

# Inducing Negligence

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September 25, 2016

## Abstract

Would a potential victim prefer to be treated negligently? We show that even with less than full compensation the answer might be yes. The reason for this is that under tort law victims are often compensated by negligent injurers for the materialization of risks not created by their negligence. Thus, by being exposed to even slight negligence, they gain free insurance for those risks. More interestingly, we also show that under certain circumstances some injurers would prefer to behave negligently toward their victims, even if they expect to compensate them for risks not created by their negligence. As a result, victims might select them as their potential injurers, or in our terms, "induce negligence." Although behaving negligently given the selection of the injurer by the victim can be efficient, inducing negligence is not the first best. In order to achieve the first best, courts should avoid attributing liability for harms materialized from risks not created by negligence (or resort to contributory negligence). We explain how they should do so.

## 1. Introduction

### 1.1. Why Induce Negligence?

A sick person arrives at a hospital in order to receive a certain medical treatment. Under negligence law, if the doctor negligently causes him any harm she should compensate him for his losses. Assuming damages are compensatory, would the patient prefer that the doctor be negligent or careful?

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The first reaction of law and economics scholars would probably be that the patient should be indifferent between the two possibilities, since if he is injured by the doctor's negligence he is neither better off nor worse off compared to his prior position. Most other people, however, would probably say that the patient would prefer that the doctor not be negligent, since non-injury is always better than injury, even if accompanied by compensation. A different way to phrase this latter response is that in actuality damages are never fully compensatory when bodily injuries – certainly severe bodily injuries – are at stake. Indeed, if damages were under-compensatory, even law and economics scholars would acknowledge that the sick patient in our example would prefer that the doctor not be negligent.

This, however, is wrong. The patient would often prefer that the doctor be negligent, even if damages were under-compensatory. This is because in such a case the patient would be compensated not only for the materialization of risks that were created by the doctor's negligence, but also for the materialization of risks which were not created by the doctor's negligence, that is, for risks which might have materialized even if the doctor was careful. Thus, if the doctor is negligent, the patient gets free insurance, or a subsidy, for risks which he "brought from home," so to speak, and for whose materialization no one would compensate him but for the doctor's negligence. Therefore, if the patient can induce the doctor to treat him negligently, he might do so!

Let us illustrate this by using a simple numerical example.

**Example 1: Doctor and Patient.** A doctor in a public hospital must decide what treatment to pursue for his patient: Treatment A or Treatment B. Each treatment creates different risks but is equally costly and produces the same utility if the risks are not realized. This utility is much greater than the risks involved. Treatment A entails a risk to the patient's left arm of 100 (there is a 10% chance that the treatment will produce a harm of 1000), and Treatment B entails a risk to the patient's right arm of 110 (there is an 11% chance that the treatment will produce a harm of 1000). The risks of Treatments A and B are not correlated: the realization of the risk from one treatment has no bearing on the probability of the realization of the risk from the other treatment. The doctor negligently chooses Treatment B, and a harm of 1000 materializes.

Under prevailing tort law, the doctor should be liable toward the patient for the harm of 1000. The reason for this is that but for her negligence, the doctor would have chosen treatment A, and chances were good (90%) that the patient would have suffered no harm at all.

Consider now the patient's perspective, before the doctor chooses what treatment to administer for him. Should the patient prefer that the doctor be careful (by choosing treatment A) or negligent (by choosing treatment B)? The surprising answer is that the patient would be much better

off if the doctor negligently chooses treatment B. Why? Because if the doctor chooses treatment B and the risk of 110 materializes, the patient is fully compensated for his losses, while if the doctor chooses treatment A and the risk of 100 materializes, the patient is not compensated and bears his own losses. In brief, a risk of 110 with full compensation is better for the patient than a risk of 100 with no compensation (imagine the extreme case where the risks are 101 and 100, respectively). Indeed, even with less—much less—than full compensation, the patient might prefer that his doctor be negligent toward him. In our example, the patient will prefer that the doctor treat him negligently as long as compensation is higher than 9% of the actual harm.<sup>1</sup>

When the doctor is negligent, the law allows the patient to get free insurance, or a subsidy, for harms that were not caused by the injurer's negligence. In Example 1, the risk that the doctor negligently created for her patient was in fact 10, not 110. A risk of 100 out of the 110 was created not by the doctor (certainly not by his negligence, but also not by his activity), but by nature: the risk of 100 was “brought from home” by the patient, and that latter risk would have existed even if the patient had been treated reasonably. Nevertheless, if the doctor is negligent she is liable for the full harm of 1,000 suffered by the patient, and the patient is “covered” for the entire risk of 110.<sup>2</sup>

Surprisingly, the anomaly that the victim will prefer that his prospective injurer behave negligently is quite broad in scope. It is present in numerous categories of cases (elaborated in Section 5)—Example 1 represents one of them—where injurers are liable for more than the harm caused by their negligent behavior, or in other words, when there is *excessive causal attribution*. One specific case of excessive causal attribution was identified a long time ago in the law and economics literature, which analyzed the rule of negligence. According to this analysis, a rule of negligence creates discontinuity in liability because of excessive causal attribution: if the injurer is not negligent, he does not bear any liability, but if he is negligent, he bears liability for all (or at least for more than the marginal) harms that have materialized.<sup>3</sup> Consider the following example:

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<sup>1</sup> If the compensation is approximately 9% of the actual harm (1/11, to be accurate), the patient will be ex-ante indifferent between the two treatments. With the non-negligent treatment A, his expected costs are 100. With the negligent treatment B and partial compensation of 9%, his expected costs are approximately also 100 ( $11\% * 1000 * 91\%$ ).

<sup>2</sup> See Porat (2007), who argued that efficiency-wise, in cases similar to Example 1, liability should be 9% of the resulting harm. Consequently, the doctor's expected liability would be 10, which is equivalent to the risk he created by his negligent choice. See also Schweizer (2016). The law, however, is different.

<sup>3</sup> Some prominent commentators questioned the existence of the discontinuity feature of the negligence rule. Most notably, Gradey, 1983, and Kahan (1989), in separate contributions, argued that if causation principles were properly

**Example 2: Driver and Passenger.** A driver fails to stop his car in the face of a sudden danger and collides with the traffic lights. As a result, a passenger in the car is injured. The driver was driving at 51 mph at the time of the accident. Given the risks of driving, the reasonable speed to drive was 50 mph.

According to the discontinuity argument, under positive law the driver in Example 2 would be liable toward the passenger for his injury, regardless of whether it was caused by the 1 mph in excess of the reasonable speed or by his driving as such. Indeed, in the extreme case, the driver who exceeded the reasonable speed would be liable for *any* injury caused by his driving rather than by his excessive speeding.

The effect of the discontinuity of liability, and more generally the effect of excessive causal attribution on the injurer's incentives, has been well studied in previous literature (see, for example, Cooter, 1982, 1989; Calfee & Craswell, 1984; Craswell & Calfee, 1986, Grady 1983, Kahan, 1989, Schweizer, 2009, Stremizer and Tabbach, 2014). What has not been studied yet is the effect of this phenomenon on victims, which is the focus of this paper.<sup>4</sup>

Our main claim is that when damages are not fully discounted for causation—or in other words, when there is excessive causal attribution as in Examples 1 and 2—the victim might prefer to be treated negligently, and accordingly might induce negligence in equilibrium. Stated differently, when courts impose liability for harms materialized from risks which have not been created *by* the injurer's negligence, but materialized *when* the injurer was negligent, the victim is better off in inducing his potential injurer to behave even just slightly negligently toward him. The reason for this is that if the victim suffers harm he will be compensated not just for the materialization of the additional marginal risk created by his injurer's negligence, but also for the materialization of other risks unrelated to the injurer's negligence. Thus, in Example 1, the patient might prefer that his doctor choose for him the slightly riskier treatment, and the passenger in Example 2 might prefer that the driver drive at 51 mph rather than 50 mph. Importantly, with high enough excessive causal attribution, the victim might be interested in inducing the injurer's negligence even if compensation is less than full relative to his actual harm. More generally, the victim's interest in being exposed to negligence is affected by three

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applied, there would be no discontinuity in liability, since injurers would be liable exactly for the harms they caused by their negligence. With exact attribution of causes to outcomes, so the argument goes, the discontinuity disappears.  
<sup>4</sup> But see Cohen and Tabbach (2014) who demonstrated the phenomenon of inducing negligence in a signaling model.

variables: the additional risk created by the injurer's negligence, the level of compensation awarded to the victim, and the magnitude of the excessive causal attribution.

The victim's interest in inducing negligence is a special moral hazard problem, which to the best of our knowledge has not been identified so far in the literature. The more familiar moral hazard problem is that victims will not take adequate precautions to reduce their own risks if they are compensated for their harms regardless of whether they took such precautions (this moral hazard problem is prevalent in insurance markets).<sup>5</sup> Furthermore, if victims are overcompensated, they might even be interested in increasing their risks, knowing that they would be better off if injured (this moral hazard problem is more prevalent with property rather than bodily injuries). In our case, the moral hazard problem is different. What motivates it is neither the victim's desire to save precautionary costs (as in the first familiar moral hazard problem mentioned above) nor his desire to be injured and overcompensated (as in the second familiar moral hazard problem mentioned above). Instead, the problem arises because the victim is interested in being insured for harms which but for the injurer's negligence he would have to bear himself. Therefore, even with less than full compensation, he is likely to induce negligence, if he is only able to do so.

## 1.2. How Induce Negligence?

The fact that the victim might prefer that his injurer behave negligently toward him is meaningless, unless the injurer indeed behaves negligently. How exactly can the victim induce his potential injurer to behave negligently? If the negligence rule operates perfectly (the standard of care is set efficiently and damages are fully compensatory), victims cannot induce negligence for the simple reason that injurers will never find it desirable to behave negligently. However, the negligence rule does not operate perfectly. Obviously, there are various non-verifiable ways whereby a victim could increase the chances that his potential injurer will behave negligently toward him. For example, a patient could "forget" to inform his doctor about some features of his medical condition, insofar as

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<sup>5</sup> See, for example, Becker and Ehrlich (1972). In the health economics literature, this type of moral hazard is named "ex-ante" moral hazard, and there is some empirical evidence demonstrating that individuals who are covered by health insurance exhibit this type of moral hazard. See, for example, Klick and Startmann (2007; finding that mandating health insurance coverage for diabetes does generate a moral hazard problem, with diabetics exhibiting higher BMIs after the adoption of these mandates); Stanciole (2008; showing that health insurance has significant incentive effects on lifestyle choices, increasing the propensity to heavy smoking, lack of exercise and obesity, and decreasing the propensity to heavy drinking). But see on the other hand, Jerant et al., (2013; finding that health insurance is associated with preventive care but not personal health behaviors). TO ADD MORE.

it does not substantially endanger him, hoping not to be explicitly asked about them. Later, if risks, even if unrelated to the doctor's negligence, materialize, the patient can argue that the doctor was negligent in failing to extract this information from him and acting accordingly. Or a pollutee who was non-wrongfully exposed to a toxic substance in the past, and who faces a risk of ending up with uncompensable harms in the future, might avoid complaining about unreasonable pollution which affects him in the present, hoping to sue the polluter when harm, even if unrelated to the excessive unreasonable pollution, materializes.<sup>6</sup> In these and other cases, the victim may succeed in inducing negligent behavior by his potential injurer.

However, more interesting are the cases—which will be our focus—when injurers *willingly* choose to behave negligently, even if they fully compensate their victims for the harms resulting from their negligence, together with harms materialized from risks not created by their negligence. Victims, when they have the choice, might choose to interact with such injurers rather than with other injurers, knowing that their chances of being “insured” or subsidized for risks unrelated to their injurers’ negligence increase.

Would it be possible for victims, when it serves their best interest, to identify those more likely to be negligent injurers and interact with them? Sometimes yes, especially when the victim has a disability insurance policy, which insures him against bodily injuries caused by either wrongful or non-wrongful causes, and when the insurance company has a subrogation claim against wrongdoers who inflicted harm on the insured. In such cases, when insurance companies could affect their insureds’ choices, it might lead them to choose an injurer whose chances of being negligent are high. When chances of the injurer’s negligence are high, so are the insurance company’s chances of collecting damages from the injurer in subrogation claims, for harms not caused by his negligence. Thus, quite realistically, victims, upon their insurance companies’ advice, might prefer to interact with injurers who are more prone to behave negligently.

Under what conditions would injurers have incentives to behave negligently? First are cases when the standard of care is set too high for some injurers; second, cases of stochastic care.

### 1.2.1. Too High a Standard of Care

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<sup>6</sup> We assume that the polluter is subject to a negligence-like regime.

In one category of cases, when the standard of care is set too high for the injurer, it might be the interest of both the injurer and the victim that the injurer behave negligently. The standard of care might be set too high due to mistakes made by courts. But it might also be set too high due to the fact that under positive law the standard of care is uniformly set without taking into account the characteristics of each and every specific injurer, and in particular each and every injurer's skill in reducing risks (Landes & Posner, 1987; Schwartz 1989; Ben-Shahar & Porat, 2016). As a result, the standard of care is set too high for unskillful injurers. In a subset of those cases, it is both the injurer's and the victim's best interest that the injurer violate the standard of care and pay damages, even if those damages might cover risks which have not been created by the injurer's negligence.<sup>7</sup>

Thus, the victim might be interested in interacting with some specific unskillful injurers, whose interest is to be negligent towards him. In other words, inducing negligence, or more specifically, victims' choosing to interact with negligent injurers, is in the best interest of both injurers and victims. For example, and counterintuitively, patients might prefer under certain circumstances to be treated by doctors who are less skillful than average,<sup>8</sup> knowing that it might be their doctor's best interest to be negligent toward them (Example 1); or a passenger in a car might prefer that his driver be less skillful than average, hoping that she will choose to be negligent towards him (Example 2).

### 1.2.2. Stochastic Care

In a second category of cases, even if the standard of care is efficiently personalized for each and every injurer and accurately enforced by courts, injurers might be negligent in equilibrium and found liable. These are the cases of stochastic control of care, namely, when the control variable of injurers results in different distribution of actual behavior (Diamond, 1974; Shavell, 2004). Lapses of attention are representative of this category of cases: although injurers aim at a certain level of care, because of lapses of attention their actual care often deviates from the intended one (Cooter & Porat, 2014).

For example, a driver might aim at driving his car at 50 mph—which is, let's assume, the reasonable speed to drive (see Example 2)—but from time to time might increase or decrease his

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<sup>7</sup> Injurers vary also with respect to risks, which they create at a certain level of care. If the risk is high, efficiency requires taking more care than if the risk is low. Generally, the legal standard of care is set uniformly and probably too high for injurers whose riskiness is low. Efficiency-wise, such injurers should not meet the legal standard of care, and in a subset of those cases, they would indeed breach the legal standard (Ben-Shahar & Porat, 2016).

<sup>8</sup> We assume that the standard of care is set according to average skill.

driving speed because of lapses of attention. When care is stochastic, and courts determine negligence based on the actual, not intended, care level, injurers who intend to take the efficient—or even higher—level of care might nonetheless be found liable if their actual care falls short of the efficient level of care. Therefore, if an accident occurs when the driver in our example drove at 51 mph, he would be considered negligent by the court, even if he aimed at 50 mph (or less) but failed to meet his intended care at the time of the accident because of a lapse of attention. Thus, exactly as with the first category of cases, here too victims might prefer to interact with injurers who exhibit some level of uncertainty regarding their realized care, even when they have the opportunity to interact with injurers whose care output is less or not at all uncertain.

As we have explained, in the stochastic care cases injurers might be found liable even if their *intended* (but not their realized) care meets the standard of care. This means that when a victim chooses to interact with an injurer whose care output is stochastic, he does not necessarily expose himself to a greater risk of injury (as in the deterministic cases); he might just gain free insurance for risks, which have not been increased by the injurer's negligence. Hence, even if severe bodily injuries are at stake, victims might have strong incentives to induce negligence by choosing to interact with injurers whose realized care is uncertain rather than with injurers whose realized care is certain.

### **1.3. Beneficial vs. Detrimental Interactions**

In both the deterministic (first category) and stochastic care (second category) cases, the first best is not achieved when victims prefer to induce negligence. The victim's interest in having his otherwise uncompensable risks subsidized or insured by the injurer distorts his incentives and encourages him to interact with injurers who are not the socially most efficient injurers.

In the long run, however, the efficiency of inducing negligence depends crucially on the nature of the interaction between injurers and victims. One set of cases are those where injurers' utility is contingent on the interaction with the victims (beneficial interactions), such as the case of doctors and patients (Example 1) or drivers and passengers (Example 2). The other set of cases are those where injurers actually prefer *not* to interact with victims (detrimental interactions), such as the case of polluters and pollutees or drivers and pedestrians.

If injurers gain from interacting with victims, injurers who are not selected by victims are crowded out. This leads to a striking conclusion: assuming no market transactions between the parties, we should expect to find operating more moderately skilled injurers (that is, injurers who are neither high-skilled nor low-skilled) and more injurers with moderately uncertain realized care (again neither too high nor too low), than if victims had never induced negligence. This implies that from a social perspective, victims' choice of potentially negligent injurers is not first best since it encourages injurers, who are interested in attracting victims, to have less-than-average skill and uncertain realized care. To achieve the first best, victims should be motivated to interact with the most skillful injurers and the injurers with certain realized care. Therefore, the victim should be disincentivized to induce negligence, and that can (sometimes) be accomplished if excessive causal attribution is removed. Alternatively, if market transactions are feasible with relatively low transaction costs, the first best is also achievable in the long run.

A different conclusion holds if we assume that injurers prefer not to interact with victims, while victims still have an interest in interacting with some injurers and can actively choose them. For example, polluters typically prefer not to interact with pollutees but cannot avoid it. In contrast, pollutees might prefer such interaction and can choose their potential polluters (e.g., by choosing where to live). When they choose their potential polluters, everything else being equal, under a negligence rule with excessive causal attribution, they might prefer polluters who are more likely to be negligent. This would, under certain plausible assumptions, encourage polluters to reduce—in the long run—the probability of being negligent, for example by improving their skillfulness (the deterministic category of cases) or by reducing the uncertainty of their realized care (the stochastic category of cases), in order to disincentivize potential victims to interact with them. Otherwise, the polluters who were not selected by the victims, and thus are not required to take costly care or occasionally compensate the victims, would have a strict advantage over other polluters. Subsequently, the first best can be achieved even without removing excessive causal attribution or lowering the market transaction costs between the parties.

The paper proceeds as follows: Section 2 develops a deterministic care model where injurers differ by their skill level and where the standard of care is set in accordance with the average reasonable injurer. It characterizes the equilibrium behavior and shows the conditions under which the victim induces negligence. Section 3 develops a stochastic care model where injurers differ by the level of uncertainty of their care output and where the standard of care is efficiently personalized. It

characterizes the equilibrium behavior and shows the conditions under which victims induce negligence. Section 4 discusses our results: it clarifies the short-term and long-term normative effects of inducing negligence, discusses how victims' aversion to increasing their risks of injury might affect our analysis, offers a possible application of our model under strict liability, and explains the effect of market transactions on our conclusions. Section 5 points out the broad scope of the application of our model to many real-life cases, and Section 6 concludes and offers policy implications. The Appendix contains the main proofs.

## 2. A Deterministic Negligence Model

We start by exploring the first category where the victim may induce negligence in equilibrium: a deterministic model where the standard of care is set too high for some injurers. In such a case, social costs are not minimized if these injurers abide by the due care standard. Hence, both the injurer and the victim may benefit from negligence inducement.

The inefficiency of the standard of care for some injurers is of paramount importance. When the standard of care is efficiently set for all injurers, the victim can never induce negligence in equilibrium under this model. Indeed, when damages are under-compensatory the injurer might prefer to breach the standard of care, even if the standard is efficient. Furthermore, the victim on his part may also prefer to be treated negligently, even if damages are somewhat under-compensatory. However, both conditions can never be satisfied at the same time. The reason is simple. If both parties benefited from breaching the standard, the standard could not be efficient.

### 2.1. Setup

Assume some interaction between an injurer and a victim, which may result in an accident that causes harm  $h$  to the victim. The harm materializes as a function of the care level,  $x$ , which reduces the chances that the accident will occur. Let  $p(x)$  be a twice-differentiable, convex function, denoting the probability of an accident,  $p''(x) > 0 > p'(x)$ . Assume further that the cost of care varies across different injurers,  $\beta x$ , where  $\beta \in [\underline{\beta}, \bar{\beta}]$  is the injurer-specific marginal costs of care. Lower (higher)  $\beta$  implies a more (less) skillful injurer.

The negligence regime is captured by the pair  $(\bar{x}, D)$ , where  $\bar{x}$  is the standard of care and  $D$  is damages awards. The sequence of the game is as follows (assuming that opting out is too costly for either side). The victim selects an injurer with whom he interacts. Once selected, the injurer chooses her care level. Subsequently, the interaction between the parties takes place and the accident either occurs or does not. In case of an accident, liability is assigned and payoffs are allocated according to the legal regime.

We assume that both players are risk-neutral and rational, that they operate in a perfect information environment and that transaction costs are high. Thus, the parties cannot contract around the legal rule or make side payments.

## 2.2. Social Optima

The expected, injurer-specific, social-cost function equals the sum of the costs of care and the expected harm:

$$(1) \quad sc(x, \beta) = \beta x + p(x)h$$

The injurer-specific, efficient care level is denoted by  $x^*(h, \beta)$ . It is implicitly defined by the first order condition,  $\beta + p'(x)h = 0$ , and it decreases with  $\beta$  and increases with  $h$ .

By the Envelope theorem, the social-cost value function,  $sc(x^*(h, \beta), \beta)$ , increases with  $\beta$ . Namely, as the injurer's skill-level decreases, social costs are higher. Thus, from a social perspective, the first best is for the victim to interact with the most skillful injurer,  $\underline{\beta}$ , who in turn takes the corresponding efficient care level,  $x^*(h, \underline{\beta})$ .

Specifying the probability function by  $p(x) = e^{-x}$  enables us to denote explicitly the injurer-specific, efficient care level,  $x^*(h, \beta) = \ln(h/\beta)$ . Hence the efficient expected harm is constant,  $p(x^*(h, \beta))h = \beta$ , and the social-cost value function is  $s(h, \beta) = \beta \ln(h/\beta) + \beta$ .

## 2.3. Legal Regime

As noted, the negligence regime is captured by the pair  $(\bar{x}, D)$ . We assume that the standard of care is set exogenously and uniformly across injurers,

$$(2) \quad \bar{x} = x^*(h, \lambda),$$

where  $\lambda > 0$  reflects the marginal costs of care by which the standard of care is determined. This can capture some notion of a “reasonable person standard” (for example, it can reflect the mean or median of  $\beta$  across all injurers).

Since the standard of care is not personalized to each injurer, it is not efficient except for the “reasonable injurer.” Given that  $x^*(h, \beta)$  decreases with  $\beta$ , the standard of care is too low relative to the efficient care level of injurers with better-than-reasonable skills,  $\beta < \lambda$ , and too high relative to the efficient care level of injurers with worse-than-reasonable skills,  $\beta > \lambda$ .

If an accident occurs, an injurer whose care level  $x$  falls short of the standard of care will be liable, and pay to the victim the following damages:<sup>9</sup>

$$(3) D(x) = \alpha h \left( 1 - (1 - \delta) \frac{p(x^*(h, \lambda))}{p(x)} \right),$$

where  $\alpha \in (0, 1]$  is the harm-discount factor and  $\delta \in [0, 1]$  is the causation-attribution factor. If  $\alpha = 1$  damages are fully compensatory, that is, they reflect all the harm the victim suffered pursuant to the accident. As  $\alpha$  decreases, damages are under-compensatory and the victim bears a greater share of the harm even if the injurer is liable.<sup>10</sup>

If  $\delta = 0$  damages correctly attribute causation to the injurer, implying that the injurer is liable only for the additional marginal risks that were caused by his negligent behavior. As  $\delta$  increases, damages subsidize some of the risks that are not the result of the injurer’s negligent behavior, but the victim’s or nature’s risks. That is,  $\delta > 0$  reflects “excessive causation attribution.” When  $\delta = 1$  damages are not discounted by causation at all. This reflects the typical economic model of tort law that assumes “full liability” (see, Landes and Posner, 1987, Shavell, 1987, 2004; Stremitzer and Tabbach, 2014).

Note that while  $\alpha$  and  $\delta$  both affect damages level, they differ in their effect on the injurer’s behavior and thus play a different role in the analysis. Assuming the injurer behaves negligently,  $\alpha < 1$  is distortive since it discounts expected damages as a function of the injurer’s care level decision. Therefore, a negligent injurer would not take the injurer-specific, efficient care level when damages

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<sup>9</sup> Alternatively,  $D = \alpha h$  is the level of damages and  $(1 - (1 - \delta) \frac{p(x^*)}{p(x)})$  is the causation attribution factor.

<sup>10</sup> We exclude the possibility that  $\alpha = 0$  as it would transform the negligence regime into a “no liability” regime. We also exclude the possibility that  $\alpha > 1$  as this involves overcompensation cases, like punitive damages.

are under-compensatory (regardless of  $\delta$ ). On the other hand,  $\delta > 0$  is not distortive as it increases expected damages by a constant regardless of the injurer's care level decision. Therefore, a negligent injurer would take the injurer-specific, efficient care level regardless of whether damages are discounted for causation (insofar as they are fully compensatory,  $\alpha = 1$ , of course).<sup>11</sup>

## 2.4. Equilibrium

To solve the game we use backwards induction. The behavior of the different injurers, assuming they were selected, is first described. Then, among the different injurers, the victim selects with whom to interact.

### 2.4.1. Injurer's Choice

Given the legal regime, the injurer's expected costs function is:

$$(4) u(x, \beta) = \begin{cases} \beta x + p(x)D(x), & x < x^*(h, \lambda) \\ \beta x, & x \geq x^*(h, \lambda) \end{cases}$$

If an injurer abides by the standard of care her costs are  $\beta x^*(h, \lambda)$  (there is no point in taking extra care). If an injurer acts negligently, she takes the care level below the standard of care that minimizes her expected costs. Plugging the damages (equation 3) into the injurer's expected costs reveals that a negligent injurer incurs the social costs with respect to a discounted harm level,  $\alpha h$ , up to a constant (depending on the causation attribution factor  $\delta$ ). Hence, the corresponding care level choice by a negligent injurer is in fact  $x^*(\alpha h, \beta)$ .<sup>12</sup>

To see whether the injurer prefers to act negligently or not, define her benefits from negligence

$$(5) \Delta u = \begin{cases} \beta(x^*(h, \lambda) - x^*(\alpha h, \beta)) + ((1 - \delta)p(x^*(h, \lambda)) - p(x^*(\alpha h, \beta)))\alpha h, & \text{if } x^*(\alpha h, \beta) < x^*(h, \lambda) \\ -p(x^*(h, \lambda))\delta\alpha h, & \text{if } x^*(\alpha h, \beta) \geq x^*(h, \lambda) \end{cases}$$

<sup>11</sup> Of course both  $\alpha$  and  $\delta$  affect an injurer's decision whether to abide by the standard of care or act negligently.

<sup>12</sup> This is true, of course, insofar as  $x^*(\alpha h, \beta) < x^*(h, \lambda)$ . Given that optimal care level increases with skillfulness level (i.e., lower  $\beta$ ), for a sufficiently skilled injurer the care choice when assuming liability may in fact be higher than the standard of care (which would contradict the injurer's liability, of course). Such injurers who "insist" on being negligent will take infinitesimally less care than the standard (which they will never do, for obvious reasons).

Note that the range  $x^*(h, \lambda) \leq x^*(ah, \beta)$  is redundant, since injurers will never act negligently under this condition. The derivative of (5) with respect to  $\beta$  is positive, since when marginal costs increase, meeting the standard of care becomes more costly and less worthwhile. Subsequently, if a certain injurer prefers to act negligently, any less skilled injurer (whose  $\beta$  is greater) will prefer to do so as well.<sup>13</sup>

We assume away the possibility that all injurers prefer to either abide by the standard of care or violate it. This is obtained, for any  $\alpha$  and  $\delta$ , by setting an interim level of  $\lambda$  such that the standard of care is neither too high nor too low for all injurers.<sup>14</sup> Therefore, there must be some interior injurer type,  $\beta^0 \in (\underline{\beta}, \bar{\beta})$ , who is indifferent between complying with and violating the standard of care. All less-skilled injurers, with  $\beta > \beta^0$ , strictly prefer to act negligently, whereas all more-skilled injurers, with  $\beta < \beta^0$ , strictly prefer to comply with the standard of care.<sup>15</sup>

The cutoff skill-level  $\beta^0$  is implicitly defined by equating the injurer's benefits from violating the standard (equation 5) to zero, as a function of the model's parameters,  $\beta^0 = \beta(\delta, \alpha, \lambda)$ . Comparative statics reveals that as compensation increases (higher  $\alpha$  or  $\delta$ ) or the standard of care decreases (higher  $\lambda$ ) the propensity of injurers to comply with the standard of care increases, hence  $\beta^0$  increases as well.

Figure 1 illustrates an injurer's negligence benefits for  $p(x) = e^{-x}$ , in a fully compensatory damages regime,  $\alpha = 1$ , when  $\lambda = 1$ .<sup>16</sup> The solid black line reflects the benefits for  $\delta = 1$  (full liability regime); the dashed line for  $\delta = 0.2$ . As illustrated in this figure for the first case,  $\beta^0 = e$ , while for the latter case,  $\beta^0 = 1.7$ . Injurers who are more skilled than the cutoff level,  $\beta^0$ , earn negative benefits from

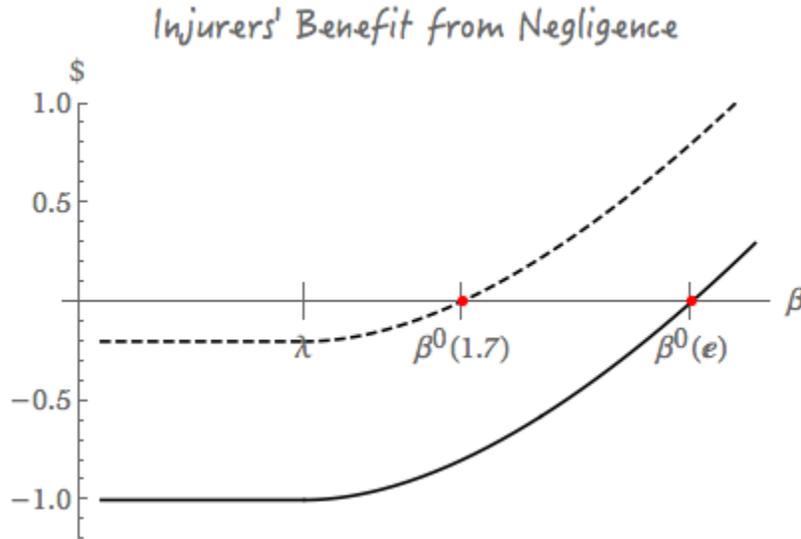
<sup>13</sup> Differentiating the benefits from negligence and using the Envelope Theorem (where  $x^*(ah, \beta) < x^*(h, \lambda)$ ) implies that the derivative is  $x^*(h, \lambda) - x^*(ah, \beta) > 0$ . Of course, if  $x^*(ah, \beta) \geq x^*(h, \lambda)$ , the benefits from negligence are independent of  $\beta$ .

<sup>14</sup> Formally, the most skillful injurer will meet the standard of care if  $\lambda$  is set such that either  $x^*(h, \lambda) < x^*(ah, \underline{\beta})$  or  $\underline{\beta}x^*(h, \lambda) < \underline{\beta}x^*(ah, \underline{\beta}) + p(x^*(ah, \underline{\beta}))ah - (1 - \delta)p(x^*(h, \lambda))ah$  when  $x^*(h, \lambda) \geq x^*(ah, \underline{\beta})$ . The least skillful injurer will violate the standard of care if  $\lambda$  is set such that  $\bar{\beta}x^*(h, \lambda) > \bar{\beta}x^*(ah, \bar{\beta}) + p(x^*(ah, \bar{\beta}))ah - (1 - \delta)p(x^*(h, \lambda))ah$ . When  $\lambda$  satisfies both these conditions then there will always be injurers who meet the standard of care and others who violate it.

<sup>15</sup> This is similar to the analysis in Landes and Posner (1987, pp. 125), which is restricted to the case where  $\alpha = 1$  and  $\delta = 1$ . It is readily proved using the boundary conditions (footnote 13) and the continuity of the injurer's benefit from acting negligently with respect to  $\beta$ .

<sup>16</sup> Simulations deriving Figure 1 and also Figures 2A-2E infra can be obtained from the authors upon request.

negligence, so they will meet the standard of care. Injurers who are less skilled than the cutoff level,  $\beta^0$ , earn positive benefits from negligence, so they will violate the standard of care



#### 2.4.2. Victim's Choice

Given the anticipated care choice of injurers, either  $x^*(ah, \beta)$  (when acting negligently), or  $x^*(h, \lambda)$  (when acting non-negligently), and the subsequent partition of the set of all injurers by  $\beta^0$ , the victim's expected costs function is:

$$(6) v(\beta) = \begin{cases} p(x^*(ah, \beta)) (h - D(x^*(ah, \beta))), & \text{if } \beta \geq \beta^0 \\ p(x^*(h, \lambda))h, & \text{if } \beta < \beta^0 \end{cases}$$

The victim chooses to interact with the injurer-type that minimizes his expected costs, denoted by  $\beta^*$ . If the victim interacts with a negligent injurer, he suffers the residual expected harm after being compensated by the injurer. If the victim interacts with a non-negligent injurer, he bears the residual expected harm and receives no compensation. We say that the victim "induces negligence" in equilibrium when he prefers to interact with a negligent injurer rather than with a non-negligent one. Since  $\beta^0 \in (\underline{\beta}, \bar{\beta})$ , the victim's choice determines the type of equilibrium.

In deciding whether to induce negligence or not, the victim trades off risks with compensation. Selecting a non-negligent injurer decreases the probability of an accident and the entailed risk, but it bars the victims from any compensation. On the other hand, selecting a negligent injurer increases the

probability of an accident and the entailed risk, but it awards the victim some compensation. Therefore, if and only if compensation is higher than the additional marginal risk imposed by the injurer's negligence will the victim induce negligence in equilibrium.

To avoid the possibility of multiple equilibria, we restrict our attention only to equilibria that survive the Pareto-Dominance (PD) refinement criterion.<sup>17</sup>

**Proposition 1:** *If  $\delta > 0$  and  $\alpha \geq \alpha(\lambda, \delta)$  the victim induces negligence by selecting the most skilled negligent injurer,  $\beta^* = \beta^0$ , whose care level is  $x^*(\alpha h, \beta^0)$ ; otherwise, if  $\delta = 0$  or  $\alpha < \alpha(\lambda, \delta)$ , the victim selects the most skilled injurer,  $\beta^* = \underline{\beta}$ , who meets the standard of care  $x^*(h, \lambda)$ .*

**Proof:** see Appendix.

The underlying notion is twofold. First, if and only if damages are not too high as to make the injurer better off by acting negligently, and not too low as to make the victim better off when treated negligently, will the victim induce negligence in equilibrium. Otherwise, if either of the parties cannot benefit from a violation of the standard of care, the victim will not induce negligence in equilibrium. Second, in either type of equilibrium, the victim chooses the most skillful available injurer, that is, the most skillful negligent injurer (when the victim prefers to induce negligence) or the most skillful non-negligent injurer (when the victim prefers not to induce negligence).

The victim induces negligence if and only if his costs when interacting with a negligent injurer are lower than his costs pursuant to a non-negligent interaction. Formally:

$$(7) (1 - \alpha)p(x^*(\alpha h, \beta)) \leq (1 - \alpha(1 - \delta))p(x^*(h, \lambda)), \beta \geq \beta^0$$

All possibilities are displayed in Figures 2A-2E:

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<sup>17</sup> The Pareto dominance criterion (or payoffs dominance criterion) is a refinement of the Nash equilibrium solution concept in game theory, defined by John Harsanyi and Reinhard Selten (1988, pp 355-356). A Nash equilibrium is considered payoff dominant if it is Pareto superior to all other Nash equilibria in the game. Observe that another refinement criterion, commonly used in the literature, namely, "risk dominance", is irrelevant in the current setting.

Figure 2A ( $\alpha=1$  and  $\delta=0$ )  
Victim's costs as a function of  $\beta^0$

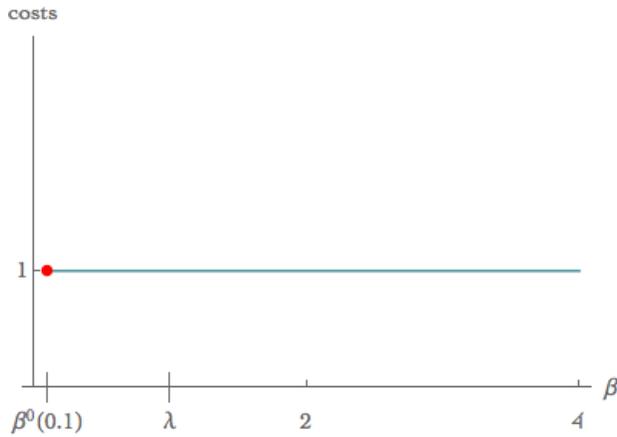


Figure 2B ( $\alpha=0.8$  and  $\delta=0$ )  
Victim's costs as a function of  $\beta^0$

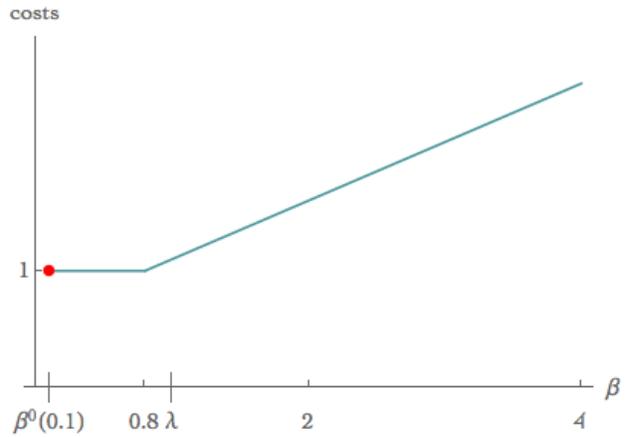


Figure 2C ( $\alpha=1$  and  $\delta=0.2$ )  
Victim's costs as a function of  $\beta^0$

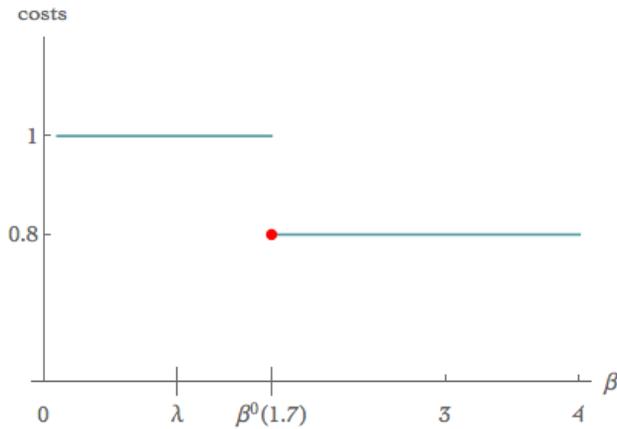
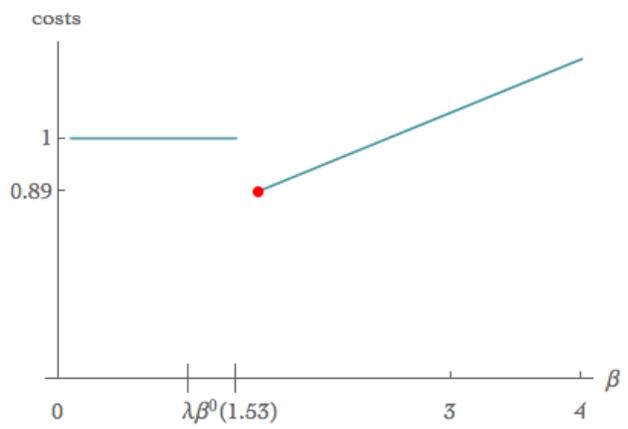


Figure 2D ( $\alpha=0.9$  and  $\delta=0.2$ )  
Victim's costs as a function of  $\beta^0$



If damages are fully compensatory,  $\alpha = 1$ , and are fully discounted for causation,  $\delta = 0$ , the victim's choice is degenerated (Figure 2A). His costs from inducing negligence equal his costs from not inducing negligence. This is because each negligent injurer is liable exactly for all the additional risks she induces by her negligence, and only for those risks, leaving the victim with the same residual expected harm that he suffers when interacting with a non-negligent injurer,  $p(x^*(h, \lambda))h$ . The victim is therefore indifferent to the type of injurer with whom he interacts, and whether or not that injurer will comply with the standard of care. Subsequently there are multiple equilibria. The PD refinement criterion implies that the victim will choose to interact with the most skillful injurer,  $\underline{\beta}$ , who will subsequently choose to act non-negligently.

If damages are under-compensatory,  $\alpha < 1$ , but are fully discounted for causation,  $\delta = 0$ , the victim prefers to interact with any non-negligent injurer (Figure 2B). His costs from inducing negligence are always higher than his costs from not inducing negligence. This is because damages cover only part of the additional marginal risks induced by the injurer's negligence. Hence the victim prefers to interact with a non-negligent injurer and bear the expected harm,  $p(x^*(h, \lambda))h$ . Again, there are multiple equilibria, and by using the PD criterion we get the same equilibrium as before, whereby the victim chooses to interact with the most skillful injurer, who meets the standard of care.

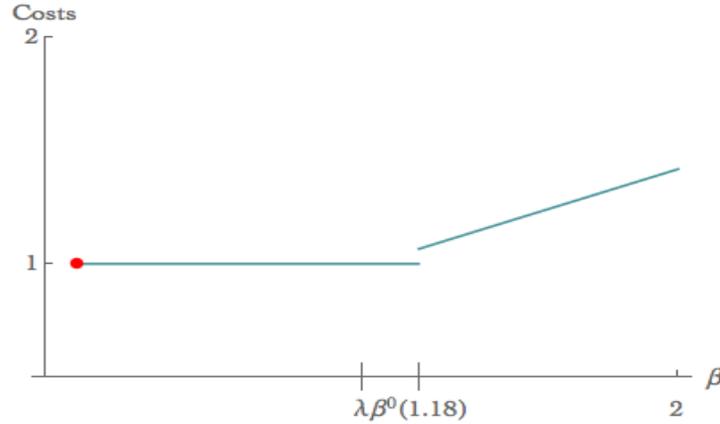
If damages are fully compensatory,  $\alpha = 1$ , but subsidize the victim's risks (attribute excessive causation to the injurer),  $\delta > 0$ , the victim prefers to interact with any negligent injurer (Figure 2C). His costs from inducing negligence are always lower than his costs from not inducing negligence. This is because a negligent injurer compensates the victim not only for the additional risk caused by her negligence, but also for some of the risks that are not induced by her negligence. The victim thus incurs some residual harm,  $(1 - \delta)p(x^*(h, \lambda))h$ , which is independent of the injurer's type (recall that  $\delta$  is not distortive). Again, therefore, we get multiple equilibria. Using the PD criterion, the victim chooses to interact with the "least negligent injurer" or the "most skillful negligent injurer," namely, the injurer-type  $\beta^0$ , whose corresponding care level is  $x^*(\alpha h, \beta^0)$ .

Finally, suppose that damages are under-compensatory,  $\alpha < 1$ , and subsidize the victim's risks,  $\delta > 0$ . As  $\alpha \rightarrow 0$ , the negligence regime approaches a "no liability" regime, in which the victim receives no compensation but incurs the expected harm, and thus prefers to be treated with the highest care possible. On the other hand, as implied above, when  $\alpha = 1$ , the opposite is true. Therefore, there is some cutoff level  $\alpha(\lambda, \delta)$ , implicitly defined by equating equation (7) when  $\beta = \beta^0$ . Consequently, two equilibria may emerge. For any  $\alpha$  equal to—or higher than—the cutoff level, the victim induces negligence (Figure 2D); for any lower  $\alpha$  he selects a non-negligent injurer who complies with the standard of care (by the PD criterion that would be the most skilled injurer, Figure 2E).<sup>18</sup>

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<sup>18</sup> Comparative statics implies that as  $\lambda$  decreases the standard increases, which means that for the victim to benefit from negligence compensation must increase as well. Similarly, as  $\delta$  decreases damages are discounted for causation more heavily, so the required  $\alpha$  must increase to substitute for that. CHECK.

Figure 2E ( $\alpha=0.7$  and  $\delta=0.2$ )  
Victim's costs as a function of  $\beta^0$



Importantly, when the victim induces negligence under the last scenario, he chooses the most skilled negligent injurer, or, the least negligent injurer,  $\beta^0$ , uniquely (without invoking the PD criterion). The intuition is the following. As damages are not fully compensatory, the victim keeps incurring some fraction of the harm. Therefore, conditional on selecting a negligent injurer, the victim would be better off decreasing the probability of the accident to a minimum, by interacting with a relatively high-skilled injurer.<sup>19</sup>

## 2.5. Normative Analysis

Social benefits from negligent behavior by the injurer are defined as follows:

$$(8) \Delta sc = \begin{cases} sc(x^*(h, \lambda), \beta) - sc(x^*(ah, \beta), \beta), & \text{if } x^*(h, \lambda) > x^*(ah, \beta) \\ 0, & \text{if } x^*(h, \lambda) \leq x^*(ah, \beta) \end{cases}$$

A necessary condition for a “negligent equilibrium” is that the social benefit from doing so is strictly positive. Namely, acting negligently must be Kaldor-Hicks preferable to meeting the standard of care (for a particular pair of victim and injurer). This, however, is insufficient. To induce negligence in equilibrium both the victim and the injurer must be better off (recall that we assume high transaction costs, thus the parties cannot negotiate). Therefore acting negligently should be Pareto improvement relative to acting carefully.

<sup>19</sup> The victim’s desire to interact with the highest-skilled injurer can be formally inferred by differentiating the victim’s costs from negligent interaction with respect to the marginal costs of care. Doing so implies that the victim’s costs increase with  $\beta$  if and only if  $\alpha < 1$ .

While inducing negligence is Pareto improvement, it does not necessarily implement the injurer-specific efficient care, or the first-best outcome. Proposition 1 implies that there are two types of equilibria – either when the victim induces negligence or not. Suppose first that the victim induces negligence by selecting injurer-type  $\beta^0$ , who takes care level  $x^*(\alpha h, \beta^0)$ . This would be efficient if and only if damages are fully compensatory,  $\alpha = 1$ . Even so, however, it will not implement the first best insofar as  $\beta^0 > \underline{\beta}$ . Only if the standard of care is set too high such that *all* injurers prefer to violate it (which we ruled out as it effectively transforms the negligence regime into a strict liability one) will the first best be implemented. This is because the victim would select the most skillful negligent injurer (either as a unique equilibrium or due to the PD refinement criterion), who would take the efficient care level,  $x^*(h, \underline{\beta})$ , which minimizes the social-cost value function.

Alternatively, when the victim does not induce negligence, the selected injurer-type  $\underline{\beta}$  meets the standard of care  $x^*(h, \lambda)$ . This equilibrium implements the first best if and only if the standard is tailored to the most skillful injurer,  $\lambda = \underline{\beta}$ . For any other case, the selected injurer takes in equilibrium less than the efficient care level.

Finally we should stress that if the victim selects the “reasonable” injurer,  $\lambda = \beta^*$ , that injurer will never act negligently in equilibrium. This is because the standard of care is efficiently tailored to the reasonable injurer, and thus by definition minimizes the injurer-specific social costs. Hence, no deviation can be profitable for both parties. A negligent equilibrium must involve, therefore, a less-than-reasonable injurer, in terms of her skill. This insight underlies the motivation for our next section, in which inducing negligence is possible even if the standard is efficiently set with respect to the selected injurer.

## A Stochastic Negligence Model

Inducing negligence in the deterministic model necessarily requires the standard of care to be inefficiently high. The reason, as we have pointed out, is simple: to induce negligence both the injurer and the victim must be better off when the standard is violated, which is possible only if the standard is inefficiently set. The main motivation of the stochastic model, therefore, is to show that inducing negligence by the victim is possible even when the standard is efficiently personalized to each injurer.

## 2.6. Setup

Assume the structure of the deterministic model with the following two adjustments: marginal costs of care are uniform and normalized across injurers,  $\beta = 1$ ; and more importantly, care level is stochastic. In particular, the victim's harm materializes probabilistically as a function of both the care level *input* taken by the injurer (the “intended care”),  $x$ , and some exogenous, injurer-specific shock,  $\epsilon$ , where  $x + \epsilon$  is the care level *output* (the “actual care”). Let  $p(x + \epsilon)$  denote the probability of an accident. The random shock  $\epsilon$  is an uncontrollable gap between the intended and actual levels of care taken by the injurer. Possible reasons for a stochastic care level are: (1) lapse of attention, (2) malfunction of some machine operated by the injurer, or (3) some uncontrollable behavior of subordinates, for which the injurer is considered responsible (Diamond, 1974, Shavell, 1987; Cooter and Porat 2014).

We assume throughout that the distribution of the exogenous shock is well defined, symmetrical with zero mean, and has an injurer-specific standard deviation,  $\sigma$ , assumed to be bounded and not too large  $\bar{\sigma}$ .<sup>20</sup> Denote the cumulative distribution function of the exogenous shock by  $F(\epsilon, \sigma)$ , and the probability density function by  $f(\epsilon, \sigma)$ . We thus refer to the uncertainty level of the exogenous shock,  $\sigma$ , as the type of injurer.

### Social Optima

The expected, injurer-dependent, social-cost function is:

$$(9) \quad sc(x, \sigma) = x + h \int_{-\infty}^{\infty} p(x + \epsilon) f(\epsilon, \sigma) d\epsilon$$

Note that for any care input level, given the convexity of the probability function, the expected probability under stochastic care is higher than the probability under deterministic care,  $\int_{-\infty}^{\infty} p(x + \epsilon) f(\epsilon, \sigma) d\epsilon > p(x)$ , by the Jensen Inequality. This implies that the interaction between

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<sup>20</sup> The reason is simple: if a driver intends to drive at 50 mph, lapses of attention, for example, may cause her to speed up to 60 or even 70 mph (or alternatively, slow down to 40 or even 30 mph). It is highly unlikely that due to lapses of attention that driver shall find herself driving at the speed of 100 mph (or at the speed of 0 mph).

the victim and the injurer is inherently riskier and more costly under the stochastic model relative to the deterministic one.<sup>21</sup>

The injurer-specific, efficient care level, denoted by  $x^*(\sigma)$ , is implicitly defined by the first-order condition of equation (9) (we omit the harm level as an argument within the efficient care function). Comparative statics reveals that, plausibly, as the uncertainty level  $\sigma$  increases the efficient care level also increases, in order to accommodate the additional risk entailed by the stochastic nature of care output.<sup>22</sup>

## 2.7. Legal Regime

Contrary to the deterministic model, suppose that the standard of care is injurer-specific and efficiently set:

$$(10) \bar{x} = x^*(\sigma)$$

We assume that the care level output is verifiable by the court, whereas the care level input is not, as it captures some latent intention of the injurer (naturally, the exogenous shock is unobservable by the court as well). Hence, under the stochastic negligence regime, the injurer is liable for the victim's harm if and only if his output care level is lower than the standard of care:

$$(11) x + \epsilon < x^*(\sigma)$$

Given that  $\epsilon$  is a random variable, for any care level input taken by the injurer,  $x$ , the injurer will be deemed liable with a probability of  $F(x^*(\sigma) - x, \sigma)$ , reflecting the probability that  $\epsilon$  will fall short of  $x^*(\sigma) - x$ . With the complementary probability,  $1 - F(x^*(\sigma) - x, \sigma)$ , the injurer will be exonerated from liability.

As in the deterministic model, a liable injurer pays damages:<sup>23</sup>

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<sup>21</sup> Note, however, that in itself this does not imply greater risk for victims who interact with injurers whose care output is uncertain. The injurer might increase her care input to compensate for her inherently greater risk, such that the probability of an accident remains the same or even decreases.

<sup>22</sup> A necessary and sufficient condition is that the partial cross derivative of the expected probability is negative.

<sup>23</sup> See the remark in footnote 9.

$$(12) D(x, \epsilon) = \alpha h \left( 1 - (1 - \delta) \frac{p(x^*(\sigma))}{p(x+\epsilon)} \right)$$

## 2.8. Equilibrium

To solve the game we use backwards induction. First, we describe the behavior of the different injurers if selected by the victim. Then the victim selects with whom to interact.

### 2.8.1. Injurer's Choice

The injurer's expected costs function for  $\sigma > 0$  is:<sup>24</sup>

$$(13) u(x; \alpha, \delta, \sigma) = x + \int_{-\infty}^{x^*(\sigma)-x} p(x+\epsilon) D(x, \epsilon) f(\epsilon, \sigma) d\epsilon$$

The liability of the injurer is expressed by the second term in equation (13). It is the product of the probability of being liable, with the expected damages paid by the injurer, conditional on her being liable. Denote the care level choice of the injurer, which minimizes her expected cost function, by  $x^u(\alpha, \delta, \sigma)$ .

If damages are sufficiently compensatory ( $\alpha$  is high enough) and the causation attribution is sufficiently excessive ( $\delta$  is high enough) injurers will over-comply with the standard of care,  $x^u(\alpha, \delta, \sigma) > x^*(\sigma)$ , for any uncertainty level  $\sigma$  associated with their care output. To the contrary, if damages are highly under-compensatory ( $\alpha$  is low enough) and sufficiently discounted for causation ( $\delta$  is low enough) injurers will under-comply with the standard of care,  $x^u(\alpha, \delta, \sigma) < x^*(\sigma)$ , for any uncertainty level  $\sigma$  associated with their care output. The reason is simple: if expected damages are high enough, injurers prefer to avoid liability, and vice versa. The following Lemma characterizes the injurer's choice for intermediate levels of  $\alpha$  and  $\delta$ .

**Lemma 1:**  $\exists \{\alpha, \delta\} \subset [0,1]^2$  and  $\sigma^u(\alpha, \delta) > 0$  such that:

$$(14) \begin{cases} x^u(\alpha, \delta, \sigma) < x^*(\sigma) & \text{if } \sigma > \sigma^u(\alpha, \delta) \\ x^u(\alpha, \delta, \sigma) = x^*(\sigma) & \text{if } \sigma = \sigma^u(\alpha, \delta) \\ x^u(\alpha, \delta, \sigma) > x^*(\sigma) & \text{if } \sigma \in (0, \sigma^u(\alpha, \delta)) \end{cases}$$

is satisfied.

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<sup>24</sup> If  $\sigma = 0$  the model is reduced back to its deterministic form.

For intermediate levels of  $\alpha$  and  $\delta$  the group of potential injurers is divided as follows: injurers whose care output is associated with low uncertainty level over-comply with the standard of care; injurers whose care output is associated with high uncertainty level under-comply with the standard of care. We denote the cutoff level of the injurer who perfectly complies with the standard of care by  $\sigma^u(\alpha, \delta)$  (see also Shavell, 1987).

The underlying intuition is the following. In her decision whether to comply with the standard of care, the injurer trades off the costs of care with her scope of (expected) liability. When she under-complies with the standard, the former effect is the dominant one: the saved costs of care exceed the additional liability entailed by under-complying. Namely, injurers can substantially save costs of care without much increasing their scope of liability. This is the case when the distribution of the exogenous shock is sufficiently dispersed (high  $\sigma$ ). On the other hand, when the injurer over-complies with the standard, the saved scope of liability exceeds the additional costs of care. Namely, injurers can substantially reduce their scope of liability by taking relatively little additional care. This is the case when the distribution of the exogenous shock is sufficiently tight (low  $\sigma$ ).

### 2.8.2. Victim's Choice

Given the legal regime and the anticipated choice of potential injurers, the expected costs function of the victim is residually defined as follows:

$$(15) v(\alpha, \delta, \sigma) = s(x^u(\alpha, \delta, \sigma); \sigma) - u(x^u(\alpha, \delta, \sigma); \alpha, \delta, \sigma)$$

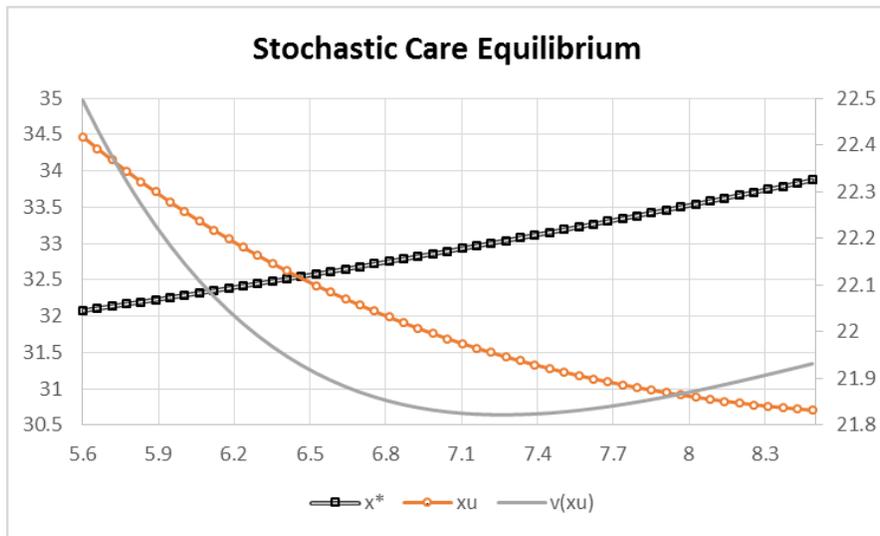
The victim's choice of an injurer, denoted by  $\sigma^v(\alpha, \delta)$ , minimizes his expected costs, equation (15), over the set of potential injurers  $(0, \bar{\sigma}]$ .

Since the stochastic model implies that the injurer is probabilistically liable, the definition of inducing negligence must be accordingly adjusted. We say that the victim "induces negligence" in equilibrium when he prefers to interact with an injurer who under-complies with the standard rather than with an injurer who complies or over-complies with it. Formally, therefore, to induce negligence under the stochastic models two conditions must be satisfied: first, the set of injurers must be divided such that some over-comply with the standard of care and some under-comply with it (see Lemma 1); secondly, the victim selects to interact with an injurer who under-complies with the standard of care.

**Proposition 2:**  $\exists \{\alpha, \delta\} \subset [0,1]^2$  such that  $\sigma^v(\alpha, \delta) > \sigma^u(\alpha, \delta) = x^*(\sigma)$ .

Proposition 2 claims that under the stochastic negligence regime the victim may induce negligence also when the standard of care is efficiently set. The victim prefers to interact with an injurer who under-complies with the efficient standard of care, even when that injurer takes less care relative to other potential injurers. Naturally this choice exposes the victim to greater risk. However, this additional risk is covered by the damages he may gain, should the injurer be found liable.

To exhibit Proposition 2 we specify  $\epsilon \sim U[-\sqrt{3}\sigma, \sqrt{3}\sigma]$  so  $f(\epsilon, \sigma) = 1/2\sqrt{3}\sigma$  (such that the mean of  $\epsilon$  is zero and the variance is  $\sigma$ ), and  $p(x + \epsilon) = 1/(1 + x + \epsilon)$ . Fixing  $h = 1000$ ,  $\alpha = 0.5$  and  $\delta = 1$  implies that  $\sigma^v(\alpha, \delta) = 7.27$  and  $\sigma^u(\alpha, \delta) = 6.45$ . The following figures plots  $x^*(\sigma)$ ,  $x^u(\alpha, \delta, \sigma)$  and  $v(\alpha, \delta, \sigma)$  as a function of  $\sigma$ . As can be readily observed, the victim minimizes his costs by selecting injurer type who under complies with the standard of care.



## 2.9. Normative Analysis

TBC...

### 3. Discussion

The deterministic model shows that under certain conditions the victim induces negligence by selecting an injurer for whom the standard of care is set too high, such that she prefers to act negligently. The stochastic model shows that even when the standard is efficiently personalized to each and every injurer, the victim may still select an injurer who under-complies with the standard of care. The underlying logic in both models is (partially) that there is excessive causation attribution, namely, the damages paid by the injurer subsidize risks not created by the injurer's negligence. We now turn to discussing the robustness of these results with respect to several issues.

#### 4.1. Short-Term and Long-Term Effects

##### 3.1.1. Short Term

*The Deterministic Model.* When the victim selects the injurer for whom the standard of care is set too high (the deterministic model), with full compensation the injurer's negligent behavior is efficient (but not the first best). Conversely, with partial compensation, the injurer's negligent behavior is inefficient. The intuition is the following: since the excessive causal attribution is constant (namely, not affected by the magnitude of the injurer's deviation from the standard of care), a negligent injurer responds only to the level of compensation she expects to pay beyond what he pays anyway for the risks not caused by his negligence. When compensation is full, a negligent injurer takes the efficient level of care, whereas if compensation is partial, he takes less than efficient care. Note that excessive causal attribution is a consideration for the injurer whether or not to be negligent, but once he decides to be negligent, it does not affect his behavior anymore.<sup>25</sup>

*The Stochastic Model.*

To be Completed.

##### 3.1.2. Long Term

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<sup>25</sup> This is a direct result of the difference between  $\alpha$  and  $\delta$ . The harm-discount factor,  $\alpha$ , reduces expected damages proportionally to the care taken, whereas the causation factor  $\delta$  discounts expected damages by a constant, irrespective of the care level taken by the injurer. This would have changed if we had assumed that the magnitude of the deviation from the standard of care affects the magnitude of the excessive causal attribution.

Assume that injurers derive benefits from the interaction with victims as in the doctor-patient case (Example 1) or the driver-passenger case (Example 2) (“beneficial interactions”). Under those assumptions, some injurers with less-than-average skill in reducing risks (in the deterministic model) and some injurers with uncertain realized care (in the stochastic model) will have a competitive advantage over skilled injurers and injurers with certain realized care, respectively. This is because victims prefer to induce negligence, and thus—everything else being equal—to interact with the former groups of injurers instead of the latter groups. In the long run, therefore, assuming that injurers can make an investment to affect their skill levels or the volatility of their care level, “mediocre injurers” trump all others. Injurers are incentivized to have only mid-level skills and medium volatile care output. Thus, many qualitative injurers, who generate less social costs when interacting with victims, will be driven out of the market.<sup>26</sup>

The reverse is true when injurers derive no benefit from interacting with victims, as in the polluter-pollutee case or the driver-pedestrian case (“detrimental interactions”). Here the injurers who were not selected by the victims have a competitive advantage over those who were selected: they can operate without taking costly care, or occasionally compensate victims for accidents. In the long run, therefore, injurers will seek the skill level and care output volatility that are the worst for victims, making themselves least likely to be selected by victims. Plausibly, this would induce injurers to improve their skillfulness and reduce the uncertainty of their care output. Hence, everything else being equal, many inefficient injurers (unskillful and with uncertain care output) would be driven out of the market.

Note that when all injurers are efficient (skillful and with certain care output), victims will prefer to avoid the interaction altogether. The reason is simple: when injurers are highly skilled (in the deterministic model), or their care output has little, if any, volatility (in the stochastic model), the injurers (almost) always comply with the standard of care and are thus not liable. Given that the interaction itself has no value to victims, they would prefer to opt out and avoid the risks of the

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<sup>26</sup> This discouraging result, however, is to be taken with caution. Beneficial interactions are likely to be taken within markets. If these markets operate rather freely (that is, transaction costs are low), the outcome shall change. See our discussion in this regard in section 4.4. Furthermore, if all doctors are obliged to charge patients a uniform price, then, depending on the price, many doctors – those that their costs of their services, including costs of care, are higher than the price – would be driven out of the market. Those latter doctors would mostly be mediocre doctors since their costs of care would typically be higher than the costs of the skillful doctors.

interaction altogether. But even if opting out is not possible and interactions between the injurer and victims must take place, the first best is achieved.<sup>27</sup>

## 4.2. Aversion to Increased Risks of Injury

While this paper's claim is that victims might be interested in being exposed to higher risks of injury in order to get free insurance, or a subsidy, for the materialization of risks not created by the injurer's negligence, we acknowledge that in reality many victims would avoid it even if they seem to be better off. It is worth noting, however, that in the stochastic cases, selecting an injurer with high uncertainty with respect to his realized care does not necessarily entail a higher risk than that imposed by an injurer with less uncertainty with respect to his realized care. To illustrate, a driver with a high magnitude of lapses might have incentives to drive much slower than a driver with a lower magnitude of lapses; the decrease in risks due to the slower driving might perfectly offset or even more than offset the increase in risks due to the higher magnitude of lapses. Indeed, while higher uncertainty increases social costs and the efficient care level, the expected harm may actually decrease or remain unchanged. In these cases, the additional care due to the uncertainty offsets or even more than offsets the additional risks due to the uncertainty. Then, even if the injurer complies with the standard of care and there is no compensation at all, the victim may be indifferent or even better off in interacting with injurers with high uncertainty levels.

Put differently, if the additional care offsets the additional risks, inducing negligence is reasonable for the victim even if severe bodily injuries are at stake: the victim simply receives free (albeit partial) insurance for risks unrelated to the injurer's negligence without necessarily increasing his risks. When the additional care actually reduces the victim's risks, then even if we ignore the advantage of receiving free insurance (such ignorance might even be realistic when the relevant risk is the victim's death), the victim might prefer an injurer with high, rather than low, uncertainty with respect to his realized care.

In many deterministic cases, however, as well as in many stochastic cases, victims would probably find it quite weird to expose themselves to higher risks of bodily injury, in return for free insurance for risks unrelated to the injurer's negligence. If this is indeed the case, and assuming victims are fully informed and rational, it must be because victims believe that damages are grossly under-

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<sup>27</sup> In some cases, injurers might find ways to avoid interacting with injurers. In such cases, the effects we describe above will not take place.

compensatory. This explanation might be less satisfactory with property damages, although even then, litigation costs and other uncompensated harms could explain why even fully informed and rational victims would hesitate to expose themselves to higher risks of injury.

### **4.3. Strict liability**

While this paper analyzes the incentives to induce negligence, it is interesting to consider whether a similar phenomenon would take place under a rule of strict liability. Under such a rule, there is no reason for the victim to induce negligence since he is “legally” insured. However, also under strict liability, victims could benefit from excessive causal attribution, if the likelihood of such attribution or its magnitude depend on a certain behavior of the injurer. This is the behavior the victim might be interested in inducing, and he may select injurers who are more likely than others to exhibit this behavior.

For example, assume that under strict liability for medical accidents, with a natural delivery of a baby, excessive causal attribution is more likely than with a Caesarian delivery. Everything else being equal, patients – and their insurance companies who insure them against all health risks – would prefer pediatricians who are more likely to deliver naturally than through a C-section.

### **4.4. Market Interactions**

Some of the interactions, in particular beneficial ones, may also be contractual. When a doctor interacts with a patient, she collects fees for her services, and may have some market power with respect to those fees. More generally, the parties’ proximity level, contrary to our assumption throughout, may imply that transaction costs are actually low, such that the parties could negotiate over the care level and make side payments.

When transaction costs are sufficiently low, Coasian reasoning should lead the parties to the first-best solution. In the deterministic model, this means that the most skillful injurer will be selected, and he will take the efficient care level (whether it is above or below the standard of care). In the stochastic model, this means that the victim will choose an injurer with deterministic care output, who will take the efficient care level (whether it is above or below the standard of care). Naturally, lowering transaction costs degenerates tort law altogether. Efficiency is established in equilibrium, regardless of what the standard of care dictates or what the damages are.

For example, free-market interactions in which the fees of the different injurers are set competitively exhibit the effect of lower transaction costs (as in a monopolistic competition). In the long run, with free entry and exit, all injurers' net profit is zero, hence the fees collected by each injurer equal her expected costs. In this case, the victim (who pays the fees, of course) bears all social costs, which would induce him to choose the first best, in either model. Only if the price for the services is equal across injurers and is set exogenously both for the injurers and the victims independently of their decision (which is some form of high transaction costs) will our analysis remain valid. That alternative can stand for public health services.

#### 4. Scope of Application

The claims developed in this paper apply to all cases when excessive causal attribution is likely.

*First*, our claims apply to situations where the excessive attributed risks were created by the injurer's careful activity. A typical case is Example 2: a driver who drives his car at 51 mph while the reasonable speed to drive at is 50 mph, and the court imposes liability for the materialization of risks not created by the driver's negligence but by his driving as such.<sup>28</sup> For this reason, passengers might prefer to interact with drivers who are just slightly unskillful or who have a certain level of lapses.<sup>29</sup> Disability insurance companies of those passengers might encourage them, through premium discounts, to choose such drivers in order to benefit from excessive causal attribution.

*Second*, our claims apply to situations where the excessive attributed risks were created by external sources, such as previous wrongdoing or nature. Example 1 is illustrative: a patient has preexisting risks not created by her doctor. The doctor's negligence increases the patient's risks, but liability is imposed for the materialization of all risks, both related and unrelated to the doctor's activity. For this

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<sup>28</sup> To avoid excessive causal attribution, liability should be imposed only for accidents that would not have been caused if the driver had driven 50 MPH or slower ("but for" cause) and the risk of whose materialization had not been increased by the additional 1 MPH of driving speed (see RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 30 (2010), which reads: "an actor is not liable for harm when the tortious aspect of the actor's conduct was of a type that does not generally increase the risk of that harm." A thorough analysis of this principle is found in Calabresi, 1975.).

<sup>29</sup> But see the discussion of market interactions.

reason, patients, again, with the encouragement of their disability insurers, might prefer to be treated by slightly unskillful doctors or doctors who have a certain level of lapses.

*Third*, our claims also apply to cases where the victim, before being exposed to the risks created by the injurer, suffered *actual* harm (rather than just being exposed to risks) from external sources. For example, a person who suffers from a previous injury for which he was not compensated might be injured by a wrongdoer, such as his employer or a car driver. In many such cases, courts consider the new wrongful harm and the previous harm as indivisible from one another and impose liability on the wrongdoer for the entire harm.<sup>30</sup>

In the latter cases, however, in order to benefit from excessive causal attribution it is not enough for the victim to induce negligence; it is also necessary to induce infliction of harm. Here, the reason the victim is arguably interested in inducing negligent infliction of harm is one of the typical moral hazard problems: the expectation of overcompensation. Indeed, victims will normally not induce infliction of severe bodily injury since damages can never be overcompensating. Still, they might be better off with injurers who would be liable toward them if harm materializes, than with injurers who would not be liable toward them if harm materializes. Therefore, with the encouragement of their disability insurance companies, they might often choose negligent injurers or injurers whose realized care is uncertain

## Concluding Remarks

Excessive causal attribution encourages inducement of negligence. Inducement of negligence, as we indicated in the introduction, could be the result of non-verifiable behaviors of victims. Courts should be attentive to injurers' arguments that victims made intentional efforts to cause their negligence in certain cases, since they expected to benefit from such negligence.

The focus of our paper, however, is the inducing of negligence through the selection of injurers, rather than by causing a specific injurer to behave negligently. As we have shown in the paper, in the beneficial interaction cases, selecting injurers because of excessive causal attribution might reward

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<sup>30</sup> See.

unskillful injurers and injurers whose realized care is uncertain. To avoid this, courts should be especially cautious in applying causation principles, and when necessary adopt a probabilistic recovery rule or reduce damages due to the presence of offsetting risks.<sup>31</sup> Thus, in Example 1, the court should impose liability on the negligent doctor for 9% of the materialized harm rather than the entire harm, thereby eliminating excessive causal attribution. Similarly, in Example 2, the driver should be liable only for the additional risk that his speeding (51 mph relative to 50 mph) has caused. When it is impossible for courts to distinguish between accidents caused by the additional 1 mph and by driving as such, a probabilistic rule should be applied when possible.<sup>32</sup>

The conclusion is different with respect to detrimental interaction cases. In such cases, as we have shown, victims' attraction to negligent injurers rewards the skillful injurers and the injurers whose realized care is certain. While this by itself is not necessarily a strong enough reason not to eliminate excessive causal attribution when possible, it shows a possible advantage of it.

## Appendix (INCOMPLETE)

*Lemma: In the deterministic model, if the standard of care is efficiently set the victim cannot induce negligence in equilibrium.*

Proof. To induce negligence two conditions need be met. First, the victim should be better off if the injurer behaves negligently. Second, the injurer should be better off acting negligently. Suppose that  $\alpha$  and  $\delta$  are such that...

**Proposition 1:** *If  $\delta > 0$  and  $\alpha \geq \alpha(\lambda, \delta)$  the victim induces negligence by selecting the most skilled negligent injurer,  $\beta^* = \beta^0$ , whose care level is  $x^*(\alpha h, \beta^0)$ ; otherwise, if  $\delta = 0$  or  $\alpha < \alpha(\lambda, \delta)$ , the victim selects the most skilled injurer,  $\beta^* = \underline{\beta}$ , who meets the standard of care  $x^*(h, \lambda)$ .*

**Proof:**

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<sup>31</sup> There are also other well-known reasons why excessive causal attribution is inefficient, which this paper has not discussed. Moreover, sometimes excessive attribution could produce desirable results. See Cooter, 1984.

<sup>32</sup> Of course, a probabilistic recovery rule cannot be applied without adequate information, and such information is not always available.

**Lemma 1:** *If injurer type- $\sigma$  under-complies with the standard, any injurer type- $\sigma'$ , where  $\sigma' > \sigma$ , also under-complies with the standard.*

**Proof:**

**Lemma 2:** *If  $\alpha > \alpha(\delta)$  there is some cutoff uncertainty level,  $\sigma^0$ , whose corresponding injurer perfectly complies with the standard of care; below this level,  $\sigma < \sigma^0$ , injurers over-comply with the standard, and above it,  $\sigma > \sigma^0$ , injurers under-comply with it. Otherwise, if  $\alpha \leq \alpha(\delta)$ , all injurers will under-comply with the standard of care.*

**Proof:**

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