Loss of Chance Rules and the Valuation of Loss of Chance Damages

Ralph R. Frasca
University of Dayton

Part I  Introduction

A defendant is liable for damages if it can be proven that her negligence was both the cause-in-fact and the proximate cause of the consequent harm. In most negligence cases the “but for” test provides a bright line rule for determining whether the defendant’s actions were the cause-in-fact of the plaintiff’s loss. The plaintiff must successfully argue that but for the act of negligence she would not have suffered the subsequent economic loss. Of course, damages that pass the “but for” test may, nevertheless, not be compensable because the relationship between the cause and the effect is too remote or tenuous. The negligence is said to be the proximate cause, the legal cause, of the plaintiff’s injury when it satisfies the cause-in-fact test and the connection between the negligence and the resulting harm is sufficiently direct.

In many situations the source of the plaintiff’s injury is certain. Accordingly, the court’s primary concern is whether the defendant was negligent. Did the defendant’s precautions fall short of a recognized due care standard? However, in a significant number of cases, in particular those claiming medical malpractice, it is uncertain as to whether the harm resulted from the defendant’s negligence or from some preceding or concurrent cause. Given a confluence of causes where any one of several different factors may have individually produced the demonstrated harm, the application of the “but for” test can be highly problematic. When the patient may have died from either the
physician’s negligence or some alternative preexisting condition, there is what Shavell has termed ambiguous causation.\(^1\) It is uncertain as to whether the harm was the result of negligence or some alternative condition. If neither of these causes can be ruled out individually, then neither cause passes the ‘but for’ test. Consequently, a strict application of the “but for” test would leave some wrongdoers unpunished and some victims uncompensated.

In order to deter negligence in the presence of ambiguous causation, all jurisdictions have adopted rules for ascertaining cause-in-fact given uncertain alternative causes for specific circumstances. These have been generally termed “loss of chance” rules. In most states these rules must be discovered in court decisions. In a few states, however, loss of chance rules are specifically embodied in state statutes.\(^2\)

Many torts may have a confluence of causes that result in lost chances.\(^3\) Indeed, all damages entail a loss of chance, since all economic damages are result of lost opportunities. However, most jurisdictions have typically restricted loss of chance rules to medical malpractice cases in which the health provider’s negligence has a negative impact on the patient’s chance of survival or recovery. This may result from an incorrect diagnosis, the application of inappropriate treatments, or the failure to provide timely proper treatment. Accordingly, the physician’s negligence has deprived the patient of a given probability of recovery. In a wrongful death case, it may be uncertain as to whether

---


\(^2\) Tory A. Weigand, “Loss of chance in medical malpractice: A look at recent developments,” Defense Counsel Journal, Vol. 70, No.3 (July 2003), p.302, lists cases in 24 states where some variant of the proportional loss of chance rule has been adopted. It is likely that the remaining states apply a variant of the all-or-nothing loss of chance rule. For a recently enacted statute that embodies a loss of chance rule see W. Va. Code § 55-7B-3 (2003).

the patient actually died from the malpractice or from the preexisting illness or injury. The negligence may have simply hastened a death due to the preexisting medical condition or it may have caused a death that would not otherwise have occurred. With ambiguous causation, the factfinder cannot be certain the negligence was the sole cause or even the primary cause of the victim’s loss.

In a typical negligence action, damages are not awarded unless it is more than likely that the harm flowed from the negligent act. Loss of chance rules can provide an exception, so that damages may be awarded even when it is more than likely that the harm can be attributed to some previous or concurrent cause. The underlying rationale for a loss of chance rule is that the wrongdoer should not benefit from the uncertainty that he or she has created. Absent the tort, the victim would have had a greater probability for a beneficent recovery. While we may not know that the negligence caused the patient harm, we do know that it reduced the probability of a better outcome. Therefore, the victim should be compensated for the foregone opportunity. The seminal statement on the loss of chance doctrine is often attributed to the following quote from Hicks v. United States (1966).4

When a defendant's negligent action or inaction has effectively terminated a person's chance of survival it does not lie in the defendant's mouth to raise conjectures as to the measure of the chances that he has put beyond the possibility of realization. If there was any substantial possibility of survival and the defendant has destroyed it he is answerable. Rarely is it possible to demonstrate to an absolute certainty what would have happened in circumstances that the wrongdoer did not allow to come to pass. The law does not in the existing circumstances require the plaintiff to show to a certainty that the patient would have lived had she been hospitalized and operated on promptly.5

---

4 Hicks v. US 368 F.2d 626 (4th Cir. 1966)
5 Ibid, p. 632.
The objectives in this paper are twofold. The first is to provide a taxonomy for loss of chance rules. There are several variations on loss of chance rules that differ by jurisdiction. The failure to distinguish unique variations can lead to confusing discussions on loss of chance. The second is to examine the basic framework for calculating damages under loss of chance rules. The methodology for estimating damages can vary significantly among the many jurisdictions that apply a variety of lost chance rules.

From an economic point of view, all damage calculations should be based upon opportunity cost. The legal system, however, may require damage estimates that reflect legal rather than economic theory. Legal rules can exclude or include items that would be treated differently using standard economic methodology. Of course, the economist is not expected to be an expert on legal rules. Accordingly, she must typically defer to the retaining attorney for advice on these matters. However, a certain familiarity with these rules can enhance the economist’s productivity and the productivity of the court system. This is particularly true when it comes to loss of chance rules.

In a loss of chance case, the economist may be asked to calculate the loss to survivors given one of three assumptions: 1) an estimate of loss assuming full recovery; 2) an estimate of loss assuming the patient’s preexisting probability of recovery; or 3) an estimate of loss assuming an incremental change in the patient’s probability of recovery. Only the third estimate is similar to an opportunity cost estimate of damages. However, depending upon the jurisdiction, each of these calculations can represent a legally appropriate presentation of loss by the economic expert. The correct presentation will be determined by the loss of chance rule in the relevant venue. An understanding of these rules can clarify the economist’s role in support of litigation.
Part II Loss of Chance Rules

The nomenclature for loss of chance rules has not been consistently stated in either the law review literature or court decisions. Consequently, the specific characteristics of a rule listed under the loss of chance rubric may not always be clear.6 As defined in this paper, any negligence rule that takes into account the probabilistic confluence of negligent causation and non-negligent causation in the determination of liability and damages is a loss of chance rule. What all of these rules have in common is that the legal cause of the harm and the valuation of damages is dependent on the confluence of ambiguous causes. Beyond this, however, for any given probability of patient recovery these rules may differ on the assignment of liability or the valuation of damages.

In a typical medical malpractice case, several factors must be considered before damages may be awarded. It must be shown that the defendant owed the plaintiff a special duty of care, the defendant negligently breached that duty, the plaintiff suffered a measurable harm and the breach was the legal cause of that harm. If any one of these conditions is lacking, the defendant is not responsible for the plaintiff’s loss. The absence of a preceding condition negates the need to examine the next. While loss of chance rules are meant to compensate the victim for a reduced chance of recovery, they are only relevant when the plaintiff has suffered an actual harm.7 Reduced chances of recovery

---

6 Some authors have used loss of chance “theory” or “doctrine” in place of loss of chance “rule.” Theory is a particularly inappropriate term, because there is no hypothesis to be tested. Doctrine is more fitting, but it connotes an element of strongly held beliefs that is unnecessary. Rule as used in a mathematical sense, a standard method for solving a class of problems, seems to most accurately convey the intended meaning.

7 There are a few exceptions discussed in Weigand, op. cit. pp. 308-309.
that do not result in an injury are typically not compensable. Accordingly, it is in consideration of the last two factors, valuation of harm and proximate cause, that loss of chance rules come into play. Did the negligence cause the plaintiff harm and, if so, what is the value of the harm? Was the action or inaction of the defendant sufficiently significant and immediate so that it might be deemed the legal cause of the harm? As these questions are typically posed in medical malpractice proceedings, the answers intertwine a finding of legal cause with the valuation of damages.

**The All-or-Nothing Rule**

The all-or-nothing rule is the traditional negligence rule for determining liability and damages when the cause is ambiguous. The inclusion of this negligence rule as a loss of chance rule must be emphasized, because the all-or-nothing rule is often presented as the alternative to loss of chance rules. Some authors use “loss of chance” to denote only the rules discussed later in this paper, while others use it to designate different subsets of those rules. In fact, the all-or-nothing standard is just another rule for evaluating a lost chance given ambiguous causation. When viewed in this context, alternative decision rules can be more effectively analyzed and compared.9

Cooper v. Sisters of Charity of Cincinnati, Inc. (1971) provides an illustrative application of the all-or-nothing standard for causation and damages.10 In Cooper, an emergency room physician failed to recognize that a patient had a fractured skull. The patient was released and returned home where he died of intracranial hemorrhaging the

---


9 Shavell (1985) does not use the term “loss of chance” in his landmark paper. However, the all-or-nothing rule is used to analyze liability under ambiguous causation.

10 Cooper v. Sisters of Charity of Cincinnati, Inc. 27 Ohio St. 2d 242.
next day. At trial the plaintiff could not successfully argue that there was more than a 50% chance the patient would have survived had he received timely treatment. As a result, the court ruled in favor of the defendant because it was less than probable that the defendant’s negligence was the cause of death.

The all-or-nothing rule supposedly applies the traditional test for proximate cause in negligence actions with ambiguous causation: it must be more likely than not that the defendant caused the “but for” harm. According to the majority opinion in Cooper, “Traditional proximate cause standards require that the trier of the facts, at a minimum, must be provided with evidence that the result was more likely than not to have been caused by an act, in the absence of any intervening cause.”\(^\text{11}\) At an even or less than even chance of recovery, no damages are awarded under the all-or-nothing rule because it is not more than likely that the negligence caused the injury. Alternatively, if there is a more than a 50 percent chance the patient would have survived, it is assumed that the malpractice was the proximate cause of the death.\(^\text{12}\) Moreover, as the sole cause of death, damages due the victim are based on an assumed full recovery. The chance that the patient might nevertheless not have survived or recovered given non-negligent care is disregarded. Consequently, awards under the all-or-nothing rule exceed the expected value of lost opportunities.

A traditional economic analysis of damages would discount the probability of recovery by any accompanying negative factors. The all-or-nothing rule specifically excludes some relevant economic alternatives. The economic expert need only provide an estimate of loss based upon the assumption that the malpractice had not occurred and that

\(^{11}\) Ibid, p. 251.
\(^{12}\) For ease of exposition we discuss loss of chance rule in terms of survivability. Loss of chance rules can be applied to personal injuries that have a less than perfect outcome, but do not result in death.
the patient was successfully treated for the ailment or injury. In effect, the economist is required to ignore the probability that even given the best of care the patient may not have recovered.

The all-or-nothing rule commingles causation and valuation by providing either an exaggerated estimate of damages or nothing. Symbolically, the all-or-nothing loss of chance rule can be stated as follows:

\[
\begin{align*}
\text{If } p_b > .5, & \text{ then } D = L. \\
\text{If } p_b \leq .5, & \text{ then } D = 0.
\end{align*}
\]

Where

\[D = \text{damages}\]
\[p_b = \text{a priori probability of recovery absent negligence}\]
\[L = \text{loss absent a full recovery}.\]

The probability of recovery, \(p_b\), is the \(a\ priori\) probability the patient would have recovered had she received non-negligent medical treatment. This will be referred to as the preexisting or prior probability of survival or recovery. It is greater than or equal to the probability of recovery in the absence of treatment and less than or equal to the probability of recovery associated with the best possible treatment. Non-negligent care is not necessarily perfect care or the best care possible. Under the all-or-nothing rule, the plaintiff is only be awarded damages when \(p_b\) is greater than 50 percent.

The probability of recovery is a factor in determining proximate cause; however, under the all-or-nothing rule it plays no part in the valuation of damages. Awards under the all-or-nothing rule are based on the assumption that the patient would have recovered
from the current injury or illness with certainty. The loss associated with non-recovery, $L$, is equal to the monetary value of full recovery less the monetary value of the diminished recovery.

Full recovery, however, does not necessarily mean that the patient would have had a normal lifestyle or normal life expectancy. It assumes that the patient would have had the most favored outcome. Unfortunately, even among those patients that are successfully treated, the most optimistic outcome may be less than a normal lifestyle or a normal life expectancy. For example, suppose a patient has a life threatening injury. The patient then receives negligent treatment and subsequently dies. Also suppose that given competent treatment, the best that could be expected was that the patient would have survived as a paraplegic. It would then be proper to base economic loss to survivors on the assumption that this individual’s future income would have paralleled that of others in this subgroup. It would be inappropriate to assume that this individual would both survive and walk.

Only the probability of survival or recovery that was impacted by the negligence is inflated when calculating damages. Full recovery is the state that would exist with certainty if $p_b$ were equal to one. All other probabilities that are unaffected by the negligence would remain unchanged in the loss calculation. If the patient had expected a diminished worklife given proper care, then those reduced probabilities of labor force participation should serve to diminish the award.

There may, of course, be situations in which it is not clear to the expert what “full recovery” entails. In these cases, the economist must receive guidance from the retaining attorney because this is a legal determination made by the court. Suppose a small
percentage of individuals with similar injuries did both survive and walk. Given this scenario, the economist may be asked to estimate economic loss based upon either or both possibilities. With either request, the expert should be prepared to discuss the assumptions underlying the estimated loss, and to illustrate how a change in those assumptions might affect the loss estimate. It is clear, however, that when proximate cause exists, the all-or-nothing rule requires some discounting of non-recovery probabilities in the damage calculations. Consequently, the estimated legal loss will diverge from an economic estimate of opportunity loss based upon an objective preexisting probability of survival and recovery.

As applied, the all-or-nothing rule overcompensates the victim when the prior probability of recovery is greater than .5, because it ignores the relationship between the associated medical condition and the preexisting probability of harm. On the other hand, the rule undercompensates other victims by establishing a probability standard of .5. When the preexisting probability of recovery is less than .5, the defendant is free of all liability. This is particularly harsh on plaintiffs who have a substantial but less than likely chance of recovery. Therefore, some courts have modified the all-or-nothing rule by applying a “substantial probability” standard.13 This has also been labeled the “relaxed causation” approach.14 It provides for full recovery if there is a substantial although less than likely probability that but for the tortious act the negative outcome would have been avoided. “Under the relaxed causation approach, the patient's ultimate death or injury,
and not the lost chance itself, continues to be treated as the relevant harm when
determining proximate cause. Hence, even while the lost chance may be less than even,
full damages are awarded in the same manner as if the plaintiff had established causation
under traditional principles.”15 It is not clear, however, as to what constitutes a
substantial probability of recovery.16 Accordingly, an all-or-nothing loss of chance rule
with a substantial probability standard may be stated as follows:

\[
\begin{align*}
\text{If } p_b &> x, \text{ then } D = L \\
\text{If } p_b &\leq x, \text{ then } D = 0 \\
\text{Where } 0 &< x \leq .5
\end{align*}
\]

It is claimed that the strict all-or-nothing rule, which only provides damages when
\( p_b \) is greater than .5, applies the traditional more than likely test for proximate cause.
However, this claim is incorrect. It is possible, however, that the negligence only
moderately reduced the patient’s probability of recovery. Therefore, even when \( p_b \) is
greater than .5 it can be more than likely that the harm resulted from the preexisting
condition. The likelihood that the harm resulted from the negligence is more accurately
assessed with what courts have named the “substantial factor test.”

In addition to a “substantial probability test,” all courts are likely to apply a
“substantial factor test”.17 To be deemed the proximate cause of the harm, the negligence
must be viewed as a substantial factor in bringing about the harm. Merely establishing

15 Kramer v. Lewisville Memorial Hospital, (Tex.) 858 S.W.2d 402 (June 30, 1993). See also Patrick L.
16 Applying Virginia law, Murray vs. U.S. 36 F. Supp. 2d 713 decided that the proper measure of proximate
cause was a substantial probability of survival and that a 30 to 60 percent chance of survival represented a
substantial possibility of survival.
that a defendant's negligent conduct had some effect in producing the harm does not automatically satisfy the burden of proving it was a substantial factor. The substantial factor test assesses the relative magnitudes of the preexisting probability of recovery, \( p_b \), and the probability of recovery after the negligent action, \( p_a \). Accordingly, the probability that the negligence was responsible for the harm is equal to the incremental reduction in the probability of recovery divided by the probability of non-recovery after the negligent act. In the current notation, this may be written as \( \frac{p_b - p_a}{1 - p_a} \). If this ratio is greater than a legally determined minimum, the negligence is viewed as a substantial factor in bringing about the harm. As with discussions on substantial possibility, the courts have not provided much guidance on an acceptable value for the substantial factor test.\(^{18}\) When probability of survival after negligence is zero, \( (p_a = 0) \), the substantial probability test and the substantial factor test produce identical results. However, when the negligence does not completely eliminate the plaintiff’s chance of recovery, it is possible for the court to find that there is a substantial probability that the patient would have survived, but that the negligence is not a substantial factor in causing the harm.

Without a substantial factor test, any plaintiff that could satisfy the substantial probability test would be awarded full recovery. The substantial probability test, however, is totally dependent on the patient’s preexisting probability of recovery. Without a substantial factor test, the defendant would be liable for full damages when there is only a small probability that the harm was due to the negligent act or the negligence had only a slight negative impact on the probability of recovery. The

\(^{18}\) If the critical value for the substantial factor test is less than .5, there can be multiple substantial factors. See Verdicchio v. Ricca, 2002 N.J. LEXIS 1740 (2002), p 41.
substantial factor ensures that some minimum standard of causation is satisfied. If the court is willing to assign liability when the patient’s preexisting chance of recovery is less than likely, then it must also be willing to assign liability when it is less than likely that the harm resulted from the negligence. The substantial factor test determines just how far the court is willing to go before it determines that proximate cause does not exist because it is much more than likely that the negligence was not the cause of the harm. The court may find that the relative increase in the chance of harm caused by the negligence is so small that it cannot be viewed as a substantial causative factor and, therefore, cannot be viewed as the proximate cause of the patient’s injury.

The Proportional Rule

The strict all-or-nothing rule provides no deterrence against malpractice when the patient has less than a fifty percent chance of recovery. Consequently, in recent years there has been a tendency for courts to replace the all-or-nothing rule with a proportional loss of chance rule that may assign damages when victims have a preexisting even or less than likely chance of recovery. The definitive statement of the proportional loss of chance rule is usually credited to Joseph H. King.\(^{19}\) The underlying notion is that if there is an even or less than probable chance the patient will not survive, it is inappropriate for the victim to walk away with nothing. After all, the plaintiff has experienced an increased risk of injury. A zero award would provide zero deterrence against medical malpractice for critically injured patients. Proponents argue that the award should be directly proportional to the lost probability of recovery when the prior probability of survival is

\(^{19}\) King Jr., op cit, p. 1353.
less than 50%. Accordingly, the proportional loss of chance rule may be stated as follows:

\[
\begin{align*}
\text{If } p_b > 0.5 \text{, then } D &= L \\
\text{If } p_b \leq 0.5 \text{, then } D &= p_b \ast L
\end{align*}
\]

This rule provides proportional damages only when the probability of survival is less than or equal to 50 percent. Full recovery is still provided when the preexisting probability of survival is greater than 50%. This feature has been widely criticized in the literature. At above a 50 percent chance of survival, damages are evaluated as if the negligence was the certain cause of death and damages are identical to those determined by the all-or-nothing rule. As stated previously, applying a full recovery assumption when the preexisting probability of recovering from the illness or injury is less than 100 percent provides an exaggerated estimate of economic loss.

At a preexisting probability of recovery of 50 percent or less, damages are proportionately awarded. The proportional loss rule allows the factfinder to find proximate cause when it is less than likely that the patient would have recovered. However, when \( p_b \) is less than or equal to 0.5, the full recovery award is discounted by the preexisting probability that the patient would not have recovered from the injury or illness, \( (1 - p_b) \). Consequently, in this range of recovery probabilities the award is equal to \( p_b \ast L \).

An interesting application of the proportional loss of chance rule can be found in Louisiana case law. In Rachel Smith v. State of Louisiana, the District Court applied the

traditional all or nothing loss of chance rule and, consequently, awarded zero damages because “the plaintiff has failed to prove he had a reasonable chance of survival.” 21 The plaintiff appealed and requested that full damages be awarded because the defendant’s actions had reduced the patient’s chance of survival. The appeals court found that survival damages should be proportionate to the loss of chance. The court stated that, “The plaintiff need not show that the decedent would have survived had he received different treatment as the result of an earlier diagnosis; rather, the plaintiff need only show that the decedent had a chance of survival which was denied him as a result of the defendant's negligence.” 22 In addition, “malpractice may be a substantial factor in destroying even a very modest chance of survival.” 23

Mr. Smith’s widow argued that she was entitled to full damages because she had proven a loss of chance. The State countered by claiming that she was only entitled to damages that are proportional to the loss of chance. The Court concluded that, “the percentage probability of loss, if less than 50%, is the proper measure of the plaintiff's damages in a case of wrongful death due to medical malpractice.” 24 Thus, a 50% loss of chance was the dividing line between proportionate recovery and full recovery. Therefore, at 50% or less, “It would not be logical or fair to impose full liability on a physician whose act or omission injures a patient whose chances of recovery were slim at best; and yet, imposing liability proportionate to the patient's chances is proper to assure the physician exercises reasonable care.” 25

---

21 Smith v. Louisiana 647 So. 2d 653 (La.App. 2 Cir, 12/09/94) at 658 and 676 So. 2d 543 (La. 06/25/96).
22 647 So. 2d at 658.
23 Ibid., p. 660.
24 Ibid., p. 662
25 Ibid.
it is proper to impose unreduced liability on the physician when the loss of chance is
above 50%, but not when it is less than 50%.26

At trial the expert witness for the plaintiff estimated Mr. Smith’s lost future
earnings assuming full recovery. He then deducted personal consumption and arrived at a
$250,000 estimate of lost support for survivors. To this amount the court added $60,000
for pain and suffering. Applying the proportional loss rule, the Court of Appeals then
subjected the previous estimates of economic and non-economic damages to reduction to
10% based upon the prior probability of recovery.

Many jurisdictions follow the procedure set down by this appeals court. The court
reviews the damages based upon full recovery presented by the economist and the
probabilities of survival presented by physicians. It then, subsequently, calculates the
value of the reduced award. However, when the Supreme Court of Louisiana reviewed
this case, it accepted the proportional loss rule, but rejected the procedures put forth by
the court of appeals for evaluating damages.

The jury can calculate the lost chance of survival without going through
the illusory exercise of setting a value for the wrongful death or survival
claims and then mechanically reducing that amount by some consensus
of the expert estimates of the percentage chance of survival. The
methodology for fixing damages attributable to the loss of a chance of
survival should not be so mechanistic as to require the jury merely to fill
in the blanks on a verdict sheet with a consensus number for the
percentage chance of survival and the total amount of damages
and then have the judge perform the multiplication task.27

Accordingly, in Louisiana the loss of chance is directly valued by the factfinder as
an element of general damages. This appears to provide wider latitude for the expert

---

26 There may be a recent tendency for courts to award proportional damages when the preexisting
probability of recovery is about 50 percent. See Liebig-Grigsby v. US 2003 U.S. Dist. LEXIS 3682. See
also Kieffer (1997).

27 Smith v. Louisiana 676 So. 2d 543 (La. 06/25/96) at 549
presenting an estimate of expected economic loss. However, the court did not totally reject the precise mathematical formula previously stated by the court of appeals. It warned that the methodology for calculating proportionate loss might be applied on appeal for judging the appropriateness of the award. “The jury's verdict of a lump sum amount of damages can be tested on appeal for support in the record by reviewing the percentage chances and the losses incurred by the tort victim and his or her heirs, and any other relevant evidence, thus providing assurance against speculative verdicts.”

One variation on the proportional rule is to include a substantial probability test. The recently enacted West Virginia Medical Liability Reform Act of 2003 includes both a substantial factor test and a substantial probability test. Recovery for loss of chance may be awarded if the, “provider's failure to follow the accepted standard of care deprived the patient of a chance of recovery or increased the risk of harm to the patient which was a substantial factor (italics added) in bringing about the ultimate injury to the patient” and “that following the accepted standard of care would have resulted in a greater than twenty-five percent chance that the patient would have had an improved recovery or would have survived.” The first requirement, the substantial factor test, calls for a substantial reduction in the probability of survival relative to the preexisting probability of survival. The judgment as to what constitutes a substantial factor is left to the courts. The second requirement, the substantial probability test states that damages are not to be awarded unless there is a substantial prior probability the patient would have

28 Ibid.,
29 West Virginia State Code §55-7B-3.
recovered. In most jurisdictions this is a vague standard established in court decisions; in West Virginia this is set at 25% by statute. Given a preexisting probability of survival of less than 25%, zero damages are awarded.

**Incremental Rule**

The incremental rule differs from the proportional loss rule by basing damages on the incremental reduction in the probability of recovery rather than the prior probability of recovery. The proportional loss of chance approach calls for proportional damages when the prior probability of recovery is less than 50 percent. In many jurisdictions, however, it is unclear whether the damage calculation employs a preexisting probability of survival or the incremental reduction in the probability of recovery. The difference is important, because an opportunity cost estimate of economic damages requires an examination of the incremental change in the probability of recovery. Of course, when the preexisting probability of survival is entirely eliminated both methods produce identical results, because the preexisting probability of survival and the incremental change in the probability of survival have the same absolute value.

The incremental loss of chance rule is clearly stated in Roberts v Ohio Permanente Medical Group.\(^{31}\)

To illustrate the method in a case where the jury determines from the statistical findings combined with the specific facts relevant to the patient [that] the patient originally had a 40% chance of cure and the physician's

---


\(^{31}\) Roberts v. Ohio Permanente Medical Group 76 Ohio St. 3d 483. Another case is which the judge reduced the economists estimate of full recovery damages is Mays v. U.S. United States District Court For The District Of Colorado, 608 F. Supp. 1476 (May 10, 1985). For the application of the incremental rule under the Federal Tort Claims Act concerning the apportionment of successive liability see Haceesa v. U.S., 2002 U.S. App. LEXIS 22192 (October 24, 2002).
negligence reduced the chance of cure to 25%, (40% - 25%) 15% represents the patient's loss of survival. If the total amount of damages proved by the evidence is $ 500,000, the damages caused by defendant is 15% x $ 500,000 or $ 75,000.

To ascertain the amount of damages in a case of lost chance of survival or recovery, the trial court must instruct the trier of fact to consider the expert testimony presented and (1) determine the total amount of damages from the date of the alleged negligent act or omission, including but not limited to lost earnings and loss of consortium; (2) ascertain the percentage of the patient's lost chance of survival or recovery; and (3) multiply that percentage by the total amount of damages.

Accordingly, the rule for calculating the incremental loss of chance with a probability constraint can be stated as follows:

\[
\text{If } p_b > 0.5, \text{ then } D = L \\
\text{If } p_b \leq 0.5, \text{ then } D = (p_b - p_a) \times L
\]

As with the other loss of chance rules, the incremental loss rule also overcompensates the plaintiff when the probability of recovery is greater than 50%. However, it is more likely to provide a more accurate assessment of economic damages than the non-incremental rule when the probability of survival is less than 50%. The expected value of the harm should equal the incremental change in the survival probability times the loss given the full recovery of the patient, \((p_b - p_a) \times L\). As long as the negligence does not reduce the probability of survival to zero, the non-incremental damage award will exceed the actual harm, because it incorrectly attributes the entire cause of harm to the negligence.

The incremental approach assumes that the marginal change in recovery probabilities can be ascertained. It is possible, however, that some courts may eschew the incremental approach because of limited information. The probability that a patient
would have recovered from the preexisting condition may be based upon well-documented epidemiological studies, but there may be little confidence in how the tort changed that probability. Accordingly, the damages are based upon the probability of survival before the tort. Given the uncertainty regarding the incremental reduction in the probability of survival, the purported rational is that the damage is assigned to the actor who was the source of the uncertainty. However, both the incremental loss rule and the substantial factor test require an assessment of post and prior probabilities of survival. Consequently, if the court applies a substantial factor test, it is inconsistent for that same court to reject an incremental approach because of informational constraints.

It has been argued, particularly in law review articles, that the all-or-nothing rule values a different harm from that valued under either the proportional rule or incremental rule. The all-or-nothing rule values the harm associated with the wrongful death or the denied recovery; whereas, the other rules value the harm associated with the lost chance. The various rules do set down significantly different tests for proximate cause and they can provide different estimates of loss; however, the charge that they intend to value different economic harms is a legal fiction.

In a wrongful death action the economic loss to survivors is the loss of expected income, \( p_b \cdot L \), which is obviously influenced by the victims preexisting probability of survival, \( p_b \). Given a posterior probability of survival of \( p_a \), the loss of expected income to survivors is equal to expected income before the negligence less expected income after the negligence or \( (p_b \cdot L) - (p_a \cdot L) \). This is the same value as the associated loss of chance \((p_b - p_a) \cdot L\). When viewed in this context, it is clear that only an incremental loss rule unconstrained by the prior probability of recovery can offer a
correct measure of economic damages.

Part III Conclusion

This paper has discussed legally imposed methodologies for calculating damages under loss of chance rules. The methods are the result of court interpretations and legislative action. As such they may not comply with an economic understanding of damages based upon opportunity cost. Accordingly, an understanding of loss of chance rules can aid the economist when providing litigation support in medical malpractice cases.

It is not the economist’s role to interpret the law; this is the judge’s domain. However, the economist can play an important rule in shaping that interpretation. In many cases, the interpretation of the law is based upon some underlying economic concept. Consequently, a clearer or more accurate understanding of those concepts can produce legal determinations that are more consistent with economic logic. Loss of chance may be one area of the law where a better understanding of economic concepts can lead to more consistent legal decisions.
Bibliography


Cases

Cooper v. Sisters of Charity of Cincinnati, Inc. 27 Ohio St. 2d 242 (1971)
Hicks v. US 368 F.2d 626 (4th Cir. 1966)
Kramer v. Lewisville Memorial Hospital, (Tex.) 858 S.W.2d 397 (1993)
Roberts v Ohio Permanente Medical Group 76 Ohio St. 3d 483 (1996)
Smith v. Louisiana 647 So. 2d 653 (La.App. 2 Cir, 12/09/94)
Smith v. Louisiana 676 So. 2d 543 (La. 06/25/96)