By John C. Goodman, Pamela Villarreal, and Biff Jones

The Social Cost Of Adverse Medical Events, And What We Can Do About It

ABSTRACT Adverse medical events—medical interventions that cause harm or injury to a patient separate from the underlying medical condition—are unfortunately an all-too-frequent occurrence in US hospitals. They may cause as many as 187,000 deaths in hospitals each year, and 6.1 million injuries, both in and out of hospitals. We estimate the annual social cost of these adverse medical events based on what people are willing to pay to avoid such risks in non–health care settings. That social cost ranges from $393 billion to $958 billion, amounts equivalent to 18 percent and 45 percent of total US health care spending in 2006. A possible solution: Patients offered voluntary, no-fault insurance prior to treatment or surgery would be compensated if they suffered an adverse event—regardless of the cause of their misfortune—and providers would have economic incentives to reduce the number of such events.

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In this article we review the evidence about the extent of adverse medical events, and we make a rough estimate of their social cost. Adverse medical events (also known as iatrogenic events) are injuries and deaths that are caused by something other than the medical condition for which the patient is seeking care. They are typically divided into three categories, as follows: preventable and negligent; preventable but not negligent; and other adverse events.

Events in the first category, also called malpractice errors, are injuries or deaths resulting from medical misconduct or lack of adherence to basic minimum standards of care. Examples are performing surgery on the wrong site, or leaving a sponge in a patient after an operation. Events in the second category are considered avoidable, although they are not the result of negligence. Some hospital-acquired infections are examples of this sort of medical error. The third category is "other" events. These are events that we do not know how to prevent with our current knowledge and technology. There is no obvious way of avoiding them.

A patient's risk of dying in a US hospital from an adverse medical event is as high as 1 in 200.[1,2] This is much higher than, for example, the one-in-one-million risk that some federal regulatory agencies have considered minimally acceptable in other industries.[3] We found that the social cost of adverse medical events—that is, what Americans would be willing to pay to avoid injuries and deaths caused by such events—was also quite large. As we report below, it was several times larger than, for example, typical estimates of the cost of the medical malpractice system.

Estimating The Number Of Adverse Events

In 1991 a Harvard University study of New York hospital records from the 1980s found that adverse events occurred in 3.7 percent of hospitalizations.[1] As shown in Exhibit 1, more than half of these were considered preventable medical errors, and roughly half of those preventable errors involved negligence (malpractice). In another 1991 study, researchers examined hospital records from Utah and Colorado and found that

EXHIBIT 1

Adverse Medical Events In New York State, 1984
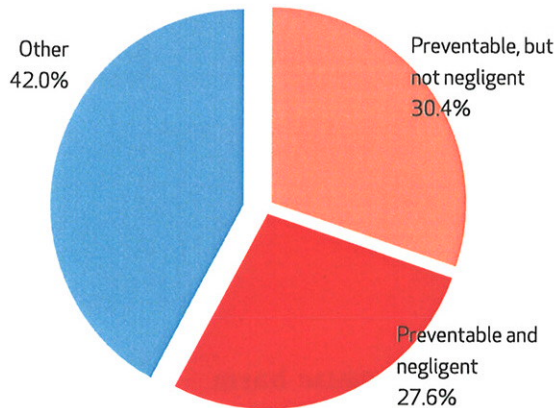
SOURCES Note 1 in text. Leape LL, Brennan TA, Laird N, Lawthers AG, Localio AR, Barnes BA, et al. The nature of adverse events in hospitalized patients: results of the Harvard Medical Practice Study II. N Engl J Med. 1991;324(6):377–84. NOTE "Other" means events that cannot be prevented by existing medical knowledge or technology.

adverse events occurred in 2.9 percent of hospitalizations.[2] The distribution of events was similar to that in the New York study.

A 2000 Institute of Medicine report, *To Err Is Human*, extrapolated these estimates to patients nationwide and concluded that 44,000–98,000 people die annually as a result of preventable medical errors.[4] Although the mortality numbers in the report—especially the higher estimate—have frequently been cited, their reliability is questionable. In the study of data from Utah and Colorado,[2] one doctor initially reviewed each record. However, in a follow-up study,[5] two reviewers and then three looked at the same records. When three reviewers were involved, there were 50 percent fewer cases in which all reviewers agreed that an adverse event had occurred, compared to when just two reviewers were involved. Moreover, three reviewers attributed 80 percent fewer adverse events to negligence, compared to the attributions to negligence made by two reviewers.

Two recent studies find even higher rates of adverse events, although this may be due not to decreased safety in hospitals but to differences in research methodology, including their definition of *adverse events*. One of the studies found that 13.5 percent of Medicare inpatients had an adverse event during a one-month period, and 1.5 percent had a fatal adverse event.[6] Another explanation of these higher rates may be that older patients are more likely than younger patients to experience adverse events.

The second study, of patients in North Carolina hospitals, did not report the percentage of patients who experienced adverse events,

although it indicated that some patients experienced multiple adverse events. That study found that 2.4 percent of adverse events contributed to patients' deaths.[7] In both studies, the researchers used a new methodology that tends to show a higher error rate than previous methods.[8]

A 2010 study from the Society of Actuaries using medical claims data for a large insured population estimated that there are 6.3 million injuries and deaths nationwide resulting from adverse events in medical treatment each year.[9] The study did not report how many of these were deaths. Therefore, we applied the highest observed rate of adverse-event mortality estimated in the New York, Utah, and Colorado studies[1,2] to the number of 2006 hospital admissions to arrive at an estimated number of 2006 adverse-event deaths. We then subtracted this figure, 187,135, from the actuarial estimate of adverse events to arrive at 6.1 million injuries each year.

CATEGORIZING ADVERSE EVENTS The category of preventable and negligent adverse events has received far more attention than the other two categories—nonpreventable events and preventable but not negligent events. Interest in the latter category is growing, however. New technology, such as electronic health records with alerts for inappropriate medications, may be able to reduce the number of preventable events.[10]

The remaining category—other, or nonpreventable adverse events—accounts for incidents when doctors and nurses execute procedures flawlessly and equipment functions perfectly, but patients do not heal or respond as expected.

Regardless of the category into which an adverse event falls, however, the social cost of a death or injury is the same. So, presumably, is our interest in eliminating the event. For that reason, we have focused on all adverse events rather than just those attributable to negligence.

PREVIOUS COST ESTIMATES There have been several attempts to measure the cost of our medical malpractice system, including the cost of defensive medicine. Estimates range from 2 percent to 10 percent of the total cost of health care, or $50–$250 billion a year in 2006 dollars. The higher figure is $2,500 per US household.[11] A 2010 study found that the cost of making and settling malpractice claims was $55.6 billion a year in 2008 dollars, equivalent to 2.4 percent of total health care spending.[12] Although these figures are informative, they are not really estimates of the cost of malpractice. Instead, they measure the cost of our system of dealing with malpractice.

A 2010 Society of Actuaries report attempted to measure the more general costs of the estimated 1.5 million inpatient preventable medical

errors that occur each year. The report combined the cost of treating the injuries attributable to those adverse events, the lifetime wages lost because of those injuries, and the insurance costs due to disability and death. The estimated total was $19.5 billion a year.[9] However, this concept of cost is narrower than the one we propose here.

The Economic Value Of A Life

Most of us feel very uncomfortable with the idea of assigning an economic value to someone else's life, much less our own. But we all engage in a closely related activity as a matter of course: We make trade-offs between economic benefits and very small increases in risks to life and limb. Every time we drive an automobile or even walk down the street, we are exposing ourselves to tiny risks. Presumably, we value the goal of the drive or the walk more than the small loss of personal safety.

There is a vast literature on the trade-offs people are willing to make, most of which focuses on the additional wages that must be paid to induce people to work in riskier occupations. Based on these observations, economists calculate what they call the "value of a statistical life" that underlies these trade-offs. This concept is frequently used by federal regulatory agencies in making new policies.[13] Currently, the value of a statistical life ranges from $6 million at the Department of Transportation to $7.9 million at the Food and Drug Administration and $9.1 million at the Environmental Protection Agency.[14]

In a thorough review of this literature, Kip Viscusi and Joseph Aldy report that most studies estimate the value of a statistical life at $5 million to $12 million, with a median value of $7 million ($8.2 million in 2006 dollars).[15]

This is not the amount of money that people would accept to give up their lives. It is instead the implicit value that people place on their lives when making choices between additional risk and money, when the risks involved and the amount of compensation needed to induce people to accept those risks are both small. Also, the figure does not include any medical costs associated with the adverse event that are borne by people other than the victim.

Total Social Costs

FATAL ADVERSE EVENTS Taking the lower and upper limits of preventable deaths in the studies in Utah, Colorado, and New York, adjusted to reflect 2006 hospital admissions nationally,[1,2,16,17] we estimate that 39,149–108,538 preventable deaths occur in US hospitals each year. As have researchers in previous studies, we are forced to assume that the error rate has not changed over time.

We do not know the age profile of the patients in the previous studies.[1,2] However, from the hospital admissions data,[16,17] we know the age profile of hospital patients in general, as well as the average length-of-stay. If we assume that a day in the hospital puts every patient at equal risk, we can adjust the previous estimates, based on the statistical life values for different age groups (Exhibit 2).[18] Because the elderly tend to enter the hospital more frequently and stay there longer compared to younger cohorts, this adjustment assigns more of the adverse outcomes to that age group. And because statistical life values are lower for people past middle age, the age-adjusted social cost will be lower. Furthermore, the estimates of Viscusi and Aldy were for people in the labor market. Therefore, somewhat arbitrarily, we have assigned to people younger than age eighteen, whose future earnings are unknown, one-half the value of the youngest adult cohort (ages 18–24). We assigned to those older than age sixty-two, who are transitioning out of the labor force, one-half the value of the oldest group in the labor market (ages 55–62).

We used the low and high estimates for annual number of deaths from adverse medical events to calculate the age-adjusted social cost. Exhibit 3 shows that the cost is $336–$884 billion.[1,2,16,18]

ADVERSE-EVENT INJURIES Because of the wide range of outcomes classified as injuries, it is difficult to summarize them in a single statistic. Adverse medical event injuries can range from minor scars to severe brain damage. The economics underlying the value of a statistical injury, however, are the same as for the value of a statistical life. In their review of the literature, Viscusi and Aldy report that estimates of the cost of a workplace injury range from $20,000 to $70,000.[15] However, in another study, Viscusi

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EXHIBIT 2

Value Of A Life, By Age, Millions Of 2006 Dollars

Under 18 years	18–24 years	25–34 years	35–44 years	45–54 years	55–62 years	Over 62 years
$3.29	$6.58	$8.67	$9.60	$8.37	$4.33	$2.17

SOURCE Authors' calculations based on Note 18 in text.

Annual Social Cost Of Inpatient Adverse-Event Mortality, Billions Of 2006 Dollars

Estimated number of deaths	Cost of preventable deaths	Cost of nonpreventable deaths	Total cost of deaths
71,180	$185	$151	$336
187,135	$513	$371	$884

SOURCE Authors' calculations based on Notes 1, 2, 17, and 18 in text.

places the average social cost of an injury at $9,570.[19]

To estimate the magnitude of the loss attributable to these injuries, we assumed that hospital injuries are comparable to workplace injuries, and we used Viscusi's $9,570 figure for the median social cost of an injury,[19] adjusting it to 2006 dollars, or $12,020. We extrapolated from the studies in New York[1] and Utah and Colorado,[2,20] as well as the actuarial study,[9] to the nationwide population. Because the Utah and Colorado studies estimated only inpatients' injuries, we calculated the cost of injuries only for inpatient treatment.

Recall that our estimates place national adverse-event injuries in 2006 at 6.1 million. Of these, only 2.4 million occurred during inpatient treatment. The study did not report how many of these inpatient injuries were preventable.[9] We multiplied the number of inpatient injuries by Viscusi's median value ($12,020) to arrive at a higher estimate of the cost of all inpatient injuries of $29 billion (Exhibit 4).

Based on the Utah and Colorado study, we estimated that 1,007,301 inpatient injuries occurred, of which about 56 percent (561,702) were preventable.[2,20] Multiplied by Viscusi's value of a statistical injury, the total cost of preventable inpatient injuries was $6.7 billion (Exhibit 4).

ESTIMATING TOTAL SOCIAL COST Summing the results in Exhibits 3 and 4, we estimate that in 2006, the social cost of all inpatient adverse medical events—both deaths and injuries—was between $348 billion and $913 billion. If we accept the actuarial study's[9] estimate of total injuries—occurring both in and out of the hospital—we can expand on our estimate of the total cost of

all adverse medical events to between $393 billion and $958 billion.[19] For purposes of comparison, we note that these amounts are equivalent to 18 percent and 45 percent, respectively, of total health care spending in 2006, which was $2.15 trillion.[21]

Searching For Solutions

Currently, patients who are harmed by medical errors have little choice but to seek compensation through the very imperfect tort system—that is, by suing whoever was involved in the adverse medical event. According to another Harvard study of New York patients, fewer than 2 percent of patients (or their families) who are harmed by malpractice ever file a lawsuit, and even fewer receive any compensation.[22] To make matters worse, malpractice victims receive only forty-six cents of every dollar that is recovered through settlements or jury verdicts; the rest goes to cover the victims' attorney fees, court administrative costs, and defense costs.[23]

To appreciate how different our health care system could be, consider the midpoint of estimated spending on the malpractice system: $150 billion.[11,12] For the same money, we could afford to pay $200,000 in compensation for every death attributable to an adverse event, and an average of $20,000 for each injury, with the amount varying depending on the severity of the injury. Prior to undergoing treatment or surgery, patients would be offered voluntary, no-fault insurance as an exclusive alternative to the tort system. A voluntary system would ensure that neither patients nor providers were compelled to give up their traditional legal rights and remedies under the tort system, although

Annual Social Cost Of Inpatient Adverse-Event Injuries, Billions Of 2006 Dollars

Estimated number of injuries	Cost of preventable injuries	Cost of nonpreventable injuries	Total cost of injuries
1 million	$6.7	$5.4	$12.1
2.4 million	—[a]	—[a]	$29.0

SOURCE Authors' calculations, based on Notes 1, 2, 9, and 19 in text. **NOTE** The table shows the low and high estimates for the number of injuries. [a]Not available.

we expect that most would gladly do so. However, no-fault compensation would have to be an exclusive remedy; otherwise, as experiments with after-the-fact no-fault compensation to the injured in Florida and Virginia have shown, parties that are not satisfied with the compensation they receive will pursue litigation.[24]

The base patient compensation should be set by an independent commission, and patients should be free to pay additional premiums to insurers out of their own pockets for more generous coverage. Base compensation would be made by insurers, from premiums paid by hospitals and physcians—just as they buy malpractice insurance today. The premiums paid would reflect the individual provider's (or institution's) past record of adverse events, in order to give the provider an economic incentive to reduce the number of adverse events, which would then lower the cost of insurance.

Providers would have an incentive to spend up to $200,000 to save an additional life, on average, since preventing an adverse event would be the only way to avoid paying compensation.

Thus, they would have financial reasons to consider using electronic health records, error-reducing software, and other safety innovations.

Insurance companies, rather than patients and institutional payers, would become the monitors of hospital quality. Doctors whose patients had high mortality rates would face high premiums. The doctors would either change their practice patterns or lose their hospital privileges. As the insurance premiums became reflected in hospital and doctor fees, patients and their insurers would become aware of potentially large differences in the cost of care. Price competition would drive patients to lower-cost, higher-quality care.[25]

The immediate consequence of offering no-fault compensation insurance to patients would be peace of mind: They would know in advance that any injury would be compensated and any harm would be acknowledged. Further, such a system would provide equity—something sorely lacking in the current malpractice system. ∎

NOTES

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Adverse medical events, whether or not they're preventable or caused by a health care provider's error, lead to large direct additional medical costs needed to cope with the consequences. They also cause "social" or indirect costs, in the form of death and disability and attendant loss of productivity. John Goodman and his coauthors at the National Center for Policy Analysis estimate that "the social cost of adverse medical events is surprisingly large," even for a rough estimate that excludes some kinds of economic damage, such as the legal costs of malpractice suits.

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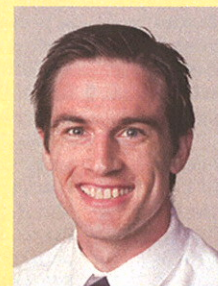
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