127/12,435 (1%)
Location		Clinical Type	
Urban	18 (75%)	Operative	280 (61%)
Rural	6 (25%)	Drug	54 (12%)
		Medical procedure	49 (11%)
Teaching Status		Incorrect/delayed diagnosis	27 (6%)
Major teaching	2 (8%)	Incorrect/delayed therapy	24 (5%)
Minor teaching	7 (29%)	Postpartum/neonatal	13 (3%)
Nonteaching	15 (63%)	Anesthesia	6 (1%)
		Other	9 (2%)
Ownership			
For profit	7 (29%)	Disability Rating	
Not for profit	12 (50%)	Emotional only	1 (<1%)
Government	5 (21%)	Insignificant	24 (6%)
		Minor temporary	145 (36%)
Volume (# admissions)		Major temporary	167 (42%)
Mean (*SD*)	8,689 (4,728)	Minor permanent	14 (4%)
		Significant permanent	7 (2%)
		Major permanent	4 (1%)
Patient Mix		Grave	2 (<1%)
Mean % Medicare (*SD*)	30% (8)	Death	34 (9%)
Mean % Medicaid (*SD*)	12% (7)		
Case Mix Index			
Mean (*SD*)	1.4 (0.23)		

†Adverse events due to medical management during hospitalization. Three adverse events missing clinical type data and 64 events missing disability data excluded from proportion calculations.

sample (61 percent), followed by drug-related injuries (12 percent) and injuries from nonsurgical procedures (11 percent). The mean disability rating for all medical injuries was 4.1 (*SD* 1.7). A score of 4 represented a "temporary major" injury; for negligent injuries the mean disability rating was 4.4 (*SD* 2.0).

B. Total Costs of Injuries

The total societal cost of the 465 medical injuries due to hospital medical management was approximately $439 million; the societal cost of the 127 negligent injuries was $270 million (Table 2). The negligent injuries accounted for such a high proportion of all costs largely because of the noneconomic loss component. The average cost per injury was $58,766 for all adverse events and $113,280 for negligent injuries. The median costs were $59,771 and $99,486, respectively.

On average, hospitals in this sample generated injury-related total costs of $2,013, and negligent-injury-related costs of $1,246, for every admission (Table 2). Hospitals' average injury costs ranged from $42 to $4,769 per admission, and were significantly higher at teaching hospitals than at nonteaching hospitals (mean $3,352 vs. $1,209, two-tailed $t = 4.55$, $p < 0.001$). The difference for negligent injuries was also significant (mean $1,886 vs. $861, two-tailed $t = 2.43$, $p = 0.024$). No significant differences were observed by hospital ownership type, state, or urban versus rural location.

C. Costs Internalized and Externalized by Hospitals

Hospitals' malpractice insurance premiums varied widely, from $91,364 to more than $2.7 million. Divided by the number of admissions per year, the range of premiums was $7 to $445 per patient, with a mean of $123.

The 465 injuries in our sample resulted in $1,791,358 in injury-related inpatient care costs that hospitals would have been unable to recoup. This translates into an average cost to hospitals of $115 per admission (Table 3). The per-admission costs varied among hospitals from zero to $351 per admission. The 127 injuries due to negligence generated $905,719 in unrecoupable care costs, for an average cost of $57 per admission.

Summing the per-admission malpractice premium and absorbed care costs for each hospital, we estimated the total costs of medical injuries absorbed by hospitals to be $238 per admission. The specific estimates varied from $39 to $682 across hospitals (Table 4). The average cost internalized for negligent injuries was $180 per admission, with a range of $20 to $554.

Table 2: Societal Costs of Medical Injuries, by Hospital†

	All Medical Injuries					*Negligent Injuries*			
	Records Reviewed	*Injuries*	*Mean Injury Cost*	*Injury Costs per Admission*	*Total Injury Costs, All 1992 Admissions*	*Negligent Injuries*	*Mean Negligent Injury Cost*	*Negligent Injury Costs per Admission*	*Total Negligent Injury Costs, All 1992 Admissions*
All Hospitals	12,514	462	$58,766	$2,013	$438,772,939	127	$113,280	$1,246	$270,005,694
Teaching Hospitals									
Large urban									
A	962	38	$118,113	$4,666	$46,478,736	10	$120,778	$1,255	$12,507,216
B	619	32	$60,354	$3,120	$23,615,834	8	$96,444	$1,246	$9,434,405
C	849	52	$77,857	$4,769	$62,531,031	20	$165,331	$3,895	$51,071,563
D	1,045	57	$61,412	$3,350	$50,406,816	8	$196,103	$1,501	$22,591,107
E	983	36	$37,098	$1,359	$4,904,619	7	$60,191	$429	$1,547,340
F	807	35	$64,883	$2,814	$13,546,549	10	$102,528	$1,270	$6,116,108
Small urban									
G	184	6	$140,334	$4,576	$44,365,241	2	$325,309	$3,536	$34,281,172
H	485	6	$99,275	$1,228	$16,356,468	3	$192,767	$1,192	$15,880,040
Large rural									
I	702	36	$83,637	$4,289	$27,806,025	12	$155,117	$2,652	$17,190,186
Nonteaching Hospitals									
Large urban									
J	142	2	$69,816	$983	$2,381,604	2	$69,816	$983	$2,381,604
K	177	3	$35,510	$602	$1,655,134	2	$49,201	$556	$1,528,839

L	163	1	$6,884	$42	$75,762	0	$0	$0	$0
M	1,011	43	$56,645	$2,409	$10,595,754	15	$105,440	$1,564	$6,880,176
N	1,136	27	$37,166	$883	$13,509,943	4	$41,706	$147	$2,245,976
O	626	10	$110,675	$1,768	$12,365,157	4	$240,455	$1,536	$10,745,959
P	432	11	$67,508	$1,719	$24,032,829	2	$217,902	$1,009	$14,104,142
Q	328	8	$85,116	$2,076	$32,016,075	3	$200,447	$1,833	$28,274,083
Small urban									
R	339	12	$15,327	$543	$7,218,102	3	$29,939	$265	$3,524,867
S	442	6	$7,878	$107	$424,864	1	$22,577	$51	$202,941
Large rural									
T	268	18	$16,424	$1,103	$8,065,999	1	$52,969	$198	$1,445,182
Small rural									
U	143	8	$59,187	$3,311	$13,539,389	4	$112,585	$3,149	$12,877,158
V	186	5	$27,308	$734	$10,907,121	2	$49,412	$531	$7,894,169
W	204	1	$16,645	$82	$990,227	1	$16,645	$82	$990,227
X	281	9	$55,321	$1,772	$10,983,660	3	$95,060	$1,015	$6,291,234

†All costs are presented in 2005 dollars.

Table 3: Internalized and Externalized Injury Costs per Admission, Averages Over All Hospitals

	Total Injury Costs[†]	*Absorbed Inpatient Care Costs*[‡]	*Passed-Through Costs*[§]	*Malpractice Premium*[¥]	*Externalized Costs*[#]	*Proportion of Total Costs Externalized*[¤]
All injuries	$2,013	$115	$1,898	$123	$1,775	78%
Negligent injuries	$1,246	$57	$1,189	$123	$1,066	70%

[†](Total adverse event costs for all sampled patients/Number of sampled patients with adverse events) * Number of admissions in 1992. All costs are presented in 2005 dollars.

[‡]Injury-related inpatient care costs for patients with fixed-payment insurance reimbursement or no insurance.

[§]Total injury costs – Absorbed inpatient care costs.

[¥]Total malpractice premium in 1992/Number of admissions in 1992.

[#]Passed-through costs – Malpractice premium.

[¤]Externalized costs/Total adverse event costs. Calculations exclude one hospital that had no negligent adverse events.

On average, hospitals externalized 78 percent of the costs of all injuries and 70 percent of the costs of negligent injuries (Table 3). The proportion of costs externalized varied among hospitals from less than zero (for one hospital that paid more in malpractice premiums than it created in injury costs) to 97 percent for all injuries, and from less than zero to 98 percent for negligent injuries, but 17 of the 24 hospitals were at the 80 percent externalization level or higher (Table 4). We estimate that for every patient admitted, hospitals in our sample externalized, on average, $1,775 in injury costs. Isolating the negligent injuries, an average of $1,066 per admission was externalized.

The mean proportion of costs externalized was higher for teaching hospitals than for nonteaching hospitals (90 percent vs. 67 percent for all injuries; 87 percent vs. 59 percent for negligent injuries), but the difference did not quite achieve statistical significance (two-tailed $t = 1.91$, $p = 0.069$ for all injuries; $t = 1.34$, $p = 0.20$ for negligent injuries). There also were no significant differences between urban and rural hospitals, between for-profit and other hospitals, or between Utah and Colorado hospitals.

In the sensitivity analysis that estimated pain and suffering awards at a fixed 35 percent of the total indemnity award for each age/severity group, we found that the lower estimate of noneconomic damages reduced the average proportion of costs externalized to 70 percent for all injuries and 51 percent for negligent injuries. Thus, for negligent injuries, the findings are

Table 4: Internalized and Externalized Injury Costs per Admission, by Hospital

	All Medical Injuries			*Negligent Injuries*		
Hospital	*Internalized Costs*†	*Externalized Costs*	*Proportion of Total Costs Externalized*	*Internalized Costs*	*Externalized Costs*	*Proportion of Total Costs Externalized*
All Hospitals (Mean)	$238	$1,775	78%	$180	$1,066	70%
Teaching Hospitals						
Large urban						
A	$370	$4,296	92%	$183	$1,073	85%
B	$98	$3,022	97%	$20	$1,227	98%
C	$248	$4,520	95%	$224	$3,671	94%
D	$484	$2,866	86%	$272	$1,229	82%
E	$302	$1,057	78%	$137	$292	68%
F	$209	$2,605	93%	$189	$1,082	85%
Small urban						
G	$449	$4,127	90%	$361	$3,175	90%
H	$219	$1,009	82%	$210	$982	82%
Large rural						
I	$163	$4,127	96%	$151	$2,501	94%
Nonteaching Hospitals						
Large urban						
J	$473	$510	52%	$473	$510	52%
K	$59	$543	90%	$59	$497	89%
L	$39	$4	8%	$39	–$39	n/a
M	$446	$1,964	81%	$419	$1,146	73%
N	$66	$817	93%	$39	$107	73%
O	$162	$1,606	91%	$133	$1,404	91%
P	$158	$1,561	91%	$143	$866	86%
Q	$159	$1,917	92%	$121	$1,712	93%
Small urban						
R	$195	$348	64%	$136	$128	48%
S	$129	–$22	–20%	$124	–$73	–143%
Large rural						
T	$175	$928	84%	$24	$174	88%
Small rural						
U	$682	$2,629	79%	$554	$2,595	82%
V	$82	$652	89%	$82	$449	85%
W	$67	$15	18%	$67	$15	18%
X	$277	$1,494	84%	$157	$858	85%

†Absorbed inpatient care costs + Malpractice premium. All costs are presented in 2005 dollars.

fairly sensitive to the choice of noneconomic damages estimator. However, the proportion externalized is still large.

IV. Discussion

A. The Tort System and Incentives for Patient Safety

Our analysis found that injuries due to medical management in the hospital are associated with substantial societal costs, yet only a small proportion of these costs are borne by hospitals. Approximately 78 percent of the costs of all injuries, and 70 percent of the costs of negligent injuries, are externalized to other parties—primarily injured patients, their families, and their health insurers. This estimate should be viewed as conservative; two factors give rise to the possibility that the proportion externalized is even higher. First, if we had been able to exclude the portion of the malpractice premium that covered the expected costs of litigation over injuries to newborns, hospitals' internalized costs would have been lower, both in absolute terms and as a proportion of total injury costs. Second, we could not observe whether hospitals raised prices as a means of passing on internalized costs to consumers and third-party payers. From a theoretical perspective, there would appear to be considerable latitude for hospitals to do so, since demand for health-care services is fairly price inelastic. However, competition and preexisting agreements with payers may make this strategy difficult to pursue in some markets.

Hospitals do incur costs related to medical injuries, through malpractice insurance premiums (which reflect the costs of malpractice litigation) and unrecoupable costs of injury-related care. At an average of $238 per admission, these costs are not trivial, but they represent only the tip of the iceberg. Medical-care costs do not generate strong incentives to reduce injuries because health-care costs, including outpatient and long-term care costs, account for only about half the total costs of hospital adverse events[27] and because hospitals are able to obtain reimbursement for some of the inpatient costs. Their ability to do so depends on their patient mix and the payment methods of each payer, and will be higher in markets where Medicare and managed care have relatively low market shares.

The single largest factor accounting for hospitals' ability to shift injury-related costs, however, is not reimbursement rules, but the very low percentage of injuries that are compensated through the tort liability system. Only injuries attributable to negligence are eligible for compensation in tort, and only a small proportion of patients who suffer negligent injuries bring a

claim. In the previous study of this sample of injuries, 27 percent of injuries were judged to be the result of negligence, but only 2.5 percent of patients injured by negligence filed a malpractice claim.[24] The gulf between the population of patients with negligent medical injuries and the group that receives compensation through the medical liability system enervates the deterrent signal of the tort law[3] and belies arguments that malpractice litigation creates significant incentives for organizations to invest in safety improvements.

B. Improving Incentives for Safety

Our findings provoke two key policy questions. First, is providing economic incentives for patient safety important? Second, if so, is there some way to resuscitate the business case for safety?

Health-care practitioners may question the necessity of demonstrating a business case for patient safety, arguing that the imperative for safety is a matter of professional ethics, not financial interest. The American Board of Internal Medicine's physician charter on medical professionalism, for example, appeals to physicians' ethical commitment to patient welfare and quality of care as a mandate for error reduction.[34]

The importance of professionalism in motivating safety improvement cannot be understated, but in our view does not obviate the need to build a business case as well. Health-care organizations may take a more pragmatic view of investments in safety than do physicians. Moreover, analyzing where the costs of medical injuries fall is important for showing that health insurers have "skin in the game." Demonstrations of the extent to which insurers bear these costs should encourage them to become more prominent players in the safety movement over time. Indeed, it could be argued that, to the extent that there is a business case for safety in current markets, it exists primarily at the payer level, not the provider level.

Is it possible to revitalize the business case for patient safety for hospitals? Arguably, yes—either by taking a broader view of the business case or by implementing market or policy interventions, including legal reforms, to improve the business case as we have conceptualized it. William Weeks and James Bagian argue that if two kinds of indirect costs are included as elements of the business case for patient safety, the case looks considerably stronger.[7] First, maintaining a poor safety record may result in reduced patient volume and revenue for a hospital. If initiatives such as the Leapfrog Group continue to grow in strength, poor-performing organizations may not have the opportunity to serve certain groups of patients. Additionally, serious

adverse events may result in negative publicity and damage to the organization's reputation.

Second, there may be an efficiency argument for proactive patient safety improvement. As more is learned about the prevalence and societal costs of adverse events, the mandate for improvement will grow and government will step in with tougher regulation. Because hospitals are better positioned than government to conceive and implement tailored, cost-effective safety initiatives, Weeks and Bagian argue, from the industry's perspective it is preferable to self-regulate.

Economic incentives for safety improvement could also be bolstered through a series of market and policy interventions. Perhaps most promising are purchasing initiatives such as Leapfrog. At present, safety-based purchasing is confined to a relatively small proportion of the market (Leapfrog represents 34 million insureds) and based on a limited number of safety-related criteria. To create strong financial incentives for hospitals, such schemes need to expand their purchaser and patient base significantly and select safety standards that are possible for most or all hospitals to meet with a reasonable investment. Expanded use of reward-and-recognition programs, through which extra payment is offered to providers with demonstrated commitments to safety,[35] is a promising avenue to pursue.

Also needed is modification of public and private payers' reimbursement policy to preclude health-care providers from billing for care necessitated by a preventable medical injury. AHRQ's Patient Safety Indicators, which permit identification of adverse events through billing codes, can facilitate this move. There are signs of increasing interest in this strategy among payers. At least one private health insurer, HealthPartners, has announced that its contracts with health-care providers from now on will bar providers from billing the company or patients for costs arising from "never events."[36] These are a set of adverse events identified by the National Quality Forum, a nonprofit coalition of health-care providers and policymakers, as preventable occurrences that should never happen in a hospital—for example, wrong-site surgery and serious injury due to a medication error.[37] The Leapfrog Group recently announced plans to recognize hospitals that report certain adverse events to patients and health-care regulators, perform a root-cause analysis, and agree not to seek reimbursement for health-care services rendered in connection with the event.[38]

Most significantly, in 2006 the Centers for Medicare and Medicaid Services (CMS) announced that it would pursue strategies to curtail reimbursement for "never events."[39] Under new statutory provisions that will

take effect in 2008, Congress has already authorized CMS to begin withholding payment for infections that occur during hospitalizations.[40] Additionally, Congress has commissioned a study from the federal Office of the Inspector General to determine how much the Medicare program has been paying for "never events" and what processes could be used to detect and refuse payment for associated care.[41] It is likely that this study will provide a means for CMS to implement its newly announced position that "paying for 'never events' is not consistent with the goals of . . . Medicare payment reforms."[42]

One risk of adopting policies that deny reimbursement for costs related to preventable or negligent injuries is that they may chill reporting of adverse events by health-care providers. However, because payers' detection strategies are likely to be based on audits of claims data, rather than provider self-reports, providers should soon discover that nonreporting is not an effective means of avoiding a reimbursement denial. Health insurers could soften the blow of more stringent reimbursement policies by offering to underwrite a portion of the costs of hospital safety improvements. Because no adverse event detection algorithm is likely to be able to pick up all avoidable injuries—indeed, the Patient Safety Indicators cover just a small part of the universe of adverse events—health insurers will continue to pick up some of the costs of adverse events and, therefore, have an economic interest in preventing them.

Although reimbursement reform is needed, it has limited potential to force hospitals to internalize the costs of medical injuries because medical-care costs do not constitute the lion's share of the total economic and noneconomic losses associated with adverse events. To transform the incentives for injury prevention, there must be a mechanism to force hospitals to confront these larger costs. This brings attention inexorably back to the role of the medical liability system. Legal reforms to increase the proportion of negligent or preventable injuries that result in compensation to patients would considerably bolster incentives for safety. Both by design and due to practical barriers to claiming, the tort liability system leaves a vast reservoir of injury uncompensated.

Because the high costs of the current system have already led to a "malpractice crisis" in which physicians and hospitals struggle to meet rising liability costs,[43] any reforms that aim to increase the number of claims should be accompanied by measures to impose reasonable limitations on the damages awarded. As we have discussed elsewhere, one attractive alternative is a move to an administrative compensation scheme, or "health court."[26,44]

Such a system would resolve medical injury claims outside the judicial system and replace the negligence standard with a broader compensation standard.

In a health court system, when a medical injury occurs, the involved providers (in conjunction with their liability insurer) would be required to disclose it to the patient, notify the patient of his or her right to file a claim for compensation, initiate an investigation, and consider whether an offer of compensation is merited under the compensation rules of the health court. The health court would be notified of all claims. If either the patient or the provider was dissatisfied with the initial determination, they could file a claim with the health court—an administrative tribunal appointed by the state. The claim process would be designed to be sufficiently user-friendly that the assistance of counsel would not be required, although it would be permitted.

Health court claims would be adjudicated by administrative law judges who specialize in medical injury claims. Either party could request a hearing. Judges would be supported by a panel of neutral, court-appointed medical experts who would provide reports on the factors that contributed to the injury. The compensation decision would turn on a judgment about whether the injury was avoidable, meaning that it would not have occurred if best practice had been followed or an optimal system of care had been in place. No proof of negligence would be required. Panels of medical and legal experts would regularly be convened by the health court to determine whether certain kinds of injuries could be deemed presumptively compensable, and processed for compensation on an expedited basis, in light of strong scientific evidence of their avoidability. Claimants with avoidable injuries would receive full economic damages, and noneconomic damages would be awarded according to ranges described in a tiered schedule based on injury severity.

A health court system would likely be faster, less adversarial, and more predictable than the current medical liability system,[44,45] but most importantly, liberalizing the compensation standard would significantly expand the group of patients who would be eligible for injury compensation. By lowering barriers to both claiming and recovery of damages, a health court system promises to direct a much larger proportion of the costs of avoidable injuries back to the involved providers and their insurers.

C. The Hospital Perspective on the Business Case for Safety

Our analysis has focused on estimating the absolute costs of medical injuries to hospitals. But from the perspective of a health-care organization leader,

whether a business case exists for investment in safety improvements depends on two factors: the costs of medical injuries to the organization and the costs of the clinical interventions that could help prevent injuries. Deterrence of medical injury at the level of the organization will hinge critically on this *marginal* analysis: How do the costs of injury prevention compare to the organizational costs of injuries themselves? Our study stops short of answering this marginal question.

Demonstrating a business case for safety is an evolving process. The first step, accomplished by previous epidemiological studies of medical injury and catapulted into the public consciousness by the Institute of Medicine report, was to measure the societal costs of adverse events. The second step, to which this study contributes, is to analyze where those costs fall and how large they are for health-care organizations.

The third step is identifying a series of clinical interventions that would be effective in reducing injuries in the hospital and estimating their organizational costs and cost effectiveness. Unfortunately, this stage is still very much in progress. Although a number of efficacious interventions have been identified,[46,47] these do not begin to span the full range of problem areas for hospital quality and safety. Moreover, several of them are high-cost interventions that may be out of reach for many hospitals.[10] Finally, very little information is available about the cost effectiveness of the interventions.[48,49,50,51]

The challenge going forward is thus to provide a better basis for health-care organizations to evaluate the marginal cost of pursuing safety improvements. The effort to better characterize the range and value of potential clinical interventions can proceed alongside measures to tip the scale in the marginal analysis by augmenting the absolute costs of medical injuries to the organization. Legal reforms alone cannot establish the business case for safety, but they can be an integral part of the solution.

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