Jurors, Judges, and the Mistreatment of Risk by the Courts

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January 31, 2000

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ABSTRACT

A sample of almost 500 jury-eligible citizens considered a series of experimental situation involving accidents. The juror sample did not properly apply negligence rules, as their errors were particularly great for low probability-large loss cases. They also penalized corporations for undertaking corporate risk analyses that seek to trade off cost versus risk reduction benefits. Jurors' damages assessments were also more prone to error than were responses by a sample of state judges. Judges were less prone to erroneous risk beliefs and less subject to the zero risk mentality.

JEL Classification: D-80, J-17

I. Introduction

A substantial literature has documented the difficulties affecting choices under uncertainty. Risk beliefs may be biased, and subsequent decisions may be in error as well. These errors are usually not random, but instead follow many quite systematic patterns. By analyzing the pattern in such biases and heuristics, it becomes possible to predict how people will tend to err in other risk decisions.[1]

These errors are not restricted to people's private decisions. Many recent analyses have suggested that jurors have substantial difficulty in thinking about accident cases as well.[2] Determination of liability and assessments of damages each may be fraught with error. Moreover, these biases are not random and in some cases reflect patterns of behavior established in the literature more generally.

Most of these studies have utilized experimental scenarios to investigate the potential errors in jury judgments. By controlling the background information concerning the accident context it is possible to eliminate the complicating influence of other factors present in actual cases. Moreover, by varying the case descriptions across respondents one can isolate the incremental effect of specific aspects of the case. Most of these studies focus on individual respondents, as does this one, because of cost considerations. However, studies of group decision making have generated similar results that in some cases have strengthened rather than mitigated the errors in individual

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[1] See, for example, the prospect theory model of Kahneman and Tversky (1979). Viscusi (1989, 1998a) provides a normative Bayesian approach that predicts many of the anomalies that are incorporated into the prospect theory framework. Jolls, Sunstein, and Thaler (1998) link many of these anomalies to legal contexts.

[2] See, among others, Hastie, Schkade, and Payne (1998, 1999a, 1999b), Kahneman, Schkade, and Sunstein (1998), Schkade, Sunstein, and Kahneman (forthcoming), Sunstein, Kahneman, and Schkade (1998), and Sunstein, Schkade, and Kahneman (forthcoming).

judgment.[3] This article is in the same vein of experimental work designed to explore how prospective jurors think about accident cases.

Risk judgments of various kinds are central to jurors' implementation of legal rules. Applying negligence criteria requires that jurors assess the adequacy of risk-cost tradeoffs. Similarly, risk-utility tests, assessments of the adequacy of a product design, and similar matters all require that jurors be able to make sensible judgments once presented with appropriate risk evidence. Assessments of whether the defendant's conduct led to willful and reckless imposition of risks on others and consequently merit punitive damages likewise requires that jurors be able to perceive the magnitude of the risk, determine how corporations and other defendants should have responded in that context, and evaluate the extent of the shortfall in the level of precautionary behavior.

To explore such issues, this paper will use an original sample of almost 500 jury-eligible citizens. Each of these participants considered a detailed series of questions regarding risk beliefs, willingness to bear risks, and a wide variety of risk judgments that parallel those arising in courtroom situations. Moreover, since many of the cases considered punitive damages, they also received general instructions regarding the award of punitive damages that covered the principal justifications for punitive damages in jury instructions:

> Several of the questions deal with punitive damages for safety decisions. As you may recall, courts may award punitive damages for conduct that is reckless. A company is reckless if it is conscious of a grave danger or risk of harm, it evaluated the danger, it disregarded the risk when deciding how to act, and its conduct involved a gross deviation from the level of care an ordinary person would use. In the punitive damages cases discussed below, courts will separately award compensatory damages to meet the income losses associated with the accident.

[3] See, for example, the punitive damages study by Schkade, Sunstein, and Kahneman (forthcoming).

Several tests of the rationality of juror behavior are possible. First, do jurors perform well with respect to legal norms, such as legal rules for negligence doctrines? Second, do jurors perform well in objective risk decision terms, e.g., are their risk beliefs accurate? Third, compared to a sample of judges, how do the jurors fare? Many of these scenarios were the same as were considered by a sample of almost 100 state judges, for which the results are reported in Viscusi (1999). This commonality will make it possible to assess whether jurors or judges are better able to deal with the types of risk judgments that arise in tort liability contexts.

The participants in the jury sample consisted of 493 jury-eligible adults who were recruited by a Phoenix, Arizona survey firm.[4] Respondents took the survey, which lasted approximately 30 minutes, and were compensated for their participation. The survey text appears in the Appendix. As is indicated in Table A, the sample included a diverse adult population group. The sample averaged 45 years of age, and at least some college education. Females were over-represented, but seatbelt use and smoking rates were comparable to national estimates. The comparison set of judges consisted of 91 state judges who participated in the University of Kansas Law and Economics Program. These respondents completed the survey before participating in the program, and their survey is described in Viscusi (1999).

Both jurors and judges are individuals and as a consequence will be subject to many biases and kinds of irrationality identified in human behavior. Judges differ in a variety of respects, however. They tend to be better educated than the typical juror. Moreover, because of their judicial experience they have observed a wide variety of accident cases, have witnessed the arguments presented by both plaintiffs and defendants, have seen how these cases have been resolved, and have also seen which case verdicts were overturned and which were not. Judges typically have also engaged in a legal practice before becoming judges, which may have also expanded their informational base. To the extent that some of the questions require that one be able to interpret various legal doctrines in a meaningful way, one would expect that the previous training of judges would make them better able to answer such questions correctly.

My effort to compare the relative performance of judges and jurors is not simply of academic interest. There has been increasing prominence of proposals to delegate more authority to judges in accident contexts, particularly with respect to the setting of punitive damages awards.[5] Whether such a shift in responsibility is warranted assumes that jurors are not always discharging their responsibilities in the desired manner. These deficiencies are well documented. However, a shift in responsibilities also assumes that judges could execute these tasks more in line with sound legal principles. Evidence on such comparisons is much more limited. One can not assume that judges will necessarily be superior assessors of tort contexts if the failings are due to cognitive biases rather than lack of knowledge of legal doctrine.

The juror's task is to assess liability and assess damages. Section II examines whether people think in terms of the types of risk-cost balancing implicit in negligence rules. In some instances, corporate defendants have undertaken explicit risk analyses,

[4] Sample size may be a few subjects less for some questions due to non-responses.
[5] See Sunstein, Kahneman, and Schkade (1998) for a proposal that judges be given increased authority on setting punitive damages levels based on their findings regarding the substantial error in juror judgments. See also Kahneman, Schkade, and Sunstein (1998) for additional empirical support of the irrationality of juror actions with respect to the setting of punitive damages awards.

concluded that the benefits of safety improvements were outweighed by the costs, and then been the subject of litigation after an accident. Section III examines how jurors react to such systematic comparisons of benefits and costs. Rather than crediting companies for undertaking systematic risk analyses, people are more likely to penalize corporations for the deliberate nature of these risk tradeoffs. Assessments of damages are also problematic, as the results in Section IV indicate. Comparison of many of these results for a sample of judges with the jury-eligible sample indicates fewer biases by judges in their treatment of risk. Moreover, the superior performance by judges with respect to accident cases is reflective of their greater ability to think systematically about risk, as is shown by the results in Section V. Possible remedies are the subject of Section VI.

The substantive themes of the article address different aspects of how jury-eligible citizens evaluate accident cases. First, do they think in terms of tradeoffs in a meaningful way? Or are they subject to a zero risk mentality that not only does not permit sensible tradeoffs but holds firms up to an unattainable standard of safety at any cost? This aspect of juror attitudes was captured in the negligence analysis in Section II, the attitude of jurors toward corporate risk analysis in Section III, and the evidence of infinite risk-money tradeoffs in Section V. Second, do jurors have accurate risk beliefs? The evidence on risk overestimation and alarmist responses in the presence of damages lotteries in Section IV indicates that jurors overassess low probability events and are particularly likely to focus on the worst case scenario. The net result is that jurors are likely to impose excessive penalties in accident contexts. The results here also embody a variety of other overreactions to accident cases that have been identified in the literature including outrage effects and anchoring biases.

II. Application of Negligence Rules[6]

How well do people fare when given the task of judging whether a corporation has been negligent? This section will explore how well jury-eligible citizens can follow the Learned Hand rule in making negligence judgments. In particular, will they make decisions as would efficiency-oriented economists to adopt safety measures provided that the benefits exceed the costs? Section III will address the same economic principle except that the risk analysis is performed by the company.

The particular test used is that respondents considered a scenario involving an airplane repair situation. Each person considered only one scenario, but a total of four different scenarios were tested across different subsamples. There is some cost of repair and associated expected benefits from the repair for each of the scenarios. The cost of the repair remains unchanged across the scenarios, as do the expected benefits. However, the scale of the losses increases and the probability of an accident diminishes to keep the expected benefits of making the repair constant. Do juror judgments incorporate such changes that leave expected benefits unchanged? The parameters of the problem are such that the $2,000 cost of the repair always exceeds the $1,500 value of the expected benefits so that the repair decision never passes a benefit-cost test. Thus, the firm should not be found negligent, much less be punished by a punitive damages award.

Large loss-low probability events create potential problems for decision making. The intent of these manipulations is to see whether increasing the size of the stakes dominates jurors' thinking even when the probability of an accident diminishes proportionately. If jurors are not sensitive to the proportional drop in the probability that occurs for the scenarios when the size of the stakes increases, then that will suggest that firms operating in contexts in which the stakes are great will be severely disadvantaged. Even if companies' safety behavior has resulted in a very low probability of an accident, jurors may focus on the magnitude of the stakes involved rather than the expected damages, i.e., the probability of damage multiplied by the size of the loss.

The jurors considered one of five different scenarios, where their first task was to determine whether they would have ordered a repair, had it been their decision. The decision to repair the plane is not, however, identical to finding that the firm was liable on account of negligence. Respondents might favor making a repair but would not hold the firm liable. This question is intended to engage respondents in the repair task and to begin thinking about how they would make the cost-risk tradeoffs. Each scenario was a variant of the initial scenario given below:

> You are CEO of Rocky Mountain Airlines. The cargo door on a plane does not operate properly. Fixing it costs $2,000. If it is not fixed, there is absolutely no safety risk. Very reliable engineering estimates indicate that there is only a 1/10 chance that there will be a total loss to your company of $15,000 due to materials damage to cargo over the life of the plane. Thus, there is a 90 percent chance that there will be no damage whatsoever. Your company has no insurance but will be liable for the cost of this damage.

Respondents were then asked whether they should repair the plane and, if the plane is not repaired and there is damage, should there be punitive damages? The other scenarios raised the losses to $1.5 million, $150 million (29 deaths valued at $5 million that reflects the full social value of life), and $1.5 billion (290 deaths valued to $5 million

[6] See Posner (1986) and Polinsky (1989) for a review of these doctrines and their linkage to the original Learned Hand formula. These principles are elaborated for the risk context in Viscusi (1998b).

each) and decreased the probabilities of an accident to 1/1,000 (for $1.5 million in damages), 1/100,000 (for $150 million in damages), and 1/1,000,000 (for $1.5 billion in damages).

Most respondents favored repairing the plane in all instances shown in Table 1. The percentages of the mock juror sample favoring repairs are 87-88 percent in the two property damage scenarios and 93-96 percent in the two fatality scenarios.

After considering the repair decision, the respondents were then told that the company chose not to repair the plane and the projected damage did in fact occur. The jurors were then asked whether punitive damages would apply in this instance. The percentage of respondents awarding punitive damages was 74-78 percent for the two property damage scenarios and 95-96 percent for the two personal injury scenarios for which total damages are greater. In every case there is an extremely large percentage of jurors awarding punitive damages. This result is particularly striking since the firm is not even negligent, much less guilty of reckless conduct warranting a punitive award. The punitive damages awards become more frequent as the stakes rise, as the significance tests reported at the bottom of Table 1 indicate.

These tests are for the within juror sample by looking across the different scenarios. However, it is also possible to examine the performance for any given scenario across the judge and juror samples. Doing so provides additional evidence regarding the extent of jurors' errors in reflecting risk-cost tradeoffs in their thinking.

A sample of state judges considered three of the four scenarios listed in Table 1, but reacted quite differently. Whereas 88 percent of the jurors favored airplane repair for the Panel A case, only 32 percent of the judges did. Similarly, 74 percent of the jurors favored punitive damages in that case, as compared to only 18 percent of the judges. The 74 percent-18 percent disparity between jurors and judges in the decision to award punitive damages provides striking evidence that judges exercise more restraint in the award of punitive damages. This result is consistent with the frequent overturning or reduction of punitive damages by judges, especially upon appeal. In this low stakes case, most judges acted in accordance with economic efficiency norms in making their decision and in choosing whether to punish a company whose decision turned out badly, whereas most of the jury-eligible sample failed to do so.

As the size of the loss increases to $1.5 million in Panel B of Table 1, the differences narrow, but are still considerable. The repair percentages are 87 percent for the jurors and 48 percent for the judges, while the punitive damages percentages are 78 percent for the jurors and 28 percent for the judges.

In the Panel D situation of personal injury, all the judges would repair the plane, which is comparable to the 96 percent figure for jurors.[7] Whereas 69 percent of the judges would award punitive damages, 96 percent of the jurors would do so. Extreme losses involving personal injury narrow the gap between judges and jurors, but jurors remain much more willing to levy punitive damages.

Both groups display an increased willingness to repair the plane and to impose punitive damages as the stakes risk, especially when loss of human life is involved. However, judges are much more willing than jurors to forego the repair of the plane and to refrain from imposing punitive damages.

[7] Judges did not consider the Panel C scenario.

Neither set of respondents was told the judgment rule to apply or that expected benefits were below costs of the repair. Thus, they were not given an explicit indication that a negligence test would not be appropriate. However, judges showed a greater capacity than the juror sample to undertake such risk balancing as part of their own assessment of the safety situation.

III. Corporate Risk Analyses and Juror Judgments

Risk Analysis Scenarios

Whereas the airplane scenario asked the respondents to, in effect, make a decision based on their own benefit-cost judgments, in many litigation contexts it is often the corporation that has made these judgments based on an explicit benefit-cost analysis. When the company proceeds with a risky action after concluding that the safety benefits are outweighed by the costs, and if this decision turns out badly, will jurors punish the corporation with punitive damages? Thus, does the fact that a company has performed an explicit economic analysis convey a sense of willful and reckless disregard that harms its prospects in court?

Contexts in which there is a corporate risk analysis and a decision to forego a safety measure followed by an accident are situations in which hindsight bias effects come into play. Not only does the jury believe that the accident could have been anticipated, but the company even did an analysis in which it explicitly considered such a prospect but chose not to take preventative measures.

Although the role of hindsight can take on many forms, the effect of hindsight when there is the risk of an accident most often has the following character. Suppose that before the accident, the best available knowledge suggests that there is some low probability p that an accident might occur due to some risky activity by the firm. In fact, the accident does occur. In retrospect, people may claim that now that the accident has occurred that the firm should have anticipated that it would have occurred. Rather than attributing a probability p to the accident, in hindsight people think the chance of an accident was greater than p based on information available before the accident. In the extreme case they may claim that it is obvious that the accident would definitely have occurred with probability 1.0, whereas in advance the anticipated risk was really quite small.

Hindsight effects are among the most well documented biases with respect to juror behavior. [8] Many of the most consequential inventions and innovative economic theories may appear to be sufficiently obvious in retrospect that one wonders why they had not been developed earlier. Similarly, second guessing managerial decisions is a popular pastime of sports fans. While such retrospective ruminations usually have no major adverse consequences, hindsight biases with respect to juror deliberations can have a distorting and deleterious influence. Assessments involving corporate risk analysis are not pure tests of hindsight effects, as they incorporate other influences as well. However, in all of these instances there is at least some element of hindsight in that juror deliberations after the fact have a quite different character than corporate decisions that must be made before the risk lottery is resolved.

[8] A considerable literature is concerned with hindsight effects in legal contexts. See, among others, Hastie, Schkade, and Payne (1999a), Hastie and Viscusi (1998), Kelman, Elliot, and Folger (1998), and Rachlinski (1998).

To promote reasonable risks corporations should think carefully about the risk levels, opportunities for reducing the risk, and the associated costs.[9] As Judge Frank Easterbrook has observed, corporations are typically better situated than jurors to make such judgments because of their specialized technical knowledge regarding the sources of risk and the cost functions for various risk reducing actions. However, their superior *ex ante* risk judgments may be outweighed by the *ex post* reality of the accident victim:

> The ex post perspective of litigation exerts a hydraulic force that distorts judgment. Engineers design escalators to minimize the sum of construction, operation, and injury costs. Department stores, which have nothing to gain from maiming their customers and employees, willingly pay for cost-effective precautions... Come the lawsuit, however, the passenger injured by a stop presents himself as a person, not a probability. Jurors see today's injury; persons who would be injured if buttons were harder to find and use are invisible. Although witnesses may talk about them, they are spectral figures, insubstantial compared to the injured plaintiff, who appears in the flesh.[10]

Indeed, appropriate risk balancing lies at the heart of tort liability concepts such as the negligence doctrine, the Learned Hand formula, and risk-utility analysis. Rather than have corporations make such decisions randomly or without any factual basis, the courts should foster careful consideration of risks and costs to promote both greater safety overall as well as more cost-effective achievement of safety levels. Society can then use its resources most effectively to enhance safety in the areas where these expenditures are most effective.

Unfortunately, our legal system is replete with examples of companies being punished in situations in which they have undertaken responsible risk analyses. The

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[9] A less formal overview of these results and broader discussion of the legal context appears in Viscusi (2000).

[10] See his superb discussion in Carrol v. Otis Elevator, 896 F.2d 210, 215 (7th Cir. 1990) (Easterbrook, F. concurring).

legendary Ford Pinto case, in which Ford apparently traded off risk and costs in its analysis of a prospective government safety regulation, led to Ford being pilloried for insensitivity to the risk-cost tradeoffs associated with the dangers of rear impact crashes for the Ford Pinto.[11] In a case involving a defective door latch for a Chrysler minivan, Chrysler was attacked for its cost-risk analysis. In the view of the plaintiff's attorneys, "Chrysler officials at the highest level cold bloodedly calculated that acknowledging the problem and fixing it would be more expensive, in terms of bad publicity and lost sales, than concealing the defect and litigating the wrongful death suits that inevitably would result."[12] Ford came under similar attack for an analysis of the Ford Mustang that paralleled that in the Ford Pinto case. Ford's transgression involved what the court labeled "safety science management."[13]

General Motors similarly has been punished by juries for analyzing the cost per vehicle of preventing fuel fed fires.[14] Indeed, the existence of an internal G.M. memo on fuel-tank fires was a key factor that led to a $4.9 billion verdict against G.M. in July, 1999 for burn injuries to six passengers in a Chevrolet Malibu, where the award consisted of $100 million in compensatory damages and $4.8 billion in punitive damages.[15] The internal memo that was the focal point of this case closely parallels the analysis in Scenario 3 to be discussed below except that the compensatory award levels have been

[11] For a detailed discussion of the Ford Pinto experience, as well as a debunking of many popular misconceptions about the character of this analysis on the part of Ford, see Schwartz (1991) and Fisse and Braithwaite (1983).
[12] See Jimenez v. Chrysler Corp., No. 2-96-269-11 (D.S.C. October 8, 1997) and Donald C. Dillworth, "Fourteen Jurors Punish Chrysler for Hiding Deadly Defect," 34 Feb. Trial 14, February 1998.
[13] See Ford Motor Company v. Stubblefield et al., 171 GA App. 331, 319 S.E. 2d 470.
[14] In particular, see Moseley v. General Motors Corp., 213 GA App. 875.
[15] See Andrew Pollack, "Paper Trail Haunts G.M. After It Loses Injury Suit: An Old Memo Hinted at the Price of Safety," New York Times, July 12, 1999, p. A12.

updated to reflect the change in award levels over the quarter century since the memo was written.

The fact that the company traded off human health risks against profits played a critical role in the G.M. trial. As the plaintiff's attorney Brian J. Parish summarized the jury's zero risk mentality: "The jurors wanted to send a message to General Motors that human life is more important than profits."[16] One juror specifically cited the use of concrete value of life estimates as a concern: "We're just like numbers, I feel, to them…statistics. That's something that is wrong."[17]

These examples are not unique, but are reflective of the kinds of situations in which corporate risk analyses have in fact had an adverse effect on the company's prospects in court. In such cases jurors may have considered the company reckless simply because the company did an analysis, not because the analysis was flawed or deficient in any way.

Juror reactions to corporate analysis may embody more than one set of influences. In hindsight the cause of the accident may be more apparent. If a corporation undertook a detailed risk analysis before the accident, then this effort may be taken as a signal of the foreseeability of the accidental outcome. Failing to undertake a safety improvement after a detailed risk analysis may be treated as indicating a conscious disregard for safety even if the analysis itself was correct and indicated that safety improvements were not warranted. Another class of influences is that a benefit-cost analysis shows a willingness to trade off risks against cost. Jurors who have a zero risk mentality may view tradeoffs

[16] Andrew Pollack, "$4.9 Billion Jury Verdict In G.M. Fuel Tank Case: Penalty Highlights Cracks in Legal System," New York Times, July 10, 1999, p. A7.
[17] Id.

of any kind unconscionable. Even striking a balance that goes beyond that reflected in governmental regulatory policy may offend jurors' sensibilities.

To isolate the effect of undertaking a corporate risk analysis, each mock juror considered one of five different scenarios summarized in Table 2. Each scenario is a variant on the case described below, which is Scenario 1:

> A major auto company with annual profits of $7 billion made a line of cars with a defective electrical system. This failure led to a series of fires in these vehicles that caused 4 burn deaths per year. Changing the design to prevent these deaths would cost $16 million for the 40,000 vehicles affected per year. This safety design change would raise the price of cars $400 each. The company thought there might be some risk from the current design, but did not believe it would be significant. The company notes that even with these injuries, the vehicle had one of the best safety records in its class.
>
> The courts have awarded each of the victims' families $800,000 in damages to compensate them for the income loss and pain and suffering that resulted. After these lawsuits, the company altered future designs to eliminate the problem.

Respondents then had to indicate whether the court should also award punitive damages and, if so, how much. By comparing the responses across different scenarios one can ascertain the incremental effect of different experimental manipulations. This, the accident context remains the same but there will be differences across the five scenarios in the nature of the economic analysis. Moreover, each of these scenarios was tested with two different levels of injuries.

<u>Performance of Different Scenarios</u>

As the results in Table 3 indicate, for Scenario 1 about 85 percent of the sample would award punitive damages, with a median value of $1 million and a geometric mean value of $3 million. The high propensity to award punitive damages proved to be the case even with major variations in the number of deaths per year (4 versus 10). Because the manipulation involving the number of total deaths had no significant effect, the results in Table 3 pool these findings. These high levels of punitive awards are not an experimental aberration but appear to track how strongly jurors have reacted to such auto injury cases. Thus, the evidence of some ceiling effects with respect to the frequency of punitive awards may be reflective of the strong reactions juries in practice have had to auto design defect cases. The main variation across scenarios will consequently be in the assessed damages level.

Scenario 2 lowers the cost of making the car safer but is otherwise identical to Scenario 1, as the firm does not undertake any systematic risk analysis. Rather than costing $4 million per life saved, the cost drops to $1 million, or safety improvements are more desirable in benefit-cost terms. As is indicated by the summary of results in Table 3, for Scenario 2 the frequency of awarding punitive damages rises by 0.07, the geometric mean award drops by $0.1 million, and the median award remains at $1 million. However, none of these differences from Scenario 1 is statistically significant.[18] Jurors are not sensitive to these different costs of providing safety.

Scenario 3 introduces the role of corporate risk analysis in which the company estimated that these deaths might occur and valued them at a compensatory damages amount of $800,000 each. Compared to Scenario 1, which has the same cost per life saved but no risk analysis, the frequency of punitive damages awards rises by 0.08, the

[18] The pertinent t statistics for these different tests are 1.58 for the probability and 0.100 for the amount of the award.

geometric mean award rises by $1.07 million, and the median award increases by $2.5 million.[19]

Juries might, however, be reluctant to endorse such analyses to the extent that compensatory awards undervalue the saving of human life. Suppose instead that the company did not use the compensatory damages amount but rather used a willingness to pay value of life measure. Specifically, the survey informed the respondent that the company used a $3 million value of life in its analysis and followed the approach now used by the National Highway Traffic Safety Administration (NHTSA) in determining whether a motor vehicle safety regulation is worthwhile. Comparison of Scenarios 3 and 4 makes it possible to ascertain the incremental effect of using such a higher value of life instead of a compensatory damages amount. The probability of awarding punitive damages remains at 0.93, but the geometric mean award level jumps by $5.31 million, and the median award jumps by $6.5 million.[20] It is especially noteworthy that the $3 million value of life figure used in the Scenario 4 analysis serves as an anchor that boosts punitive damages. Whereas 42 percent of the sample recommending punitive damages indicated an award level of $1 million or less for Scenario 3, with Scenario 4 this percentage drops to 35 percent.

More responsible risk analyses have an adverse effect on the company's prospects, as jurors apparently seek to top the company's internal valuation. These higher award amounts do not appear to be the result of greater jury outrage – an effect that Kahneman, Schkade, and Sunstein (1998) have found to be very influential in other

[19] The pertinent t values are 1.826 for the probability (significant at the 95 percent confidence level, one-tailed test) and 1.058 for the mean amount of the log of the award.

contexts. Presumably, jurors should be more receptive to a company acting in line with the same risk evaluation guidelines as are used by government agencies. The effect instead appears to be due to anchoring.[21] Jurors wishing to "send a message" to the company have to levy punitive damages that are higher so as to top the corporation's value of life figure and foster a higher degree of safety than would emerge from the firm's estimates.

In Scenario 5 the company's risk analysis is the same as in Scenario 4 except that the company errs in its analysis by underassessing the level of the risk by 50 percent. How do flaws in the risk estimate that would affect the outcome of a benefit-cost analysis influence juror behavior? The result is that the cost per life saved turns out to be $2 million rather than the $4 million value estimated by the company. Based on the actual costs and risks, the benefits of improved safety would have exceeded the costs. These errors have an inconsequential effect on the propensity to award punitive damages or the level of such awards.[22]

By pooling the similar scenarios, these effects are more pronounced as well as statistically significant. For Scenarios 1 and 2 in which there is no analysis by the company, an average of 88 percent of the respondents would favor punitive damages, as compared to 94 percent for the other three scenarios. This six percent difference is statistically significant (t=2.10). Differences in the award level are also statistically significant (t=2.44 for the mean of the log award), with the geometric mean rising from

[20] The pertinent t values are 0.088 for the probability of an award and 1.066 for the mean values of the log of the award.
[21] Anchoring effects arise in other punitive damages contexts as well. See Hastie, Schkade, and Payne (1999a).
[22] Pertinent t values are 0.50 for the probability and 0.60 for the log of the award.

$2.9 million for the no analysis scenario to $4.6 million for those with risk analysis, while the median award increases from $1 million to $10 million.

Each of the five scenarios was run in two variants – one set the number of lives lost at 4 and the other set it equal to 10. This manipulation sought to test whether the absolute level of the risk was a matter of concern. Surprisingly, the influence of this difference was never significant.[23]

These variations in response across scenarios are not attributable to the role of respondents' personal characteristics. Table 4 provides the probit estimates for the probability that the respondent favors a punitive damages award, where the coefficients have been transformed to reflect the marginal probability effect of each variable. Table 5 presents analogous regression estimates for the natural logarithm of award size. The principal experimental manipulations included in the initial set of estimates were whether the company performed a risk analysis, the cost per life saved, and whether the absolute risk level was high (i.e., 10 deaths rather than 4 deaths). The second set of estimates in each case adds a detailed series of personal characteristics: gender, age, race, education, smoking status, and seatbelt use. These variables have a small effect on the coefficient estimates, as the pure experimental effects are largely unaffected. Moreover, the predictive power of the equations is very low. Somewhat surprisingly, controlling demographic factors has a negligible effect on the influence of risk analyses on punitive damages. The statistically significant manipulation in these estimates is whether the company performed a risk analysis. Undertaking a risk analysis increases the probability

[23] Pertinent t values are 0.80 for the probability and 0.43 for the log of the award.

of a punitive damages award by 0.05[24] in both equations. Moreover, the risk analysis variable boosts the level of a punitive damages award by 47 percent and 38 percent for the two sets of estimates in Table 5.

The absence of other statistically significant risk variable influences in Tables 4 and 5 is noteworthy as well. Ideally, it should be efficiency concerns driving juror judgments, in particular the shortfall of the company's behavior from the socially efficient risk tradeoff level. However, the cost per life saved, which is the pivotal efficiency index, is not statistically significant. In addition, even the absolute level of the risk proves to be inconsequential. The fact that the variables that should affect juror judgments have no significant effect is a striking result in that it indicates that the underlying economic merits are not consequential. All that matters is whether the company performed a risk analysis in advance.

Synthetic Juries

The results for the corporate risk analysis scenarios thus far have focused on individual responses and the determinants of these results. A somewhat different question is how would juries actually perform in such cases. Instead of focusing on an individual, the issue becomes one of group decision making. The approach here will consider a series of synthetic juries drawn randomly from the 489 respondents on a scenario by scenario basis. These synthetic jury results will give some indication of how the decision to award punitive damages and the determination of the level of punitive damages would have fared in a jury context. However, as the comparison of the

[24] Note that the reported probit coefficients have been transformed to reflect the marginal probabilities of

synthetic jury results in Kahneman, Schkade, and Sunstein (1998) with actual group decision making reported in Schkade, Sunstein, and Kahneman (forthcoming) indicates, group decision making in practice may lead to more extreme awards rather than a moderation of outcomes.[25]

The procedure used to construct the synthetic juries is the following. For each of the five versions of the survey a random sampling replacement procedure was used to draw 1,000 juries of 12 individuals. For these 1,000 mock juries, it is possible to analyze the distribution of the number of jurors who favor the award of punitive damages as well as the level of punitive damages that they favor.

Consider first the distribution of the number of jurors favoring punitive damages, which is shown in Table 6. For Scenario 1 in which the company undertook no analysis but there was a cost per life saved of $4 million there were very few cases in which the jurors were unanimous in favoring a punitive damages award. In only 12.8 percent of the cases did all 12 jurors favor a punitive damages award, and in only 28.2 percent of the cases did 11 of the jurors favor punitive damages. If, however, the cost per life saved drops to $1 million as in Scenario 2, the jurors become much more willing to levy punitive damages. Jurors unanimously recommend punitive damages 35.4 percent of the time and all but one juror favors punitive damages 40.2 percent of the time. The overall combined results of the 2,000 synthetic juries for Scenarios 1 and 2 appear in the third row of Table 6. For these two scenarios 24.1 percent of the juries unanimously favored punitive damages, and an additional 34.2 percent had all but one juror in favor of punitive damages.

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each variable.

Below in Table 6 appear the results for the three analysis scenarios, each of which indicates a striking willingness of jurors to levy punitive damages. The instances in which all jurors unanimously favor punitive damages range from 39.0 percent for Scenario 3 to 47.6 percent in Scenario 5. The instances in which all but one juror favor punitive damages averaged approximately 40.0 percent in all three scenarios. The result is that the combined analysis of the 3,000 synthetic juries in Scenarios 3 through 5 indicates that 42.3 percent of the synthetic juries unanimously favored punitive damages, with an additional 40.6 percent having all but one juror in favor of punitive damages. Overall, 82.9 percent of the synthetic juries had 11 or 12 jurors favoring punitive damages in the three scenarios in which the companies did analysis as compared to 58.3 percent of the juries for the two situations in which the company did not do analysis.

These results in the frequency of awarding punitive damages for the synthetic juries consequently magnify the differences that were found in individual responses above. Consideration of the frequency in which jurors awarded punitive damages on an individual bases did not yield as striking results for the probability of awarding punitive damages as it did for the level of punitive damages. However, once these individuals are placed within a group context, the role of these differences becomes very apparent. The greater willingness of jurors to levy punitive damages when the company performs a risk analysis dramatically shifts the balance within a jury to a level that is much more nearly unanimous or almost unanimously in favor of punitive damages.

The second issue pertaining to the role of synthetic juries is the level of punitive damages that they would award. Table 7 reports the award level favored by the median

[25] Indeed, this phenomenon may be more general, as is indicated by ongoing research by Cass Sunstein.

juror, the mean value of the award favored by these jurors, and the standard error of the mean. The review of the literature in Kahneman, Schkade, and Sunstein (1998) suggests that the median award is the most representative statistic for reflecting actual jury behavior though, as is indicated above, it may understate the extent to which groups will levy harsh punitive damages sanctions.

The synthetic jury results for the award levels in Table 7 reflect the patterns found earlier for the individual responses as well as the kinds of discrepancies reflected in the synthetic jury results for the probability of awarding punitive damages. Although there is little variation in the median award level for the no analysis scenarios, the mean level of the award is higher for the no analysis Scenario 2, which mirrors the greater propensity to award punitive damages in that instance as well. For the combined results for Scenarios 1 and 2, the median award level is $1 million and the mean award level is $3 million.

The three analysis scenarios each indicate higher award levels than in the no analysis situations. The highest awards occur not when the company uses a low value of life based on court awards in Scenario 3; nor does it occur in Scenario 5 in which the company undertakes erroneous analysis. Rather, it is for Scenario 4 in which the company performs the analysis correctly and in line with the procedures used by the National Highway Traffic Safety Administration that the jury levies its greatest sanction -- $7.5 million for a median award and $6.9 million for the mean award level. The combined results for the three analysis scenarios indicated a median award level of $6 million and a mean award level of $5.8 million, each of which is substantially above the comparable findings for the no analysis scenarios.

What these synthetic jury results suggest is that the individual differences in the propensity to award punitive damages and the setting of the level of punitive damages may translate into considerable differences in terms of actual group decision making outcomes. Moreover, as in the individual results, the results are the opposite of what one would hope to find. Performing a risk analysis is likely to tilt the jurors against the company in a manner that can have a demonstrable and substantial effect on jury outcomes.

The failure to find many systematic predictors of the level of punitive damages awards in Table 5 as is evidenced by the low explanatory power and the insignificant risk variables is reflective of more general difficulties jurors have in mapping their concerns into dollars. As Kahneman, Schkade, and Sunstein (1998) and Sunstein, Kahneman, and Schkade (1998) have shown, jurors have no consistent basis for mapping their outrage into dollar awards. The finding that it is only the existence of a corporate risk analysis rather than other aspects of the risk context that is influential in driving the award of punitive damages or their level is consistent with the spirit of their findings in which no clear liability principles appear to be driving juror behavior. In the case of risk analyses that specify value of life figures, both outrage and anchoring effects are influential.

IV. Setting Damages When Losses May Vary

Tort liability situations involve many uncertainties. It is rare that we know in advance that an accident will occur. Moreover, if an accident does occur, the amount of the damage may vary. Dealing with the role of possible loss variance creates potential hurdles for juror judgments. If jurors have ambiguity aversion and anchor their views on the worst possible case scenario rather than the actual damages amount, the damages levied will be too high. The results below will also compare the behavior with that of judges, who will be found to have less of a bias of this type.

Suppose that an accident could generate damages that could have either a high value or a low value. Thus, there will be damages, but there is a lottery on the damages level. What should be the accident award? The legal principles in situations of financial loss are well established. Compensating the accident victim for the amount of the loss provides an optimal level of insurance of the harm. Damages equal to the size of the loss will also create efficient levels of deterrence if we assume away complications such as detectability problems. Thus, paying off damages equal to the high loss amount when the loss is high and the low loss amount when the loss is low will generate efficient insurance and deterrence. While there is no other optimal insurance amount, it is possible to create efficient deterrence by always setting damages equal to the expected loss. However, such a penalty will not provide optimal insurance, and for it to provide efficient deterrence damages must always be paid when there is a damages lottery even if the low damages amount is zero. However, these cases will not appear in court. If instead damages are always set to equal the worst case scenario, they will provide excessive insurance for the low loss cases and excessive deterrence. Thus, I will take damages equal to the loss as the normative reference point for compensatory damages awards.

To explore the influence of uncertainty regarding the damages amount, respondents considered an oil well blowout situation in which there was a lottery on damages. Some respondents received the scenario in which the lottery outcome was a low level of losses, while others considered a scenario in which the losses were high. The scenario was as follows:

> Acme Oil Company has been found that it did not meet the legal standards for safe operation of its wells. Consequently, it is liable for an oil well blowout that caused $10 million in property damage and no personal injury. The company in many respects was unfortunate in that such blowouts have a 90% chance of no damage and a 10% chance of $10 million in damages. What damages award would you select?

The counterpart scenario also had $10 million in damages actually occurring, but the company was fortunate in that the damages could have been worse -- $100 million. Do the respondents focus on what might have been, or do they assess damages properly based on the actual outcome? Focusing on what might have been would be a form of ambiguity aversion or alarmist response to risk that has been identified as an influence in other risk contexts for probabilities.[26] In particular, people often focus on the worst case scenario in terms of the level of the risk probability when the probability is uncertain. Here the uncertainty is with respect to uncertainty involving the size of the loss. Risk aversion should presumably not be influential because there is no indication that the losses are borne privately and concentrated among a small group.

Table 8 summarizes the damages amounts levied by a sample of judges and juror-eligible citizens, where for simplicity the results from both scenarios have been pooled. The results for the judges sample varied very little across the two scenarios. Overall, 92 percent of the judges given this question selected a $10 million award, which was the value of damages that occurred. The median award level was also $10 million, and the geometric mean of the awards was quite similar, as it was $11.1 million.

[26] See Viscusi (1998a) for a review of this evidence.

The results for the jury-eligible citizens also shown in Table 8 reflect an enormous variation in the assessed damages amount. Even though the actual damages were only $10 million, only 26 per cent of the respondents assessed this damages value. In contrast, virtually the entire judges' sample selected $10 million in damages. Thirty-seven percent of the juror sample awarded $30 million in damages. Roughly one-fifth of the sample awarded damages under $10 million, with a similar percentage awarding damages over $30 million. The median award level of $30 million and the geometric mean award level of $21.4 million each greatly exceed the award amount selected by judges.

The distribution of the responses depends on which scenario the respondent received. In the case in which the firm was fortunate in that the accident did not cause more damage than it actually did, jury-eligible respondents who deviated from the $10 million damages amount in setting awards tended to award levels in excess of $10 million. In contrast, when the company was unfortunate in that the $10 million damages amount could have been zero, there is a greater propensity of the subjects to award damages below the $10 million damages level.

For the judges the few departures from the $10 million damages amount occurred because of awards exceeding $10 million.[27] The larger sample for the jury-eligible citizens indicates that for this group the frequency of departures from the $10 million award amount do reflect the expected pattern given the character of how the lottery might

[27] Somewhat surprisingly, there were more large awards when the company was unfortunate in experiencing damages when there was a 90 percent chance of no loss than in the situation in which the company was fortunate that the damages were not as bad as $100 million. Due to the small sample of judges deviating from the $10 million amount, this result may not be consequential. These errors could be due to random misreadings of the survey.

have turned out. In situations in which the company was fortunate in that there was a 90 percent chance of experiencing damages greater than $10 million, over half the sample awarded a damages amount exceeding $10 million, and 14 percent of the sample awarded damages below $10 million. For the unfortunate case in which the company had a 90 percent chance of having no damages, but did in fact experience $10 million in damages, 22 percent of the sample awarded damages below $10 million, and 44 percent of the sample awarded damages in excess of $10 million. However, there is much greater clustering of these awards above $10 million in the $30 million range rather than the damages amounts of $75 million and $100 million, which were selected much more often in the fortunate case scenario. The existence of a damages lottery often leads jurors to assess damages in excess of the actual damages amount, irrespective of whether there was a chance of greater or smaller damages. However, this tendency to award damages exceeding the actual amount is much greater when there is a chance that the accident could have been worse than it was. The net result is that potential damages variance before the accident leads jurors to award higher penalties than would be warranted based on sound law and economic principles. Jurors anchored their damages assessments on the worst case scenario even when it did not prevail. Judges were not susceptible to this error.

V. Sources of Error: Risk Beliefs and Risk Tradeoffs

What factors might account for the errors of jurors and the comparatively better performance of a sample of judges? These groups may differ in terms of how they view risk more generally. Do jurors perceive risk differently, or is it that they have different valuations of risk for any given level of risk beliefs? This section will explore differences in mortality risk beliefs and personal risk-money tradeoffs. If there are systematic differences in how mock jurors and judges address risk issues more generally, that result will suggest that knowledge of the law alone does not account for differences in treatment of the accident situations. Two differences are more salient. First, judges tend to perceive risks more accurately and are less likely to overestimate low probability events such as those involved in accident and product safety contexts. Second, judges are less subject to the zero risk mentality of being willing to spend unbounded amounts to achieve small reductions in risk. Each of these influences will tend to make juries more likely to find companies liable and impose substantial damages in accident contexts.

Consider first how people perceive risk. One of the most well established results in the literature on risk and uncertainty is that people overestimate low probability events and underestimate larger risks.[28] The principal studies generating this result are those by Lichtenstein et al. (1978) and Morgan (1983), who found that for a set of mortality risks that people exhibit the systematic patterns of bias noted above. Here I will run a similar experiment in which judges and jurors each rate the total number of fatalities from different causes. Each individual in the sample assessed the total annual deaths associated with 23 major sources of mortality using an approach that paralleled that used in the risk perception studies above.

The survey question that the respondents considered with respect to the mortality risk assessment was the following:

> In 1990, 47,000 people in the United States died in automobile accidents. How many people died from the other causes of death listed

[28] There are, of course, exceptions. Kunreuther et al. (1978) find that some low risks tend to be ignored.

> below? You are not expected to know any of these answers exactly. Your best estimate will do. Fill in your best estimate in the space.

The respondents then considered 23 different causes of death.

Figure 1 sketches the level of risk beliefs for the juror sample and a sample of judges as a function of the actual risk level.[29] The risk perception curve for the juror sample is the solid curve. The bold dashed curve indicates the comparable relationship for judges. Figure 1 demonstrates the established pattern of overperception of small risks and underassessment of large risks, as respondents tend to overassess risks such as botulism, fireworks accidents, and lightning strikes. In contrast, the truly substantial hazards that we face such as the risks from diabetes, stroke, all forms of cancer, and heart disease tend to be underestimated.

It is noteworthy that the risk perception curve for judges is closer to the 45 degree line along which perceived risks equal actual risks almost throughout the risk range. Judges have more accurate risk beliefs than do juror-eligible citizens. The relative discrepancy is particularly great for the large risks, for which the judges have an error in their risk assessments that is approximately half as great as that of the jurors.

A second critical attribute for determining how individuals will make decisions regarding risk is their risk-money tradeoff. The most widely used measure of this type in the economics literature is the implicit value of life. This terminology does not refer to the amount one would pay to avoid certain death. Nor does it pertain to the appropriate level of compensation after a fatality. Rather, it gives individuals' rate of tradeoff between small probabilities of death and money. Economists typically base these

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[29] These curves were based on estimates of the natural log of perceived risks as a function of a person-specific intercept and both a linear and quadratic term for the natural log of actual deaths.

estimates either on the revealed tradeoff in higher wages for a risky job or the lower prices people pay for more hazardous products. Most of these estimates based on wage equations cluster in the range of $3 million to $7 million, with a midpoint value of $5 million.[30]

In order to elicit survey responses that are meaningful, it is essential to create a credible survey context that will in fact elicit the underlying risk-money tradeoff. U.S. Supreme Court Justice Stephen Breyer (1993) has suggested that a particularly useful way to think about value of life issues in general is to ask people how much they would be willing to pay for a marginally safer car. These personal risk tradeoffs could then be used to guide the individual in thinking about the risk tradeoff that corporations should strive to achieve. Survey evidence in the literature regarding hypothetical improvements in automobile safety have yielded estimates for the implicit value of life comparable to those that have emerged from wage-job risk studies using actual labor market behavior.[31]

The specific question that the respondents considered regarding the value of life was the following:

> Suppose you could reduce your annual risk of death in a car crash by 1/10,000. Thus, if there were 10,000 people just like you, there would be one less expected death per year in your group. This risk reduction would cut your annual risk of death in a car crash in half.
>
> How much would you be willing to pay each year either for a safer car or for improved highway safety measures that would cut your motor vehicle risks in half?

[30] For a review of this evidence, see Viscusi (1993, 1998a).

[31] For a review of these studies in comparison to the wage equation literature, see Viscusi (1993). A recent study of the implicit value of life reflected in used car purchases, which parallels the case study approach advocated by Justice Breyer, is that of Dreyfus and Viscusi (1995).

Respondents then considered five different dollar ranges as well as the possibility of spending an infinite amount on such a safety improvement, where this was defined as being "all present and future resources." Converting responses to an implicit value of life measure is a straightforward exercise. The risk change indicated in the question was a decrease in the probability of death of 1/10,000. For those who gave finite responses, the mean implicit value of life of $5.1 million was quite reasonable and in line with estimates in the literature.

What is disturbing is that almost 10 percent of the juror sample -- or 47 respondents -- indicated that they had an infinite value of life amount. Such responses indicate a failure to be willing to make such complex risk tradeoffs. In contrast, only 3 percent of the judges indicated an unlimited willingness to pay for greater safety.[32] Jurors more than judges fall prey to the zero risk mentality and are willing to pay any price to achieve safety. Such unbounded commitments to safety are not feasible, given the multiplicity of hazards that we face and the limited resources we have to address them. A belief in the zero risk approach will make jurors less willing to accept the behavior of corporations that make finite risk tradeoffs, as in the auto safety scenarios discussed in Section III.

Thus, in addition to the differences found in the accident scenarios, the jurors displayed two classes of systematic errors in dealing with risk more generally. They are more likely to believe that low probability hazards are more dangerous than they are. Moreover, in considering risk contexts they are more susceptible to the zero risk

[32] In addition, 4 percent of the judges did not respond to the question.

mentality than are judges. Each of these sources of error will make jurors more likely to err in a systematic manner in their liability judgments and damages assessments.

VI. Conclusion

Anomalies in individual behavior regarding risk are not restricted to private decisions. People's participation in juries also involves consideration of risk contexts for cases involving accidents. An important question for assessing the function of our judicial system is how juries in fact approach such decisions and whether their judgments are flawed in a systematic manner.

The results of this study of risk attitudes of jury-eligible citizens and a comparison of these findings with similar results for judges suggests that jurors particularly fall short of reasonable standards of behavior. Several noteworthy discrepancies indicated comparatively better performance by judges. Whereas 74 percent of jurors favored punitive damages in the small property loss airline repair case, only 18 percent of judges did. When faced with damages resulting from a previous risk lottery, 92 percent of judges awarded damages equal to the loss, as compared to 26 percent of jurors. Judges had more accurate risk beliefs and were less prone to overestimating low probability events. Few judges were subject to the zero risk mentality, whereas 10 percent of the jury-eligible citizens had infinite risk tradeoffs. Overall, judges displayed a greater capacity to think in a balanced manner about the competing concerns pertinent to accident contexts.

These findings raise the more fundamental issue of whether jurors make risk judgments sensibly when comparing the costs and benefits in risk contexts, determining whether a firm should be liable for an accident, and assessing the appropriate level of damages to be levied. Jurors fall substantially short of what one might hope for in terms of a desired pattern of decisions, particularly in small probability-large loss cases. In situations in which companies undertake a benefit-cost analyses, jurors pay very little attention to either the risk level or the cost per life saved—two key characterizations of the risk decision from the standpoint of how the company should approach accident risks to its products. What does matter, consistently, is whether the corporation undertook a systematic risk analysis, but nevertheless proceeded to market a risky product. Jurors fault the companies for thinking systematically about risk, even in situations in which based on the usual economic criteria the firm was not negligent and complied with state-of-the-art economic evaluation practices employed by the responsible regulatory agencies. Moreover, sound economic analyses with high values of life are targeted by jurors for even greater punitive damages.

Jurors also display a particular willingness to boost the level of such damages when the damages could have been worse, but were not. This bias will make damages awards systematically too high.

The underlying theme throughout these results is that jurors not only make errors that are inconsistent with the usual law and economics principles, but also that these biases are quite systematic and will generate higher liability costs for firms. These findings also produced evidence of a zero risk mentality, risk overestimation, and undue emphasis on worst case outcomes. Anchoring effects were also influential with respect to corporate risk analyses, as was the role of hindsight bias. The results also were consistent with evidence suggesting that juror judgements are driven more by an outrage model than a careful benefit-cost framework. A variety of such influences are no doubt operative in these instances as well as in actual cases in court.

Failure to make sensible risk tradeoffs and penalizing companies for making responsible efforts to trade off risk and cost distorts the behavior of juries from what should be their proper role. Recent research focusing on punitive damages awards has urged that judges be given more discretion over complex risk cases, particularly with regard to setting punitive damages.[33] The findings here suggest that the case for such a shift in responsibility has a broadly based cognitive rationale.

Other reform proposals also are potentially consistent with the spirit of the results here. A sweeping reform possibility that I considered in Viscusi (1998b) is that punitive damages be eliminated for safety and environmental risks. The underlying rationale stemmed from the fact that punitive damages have no apparent incentive effect empirically. Moreover, most of the responsibility for creating these incentives lies both with market forces and with government regulatory agencies, which are better equipped than are juries to deal with the complex scientific issues that often arise in these areas. A less sweeping proposal that also is reflective of the scientific complexities and the need for technical expertise is Justice Breyer's (1993) suggestion that the courts avail themselves more of scientific experts to assist in illuminating these concerns because of the great difficulty that risk issues pose for courts and the typical juror.

The results in this article highlight the fact that there is a serious problem in the way the courts address matters pertaining to health, safety, and environmental risks.

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[33] See Sunstein, Kahneman, and Schkade (1998) For advocacy of delegating increased responsibility over punitive damages to judges as well as the documentation of the errors that occur as jurors map their concerns regarding the behavior of defendants into dollar punitive damages amounts.

Numerous other studies have also indicated that there are many deficiencies in juror deliberations, particularly as they relate to the determination that punitive damages are warranted and to the mapping of these concerns into dollar damages amounts. Presumably any reform effort should also reflect the insights of these many additional contributions as well. What is clear is that the shortcomings that researchers have identified in behavior toward risk by individuals also carry over to the courtroom.

References

Breyer, Stephen. (1993). BREAKING THE VICIOUS CIRCLE (Cambridge, MA: Harvard University Press).

Dreyfus, Mark, and W. Kip Viscusi. (1995). *Rates of Time Preference and Consumer Valuations of Automobile Safety and Fuel Efficiency*, 38 J.L. AND ECON., 79-105.

Fischhoff, Baruch, Sarah Lichtenstein, Paul Slovic, Stephen L. Derby, and Ralph L. Keeney. (1981). ACCEPTABLE RISK (Cambridge: Cambridge University Press).

Fisse, Brent, and John Braitwaite. (1983). THE IMPACT OF PUBLICITY ON CORPORATE OFFENDERS (Albany: State University of New York Press).

Hastie, Reid, David Schkade, and John Payne. (1998). *A Study of Juror and Jury Judgments in Civil Cases: Deciding Liability for Punitive Damages*, 22 LAW & HUM. BEHAV., 287-314.

Hastie, Reid, David Schkade, and John Payne. (1999a). *Juror Judgments in Civil Cases: Effects of Plaintiff's Requests and Plaintiff's Identity on Punitive Damage Awards*, 23 LAW & HUM. BEHAV., 445-470.

Hastie, Reid, David Schkade, and John Payne. (1999b). *Juror Judgments in Civil Cases: Hindsight Effects on Judgments of Liability for Punitive Damages*, 23 LAW & HUM. BEHAV., 597-614.

Hastie, Reid, and W. Kip Viscusi. (1998). *What Juries Can't Do Well: The Jury's Performance as a Risk Manager*, 40 ARIZ. L. REV., 901-921.

Jolls, Christine, Cass R. Sunstein, and Richard Thaler. (1998). *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV., 1471-1550.

Kahneman, Daniel, David Schkade, and Cass Sunstein. (1998). *Shared Outrage and Erratic Awards: The Psychology of Punitive Damages*, 16 J. RISK AND UNCERTAINTY, 49-86.

Kahneman, Daniel and Amos Tversky. (1979). *Prospect Theory: An Analysis of Decision Under Risk*, 47 ECONOMETRICA, 263-291.

Kelman, Mark, David Elliot, and Hilary Folger. (1998). *Decomposing Hindsight Bias*, 16 J. RISK AND UNCERTAINTY, 251-269.

Kunreuther, Howard et al. (1978) DISASTER INSURANCE PROTECTION: PUBLIC POLICY LESSONS (New York: John Wiley).

Lichtenstein, Sarah et al. (1978). *Judged Frequency of Lethal Events*, 4 J. EXPERIMENTAL PSYCHOLOGY, 551-578.

Morgan, M. Granger. (1983). *On Judging the Frequency of Lethal Events: A Replication*, 3 RISK ANALYSIS, 11-16.

Polinsky, A. Mitchell. (1989, 2d ed.). AN INTRODUCTION TO LAW AND ECONOMICS (Boston, MA: Little Brown and Co.).

Posner, Richard. (1986, 3d ed.). ECONOMIC ANALYSIS OF LAW (Boston, MA: Little, Brown, and Co.).

Rachlinski, Jeffrey J. (1998). *A Positive Psychological Theory of Judging in Hindsight*, 65 U. CHI. L. REV. 571-625.

Schkade, David A., Cass R. Sunstein, and Daniel Kahneman. *Are Juries Less Erratic than Individuals? Deliberation, Polarization, and Punitive Damages*," COLUMBIA L. REV., forthcoming.

Schwartz, Gary. (1991). *The Myth of the Ford Pinto Case*, 43 RUTGERS L. REV., 1013-1068.

Sunstein, Cass, Daniel Kahneman, and David Schkade. (1998). *Assessing Punitive Damages (with Notes on Cognition and Valuation in Law)*, 107 YALE L.J., 2071-2153.

Sunstein, Cass, David Schkade, and Daniel Kahneman. *Do People Want Optimal Deterrence?* J. LEGAL STUD., forthcoming.

Viscusi, W. Kip. (1989). Prospective Reference Theory: Towards an Explanation of the Paradoxes, 2 J. RISK AND UNCERTAINTY, 235-264.

Viscusi, W. Kip. (1993). *The Value of Risks to Life and Health*, 21 J. ECON. LITERATURE, 1912-1946.

Viscusi, W. Kip. (1998a). RATIONAL RISK POLICY (Oxford: Oxford University Press).

Viscusi, W. Kip. (1998b). *The Social Costs of Punitive Damages Against Corporations in Environmental and Safety Torts*, 87 GEO. L. J., 285-345.

Viscusi, W. Kip. (1999). *How Do Judges Think about Risk?* 1/2 AM. L. AND ECON. REV., 26-62.

Viscusi, W. Kip. (2000). *Corporate Risk Analysis: A Reckless Act?*, 52 STANFORD L. REV., forthcoming.

Viscusi, W. Kip, Jahn K. Hakes, and Alan Carlin. (1997). *Measures of Mortality Risks*, 14 J. RISK AND UNCERTAINTY, 213-233.

Table 1. Relation of Jurors' Opinions on Repairing Airplane Defect to Whether Punitive Damages Should Apply If an Accident Occurs

Panel A: Property Damage Low: $15,000; Risk Probability 1/10

	Repair Plane	Don't Repair Plane	Total
Punitives apply	75 (65.2%)	10 (8.6%)	85 (73.9%)
Punitives don't apply	26 (22.6%)	4 (3.5%)	30 (26.1%)
Total	101 (87.8%)	14 (12.2%)	115 (100 %)

Panel B: Property Damage High: $1.5 million; Risk Probability 1/1,000

	Repair Plane	Don't Repair Plane	Total
Punitives apply	105 (73.4%)	7 (4.0%)	112 (78.3%)
Punitives don't apply	19 (13.3%)	12 (8.4%)	31 (21.7%)
Total	124 (86.7%)	19 (13.3%)	143 (100 %)

Panel C: Personal Injury -- 29 deaths for $150 million; Risk Probability 1/100,000

	Repair Plane	Don't Repair Plane	Total
Punitives apply	110 (92.4%)	4 (3.4%)	114 (95.8%)
Punitives don't apply	4 (3.4%)	1 (0.8%)	5 (4.2%)
Total	114 (95.8%)	5 (4.2%)	119 (100 %)

Panel D: Personal Injury -- 290 deaths for $1.5 billion; Risk Probability 1/1,000,000

	Repair Plane	Don't Repair Plane	Total
Punitives apply	50 (89.3%)	3 (5.4%)	53 (94.6%)
Punitives don't apply	2 (3.6%)	1 (1.8%)	3 (5.3%)
Total	52 (92.9%)	4 (8.9%)	56 (100 %)

Panel E: Overall Results

	Repair Plane	Don't Repair Plane	Total
Punitives apply	340 (78.5%)	24 (5.5%)	364 (84.1%)
Punitives don't apply	51 (11.8%)	18 (4.2%)	69 (15.9%)
Total	391 (90.3%)	42 (9.7%)	433 (100 %)

t-statistics:

Repair Plane:
A vs. B: 0.340
C vs. D: 0.936
(A+B) vs. (C+D): 2.782***

Award Punitives:
A vs. B: 0.955
C vs. D: 0.354
(A+B) vs. (C+D): 5.569***

Notes: *** -- Significant at 99% confidence level, two-tailed test.
Percentages might not sum across rows and columns due to rounding error.

Table 2. Juror Risk Survey Variations

Scenario	Description
	No Benefit-Cost Analysis
1	No analysis performed, $4 million cost per life saved
2	No analysis performed, $1 million cost per life saved
	Benefit-Cost Analysis Performed
3	Analysis using $800,000 compensatory damages amount to value life, $4 million cost per life saved
4	Analysis using NHTSA value of life figure of $3 million to value life, $4 million cost per life saved
5	Erroneous analysis using NHTSA value of life figure of $3 million to value life, estimated cost per life saved of $4 million but actual amount was $2 million

<u>Survey Waves</u>:

1. Total lives lost was 10.
2. Total lives lost was 4.

Table 3. Jurors' Reactions to Automotive Negligence Case

Panel A: No Benefit-Cost Analysis by Company

Version of survey	Sample Size	Percent of sample favoring punitive damages	Geometric mean of awards ($ millions)	Median Award
$4million/life (Scenario 1)	97	.845	2.95	1.0
$1million/life (Scenario 2)	97	.918	2.86	1.0
Combined no analysis by company	194	.881	2.91	1.0

Panel B: Benefit-Cost Analysis by Company

Version of survey	Sample Size	Percent of sample favoring punitive damages	Geometric mean of awards ($ millions)	Median Award
Court costs as value (Scenario 3)	97	.928	4.02	3.5
NHTSA value of life (Scenario 4)	102	.931	5.31	10.0
NHTSA value of life, error (Scenario 5)	96	.948	4.50	10.0
Combined analysis by company	295	.936	4.59	10.0

Panel C: Full Sample Results

Version of survey	Sample Size	Percent of sample favoring punitive damages	Geometric mean of awards ($ millions)	Median Award
Total for all five scenarios	489	.914	3.85	5.0

t-test (punitive damages frequency): t=2.0958**
t-test (ln punitive damages amount): t=2.4431**

**Significant at the 95% confidence level.

Table 4. Effect of Case Characteristics on the Probability of a Punitive Damages Award

(Marginal probabilities based on probit estimates)

	Coefficient (Standard Error)	
Risk analysis performed	0.051* (0.027)	0.051* (0.027)
Cost per life saved	-0.011 (0.089)	-0.011 (0.009)
High absolute risk	-0.021 (0.028)	-0.027 (0.030)
Personal characteristics	Not Included	Included

*Asterisks indicate coefficients that are statistically significant at the 95% confidence level, one-tailed test. Personal characteristics included an indicator variable for sex, education in years, age, personal revealed value-of-life estimate, an indicator for infinite value of life, and two measures of mortality risk belief.

Table 5. Effect of Case Characteristics on the Size of a Punitive Damages Award

(Natural logarithm of award size)

	Coefficient (Standard Error)	
Risk analysis performed	0.466*	0.378**
	(0.188)	(0.190)
Cost per life saved	0.055	0.033
	(0.067)	(0.069)
High absolute risk	-0.132	-0.124
	(0.199)	(0.203)
Personal characteristics	Not Included	Included
R^2	0.02	0.04

*Asterisks indicate coefficients that are statistically significant at the 95% confidence level, one-tailed test. Personal characteristics included an indicator variable for sex, education in years, age, personal revealed value-of-life estimate, an indicator for infinite value of life, and two measures of mortality risk beliefs.

Table 6. Award of Punitive Damages by Synthetic Juries

Survey Version	Percentage Distribution of Number of Jurors Favoring Punitive Damages							
	5	6	7	8	9	10	11	12
1: (No analysis, $4 million per life)	0.1	0.1	1.9	6.7	18.2	32.0	28.2	12.8
2: (No analysis, $1 million per life)	0	0	0	0.9	4.1	19.4	40.2	35.4
1-2: (Combined no analysis)	0.05	0.05	1.0	3.8	11.2	25.7	34.2	24.1
3: (Analysis, court costs)	0	0	0	0.5	3.3	16.0	41.2	39.0
4: (Analysis, NHTSA value)	0	0	0	0.2	2.8	16.1	40.7	40.2
5: (Flawed analysis, NHTSA value)	0	0	0	0	1.3	11.2	39.9	47.6
3-5: (Combined analysis)	0	0	0	0.2	2.5	14.4	40.6	42.3

Table 7. Levels of Punitive Damages Awarded by Synthetic Juries

Survey Version	Award Level		
	Median	Mean	Standard Error of Mean
1: (No analysis, $4 million per life)	1	2.5	(0.1)
2: (No analysis, $1 million per life)	1	3.5	(0.1)
1-2: (Combined no analysis)	1	3.0	(0.1)
3: (Analysis, court costs)	3	4.5	(0.1)
4: (Analysis, NHTSA value)	7.5	6.9	(0.1)
5: (Flawed analysis, NHTSA value)	6	6.0	(0.1)
3-5: (Combined analysis)	6	5.8	(0.1)

Table 8. Comparison of judges' and jurors' awards in oil well blowout trial

Judges

Damages awarded	Number of responses	Percent of sample
$0	0	0.0
$5m	0	0.0
$10m	57	91.9
$30m	4	6.5
$75m	0	0.0
$100m	1	1.6

Median award - $10m; Geometric mean award - $11.14m

Juries

Damages awarded	Number of responses	Percent of sample
$0	22	4.5
$5m	65	13.3
$10m	129	26.3
$30m	179	36.5
$75m	47	9.6
$100m	48	9.8

Median award - $30m; Geometric mean award - $21.43m

t-test on arithmetic means: t=4.7942***
*** indicates confidence at 99% confidence level

Appendix

Below is a summary of the questions in the survey that were the basis for the analysis in this paper. The order of the questions parallels that for the discussion in the paper. For simplicity only one variant of each question is reported, but the different variations are noted.

Survey Instructions

> The survey below consists of a series of questions about safety risks. There are usually no right or wrong answers. The main purpose of the survey is to get your opinion on a variety of safety problems. If you do not know an answer, please provide your best estimate.
>
> Several of the questions deal with punitive damages for safety decisions. As you may recall, courts may award punitive damages for conduct that is reckless. A company is reckless if it is conscious of a grave danger or risk of harm, it evaluated the danger, it disregarded the risk when deciding how to act, and its conduct involved a gross deviation from the level of care an ordinary person would use. In the punitive damages cases discussed below, courts will separately award compensatory damages to meet the income losses associated with the accident.

Airplane Repair Case

Four versions of the airline repair case were tested. Two involved property damage of $15,000 and $1.5 million, and two involved personal injury of $150 million and $1.5 billion. One property damage scenario and one personal injury scenario appear below.

Property Damage Scenario

You are CEO of Rocky Mountain Airlines. The cargo door on a plane does not operate properly. Fixing it costs $2,000. If it is not fixed, there is absolutely no safety risk. Very reliable engineering estimates indicate that there is only a 1/10 chance that there will be a total loss to your company of $15,000 due to in materials damage to cargo over the life of the plane. Thus, there is a 90 percent chance that there will be no damage whatsoever. Your company has no insurance but will be liable for the cost of this damage. Should you undertake the repair? Circle one.

Repair Do Not Repair

If you do not undertake the repair and there is luggage damage, should the court award punitive damages? Punitive damages represent a payment the company must make in addition to compensating people for their losses to punish the company. Circle one.

Yes No

Personal Injury Scenario

You are CEO of Rocky Mountain Airlines. The cargo door on a plane does not operate properly. Fixing it costs $2,000. If it is not fixed, there is a remote chance that the problem with the door will cause the plane to crash. Very reliable engineering estimates indicate that there is only a 1/1,000,000 chance over the expected life of the plane that the plane will crash, killing an estimated 29 people. Thus, there is a 999,999/1,000,000 chance that there will be no loss of life whatsoever. The best economic estimates are that a crash will cost your company $150 million, which includes the full social value of life. Your parent company has no insurance but does have sufficient resources to pay these damages. Should you undertake the repair? Circle one.

Repair Do Not Repair

If you do not undertake the repair and there is a crash, should punitive damages be awarded? Circle one.

Yes No

Corporate Risk Analysis

There were five corporate risk analysis cases, each of which was done for a situation with 10 deaths and 4 deaths per year. For simplicity, I report only one example of no analysis Scenario 1, the analysis Scenario 3, and NHTSA analysis Scenario 4.

Scenario 1

> A major auto company with annual profits of $7 billion made a line of cars with a defective electrical system design. This failure has led to a series of fires in these vehicles that caused 4 burn deaths per year. Changing the design to prevent these deaths would cost $4 million for the 40,000 vehicles affected per year. This safety design change would raise the price of cars by $100 each. The company thought that there might be some risk from the current design, but did not believe that it would be significant. The company notes that even with these injuries, the vehicle had one of the best safety records in its class.
>
> The courts have awarded each of the victims' families $800,000 in damages to compensate them for the income loss and pain and suffering that resulted. After these lawsuits, the company altered future designs to eliminate the problem.
>
> (1) Should the court also award punitive damages to punish the company for reckless behavior?
>
> Yes __________ No __________
>
> (2) If yes, what amount would you award to the survivors per fatality? Pick one.
>
> (a) $100,000
> (b) $1 million
> (c) $10 million
> (d) $100 million
> (e) other amount you select __________

Scenario 3

A major auto company with annual profits of $7 billion made a line of cars with a defective electrical system design. This failure has led to a series of fires in these vehicles that caused 4 burn deaths per year. Changing the design to prevent these deaths would cost $4 million for the 40,000 vehicles affected per year. This safety design change would raise the price of cars $100 each. The company thought that there might be some risk from the amount design, but did not believe that it would be significant.

The company did a detailed analysis of the risk and estimated that 4 people would die each year. However, the company estimated that the liability cost would only be $800,000 per death based on the median award all industries pay for product-related fatalities. The company's estimate of the total court awards for the design problem was $3.2 million per year. As a result, the company estimated that the $4 million annual cost of making the change exceeded the estimated value of the court awards. The company concluded that it was cheaper not to adopt the safer design. The company notes that even with these injuries, the vehicle had one of the best safety records in its class.

The courts have awarded each of the victims' families $800,000 in damages to compensate them for the income loss and pain and suffering that resulted. The compensatory damages awards to the families were in line with the company's estimates, or $800,000 per death. After these lawsuits, the company altered future designs to eliminate the problem.

(1) Should the court also award punitive damages to punish the company for reckless behavior?

Yes __________ No __________

(2) If yes, what amount would you award to the survivors per fatality? Pick one.

(a) $100,000
(b) $1 million
(c) $10 million
(d) $100 million
(e) other amount you select __________

Scenario 4

A major auto company with annual profits of $7 billion made a line of cars with a defective electrical system design. This failure has led to a series of fires in these vehicles that caused 4 burn deaths per year. Changing the design to prevent these deaths would cost $16 million for the 40,000 vehicles affected per year. This safety design would raise the price of cars $400 each. The company thought that there might be some risk from the design, but did not believe that it would be significant.

The company did a detailed analysis of the risk and estimated that 4 people would die on average per year. However, the cost to eliminate the risk was $4 million per fatality prevented. To determine whether the safety improvement was worthwhile, the company used a value of $3 million per accidental death, which is the value used by the National Highway Traffic Safety Administration in setting auto safety standards. The company estimated that the annual safety benefits of the safer design would be $12 million (4 expected deaths at $3 million per death), while the costs would be $16 million. As a result, the company believed that other safety improvements might save more lives at less cost. The company notes that even with these injuries, the vehicle had one of the best safety records in its class.

The courts have awarded each of the victims' families $800,000 in damages to compensate them for the income loss and pain and suffering that resulted. After the deaths occurred, the company altered future designs to eliminate the problem.

(1) Should the court also award punitive damages to punish the company for reckless behavior?

Yes __________ No __________

(2) If yes, what amount would you award per fatality? Pick one.

(a) $100,000
(b) $1 million
(c) $10 million
(d) $100 million
(e) other amount you select __________

Oil Well Blowout

The oil well blowout damages case had two variations, one in which damages were less than the worst case and one in which damages equaled the worst case.

Fortunate Case

> Acme Oil Company has been found that it did not meet legal standards for safe operation of its oil wells. Consequently, it is liable for an oil well blowout that caused $10 million in property damage and no personal injury. The company in many respects was fortunate in that such blowouts have a 90% chance of $100 million in property damages and a 10% chance of minor damage of $10 million. What damages award amount would you select?

- 9 Zero
- 9 Under $10 million
- 9 $10 million
- 9 Between $10 million and $50 million
- 9 Between $50 million and $100 million
- 9 $100 million

Unfortunate Case

> Acme Oil Company has been found that it did not meet the legal standards for safe operation of its oil wells. Consequently, it is liable for an oil well blowout that caused $10 million in property damage and no personal injury. The company in many respects was unfortunate in that such blowouts have a 90% chance of no damage and a 10% chance of $10 million in damages. What damages award amount would you select?

- 9 Zero
- 9 Under $10 million
- 9 $10 million
- 9 Between $10 million and $50 million
- 9 Between $50 million and $100 million
- 9 $100 million

Value of Life

Suppose you could reduce you annual risk of death in a car crash by 1/10,000. Thus, if there were 10,000 people just like you, there would be one less expected death per year in your group. This risk reduction would cut your annual risk of death in a car crash in half.

How much would you be willing to pay each year either for a safer car or for improved highway safety measures that would cut your motor-vehicle risks in half?

Check one:

Dollar amount

9 0 - 50
9 50 - 200
9 200 - 500
9 500 - 1,000
9 Above 1,000
9 Infinite - All present and future resources

Risk Assessment

In 1990 47,000 people in the United States died in automobile accidents. How many people died from the other causes of death listed below? You are not expected to know any of these answers exactly. Your best estimate will do.

Fill in your best estimate in the space.

Electrocution	____________	Diabetes	____________
Appendicitis	____________	Lightning	____________
Fireworks	____________	Fire and Flames	____________
Stroke	____________	Drowning	____________
Poisoning (solids and liquids)	____________	Accidental Falls	____________
Heart disease	____________	Firearms (accidents)	____________
Asthma	____________	Measles	____________
Botulism	____________	Lung Cancer	____________
Homicide	____________	Breast Cancer	____________
Pregnancy/childbirth/abortion (death to mother)	____________	Stomach Cancer	____________
		All cancer	____________
Infectious hepatitis	____________	All causes of death	____________

Personal Characteristics

Please answer the following background characteristic questions. The answers will not be used to identify you. They will, however, be useful in seeing how the responses to the survey vary across the population.

What is you sex?
9 Male 9 Female

What is your age?
____

What is your race?
________________ White ________________ Hispanic
________________ Black ________________ Asian
________________ Native American________________ Other

What is your education?
________________ Some high school
________________ High School graduate
________________ Some college
________________ College graduate
________________ Professional degree

Which category best describes your smoking status?
________________ Current smoker (average at least 1 cigarette per day)
________________ Former smoker
________________ Nonsmoker

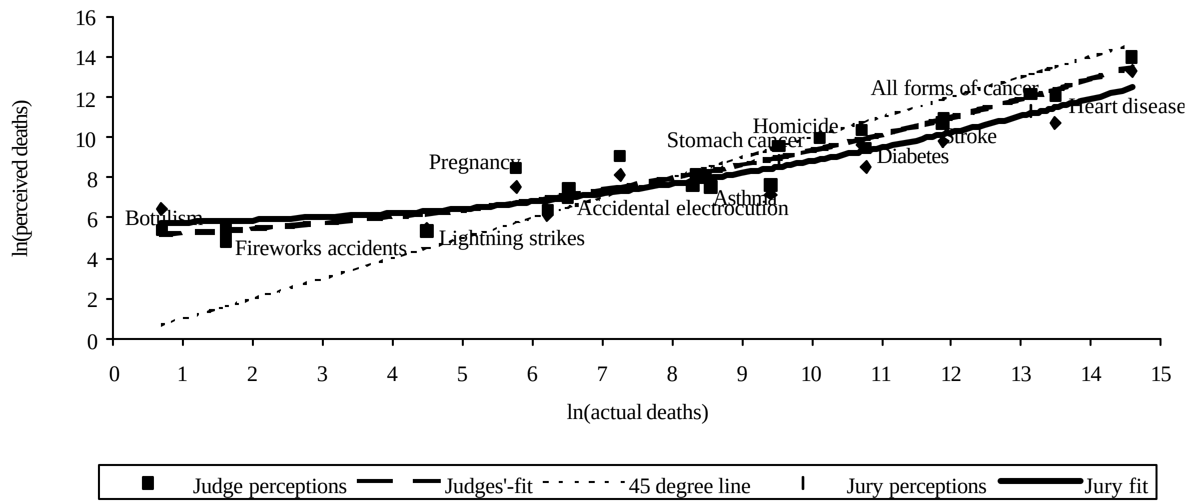
How often do you use seatbelts while driving or riding in a car?
________________ Always
________________ Sometimes
________________ Never

Table A. Means of Variables Used in Analysis

Variable	**Mean**	**Standard deviation**
Female	0.682	0.466
Age	44.7	15.3
Race:		
White	0.884	0.320
Black	0.022	0.149
Native American	0.006	0.078
Hispanic	0.047	0.211
Asian	0.004	0.064
Other race	0.016	0.126
Education:		
Some high school	0.037	0.189
High school graduate	0.186	0.389
Some college	0.401	0.491
College graduate	0.269	0.444
Professional degree	0.107	0.310
Smoking status:		
Current smoker	0.225	0.418
Former smoker	0.233	0.423
Nonsmoker	0.541	0.499
Seatbelt use:		
Always	0.804	0.398
Sometimes	0.157	0.364
Never	0.039	0.194

The sample size for this table is 489, as there were four observations for which the respondents did not report their personal characteristics. The total sample size was 493.

Figure 1
Comparison of Judges Perceived and Actual Mortality Risks



lnd93	lnd93sq	Risk perception	Judges'-fit	45 degree line	Jury perception	Juries' fit	cause	
0.6931472	0.480453	5.416101	5.200624	0.693147	6.452942	5.779645		botulism
1.609438	2.590291	4.844187	5.354548	1.609438	5.459384	5.818915		firework
1.609438	2.590291	5.446737	5.354548	1.609438	5.454564	5.818915	measles	measles
4.488636	20.14786	5.327876	6.198834	4.488636	5.481324	6.311736		lightnin
5.768321	33.27353	8.48694	6.749712	5.768321	7.516186	6.710691		birthing
6.214608	38.62135	6.378426	6.967248	6.214608	6.151175	6.875865		appendix
6.507277	42.34466	6.981935	7.117043	6.507277	6.980095	6.991496	electro	electro
6.517671	42.48004	7.489971	7.122467	6.517671	7.244717	6.995709		hepatit
7.255591	52.64361	9.068201	7.525754	7.255591	8.11825	7.31348		firearms
8.288786	68.70397	7.582738	8.150799	8.288786	8.013992	7.820267		drowning
8.336869	69.50339	8.198364	8.181604	8.336869	8.076327	7.84561	fire	fire
8.465899	71.67146	7.993958	8.265021	8.465899	8.182267	7.914389		asthma
8.556414	73.21221	7.554859	8.324193	8.556414	7.840446	7.963309		poison
9.418411	88.70647	7.629004	8.914807	9.418411	7.175337	8.456947		accfalls
9.520761	90.64489	9.557117	8.988191	9.520761	8.822993	8.518896		stomachc
10.11107	102.2337	9.982021	9.424932	10.11107	10.07135	8.890014	homicide	homicide
10.71442	114.7988	10.36565	9.895087	10.71442	9.664977	9.293678		breastc
10.77193	116.0345	9.465603	9.941155	10.77193	8.529627	9.333439		diabetes
11.87818	141.0912	10.70412	10.8698	11.87818	9.812705	10.1418	stroke	stroke
11.88449	141.2411	10.88401	10.87533	11.88449	9.791771	10.14665		lungcanc
13.13295	172.4744	12.12825	12.02089	13.13295	11.29301	11.15883	allcanc	allcanc
13.48701	181.8993	12.04277	12.36448	13.48701	10.70763	11.46506		heartdis
14.58026	212.5841	13.96281	13.47766	14.58026	13.27366	12.46414		allcause