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***491** "REDUCTION OF LIKELIHOOD" REFORMULATION AND OTHER RETROFITTING OF THE LOSS-OF-A-CHANCE DOCTRINE

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***492** I. Introduction

More than fifteen years have passed since the publication of the predecessor to this Article, in which this author advocated a different approach to the loss-of-a-chance doctrine in personal injury torts cases. [FN1] The thesis of that article was, simply put, that when a defendant tortiously destroys or reduces a victim's prospects for achieving a more favorable outcome, the plaintiff should be compensated for that lost prospect. [FN2] Damages should be based on the extent to which the defendant's tortious conduct reduced the plaintiff's likelihood of receiving a better outcome. [FN3] The victim's lost prospects should be compensable irrespective of whether the tortiously reduced likelihood was better than even. [FN4] In other words, a plaintiff's right to damages for the loss of a chance should not be restricted to situations in which the plaintiff proves that it was more likely than not that he would have received a better outcome in the absence of the tortious conduct. For purposes of the present Article, [FN5] the loss-of-a-chance doctrine [FN6] will refer to a rule wherein a victim will be entitled to damages for the tortious ***493** reduction of the likelihood of avoiding the adverse consequences in question even if that likelihood was not better than even.

The most common paradigm for the loss-of-a-chance doctrine involves a victim suffering from a preexisting condition the adverse consequences of which a defendant health care provider negligently fails to prevent. [FN7] Under the loss-of-a-chance doctrine, the plaintiff would be compensated for the extent to which the defendant's negligence reduced the victim's likelihood of achieving a better outcome, notwithstanding the fact that the likelihood may have been reduced by less than fifty-one percent.

Part II of this Article briefly discusses the development of the loss-of-a- chance theory. The purpose in revisiting this topic is neither to survey the current state of the law in any specific jurisdiction or nationally nor to review the many cases and arguments for or against the loss-of-a-chance doctrine. [FN8] Although ***494** this Article discusses the British House of Lords's decision in Hotson v. East Berkshire Area Health Authority [FN9] in some detail, the purpose of this discussion is to facilitate analysis of one conceptual path. This Article does not examine post-Hotson developments in English law nor English law generally regarding the loss-of-a-chance doctrine. Once the reader is provided with an overview and analytical framework, the Article considers a reformulation of the doctrine.

The loss-of-a-chance doctrine has garnered substantial support over the past two decades, particularly in medical malpractice cases. [FN10] Nevertheless, a nagging perturbation has emerged that threatens to subvert, or at least unnecessarily obfuscate, the doctrine. It is based on some courts' insistence, to varying degrees, on proof of the existence of a literal chance as a precondition to the application of the loss-of-a-chance doctrine. [FN11] In order to clarify and rationalize the conceptual line separating causation and valuation, [FN12] this Article recommends focusing on the tortious reduction of the victim's likelihood of achieving a more favorable outcome. [FN13] Specifically, this Article seeks to purge the conceptual pitfall that is based on a one-dimensional causation focus on whether the victim had a literal chance.

As will be explained, a literal-chance requirement is questionable for several reasons. First, a truly literal chance in the sense of a condition whose effects are totally unpredictable may be nonexistent. Rather, what has typically been referred to in chance parlance would be better conceived as reflecting the reality of our limited perception and fund of knowledge. Second, and more importantly, whether there is or is not a literal chance should not be the deciding factor in determining whether ***495** a claim is resolved by causation or valuation (loss-of-a-chance) principles. Rather, application of the loss-of-a-chance doctrine should depend on the four criteria discussed below. A central consideration should be whether the defendant's tortious conduct was the cause of the trier of fact's inability to determine the precise effects of the defendant's tortious conduct on the victim's interests. The line separating causation and valuation should not be drawn based on the variable perceptions of whether the issues related to past or future events or on the extent to which the evidence was deemed personal as opposed to statistical.

The loss-of-a-chance doctrine should operate when the following criteria are present: (1) the defendant tortiously failed to satisfy a duty owed to the victim to protect or preserve the victim's prospects for some more favorable outcome; (2) either (a) the duty owed to the victim was based on a special relationship, undertaking, or other basis sufficient to support a preexisting duty to protect the victim's likelihood of a more favorable outcome, or (b) the only question was how to reflect the presence of a preexisting condition in calculating the damages for a materialized injury that the defendant is proven to have probably actively, tortiously caused; (3) the defendant's tortious conduct reduced the likelihood that the victim would have otherwise

achieved a more favorable outcome; and (4) the defendant's tortious conduct was the reason it was not feasible to determine precisely whether or not the more favorable outcome would have materialized but for the tortious conduct. [FN14]

The broadest potential application of the loss-of-a-chance doctrine occurs in situations where the defendant violated a duty to the victim that was based on a special relationship, undertaking, or other basis sufficient to support a preexisting duty. The most common example involves the health care setting. No special preexisting duty should be required, however, when it is proven that the defendant's active, tortious conduct probably caused the victim's materialized injury and the only ***496** question is to what extent to reduce damages for that injury to reflect the likelihood that the victim's preexisting condition would produce harm independent of the tortious conduct. The plaintiff's loss should be measured by the extent to which the percentage likelihood of the victim achieving a more favorable outcome was reduced by the defendant's tortious conduct.

Where the defendant's tortious conduct created a risk of future consequences, the operation of the loss-of-a-chance doctrine should be suspended until the harmful effects actually materialize. This assumes that, when necessary, appropriate rule changes are made to remove potential limitations and restrictions on bringing such claims at a later time. Moreover, the application of the loss-of-a-chance doctrine to materialized losses would depend on the satisfaction of each of the four above criteria. [FN15]

Part III of this Article suggests refinements in the process of valuing the tortiously reduced likelihood of loss avoidance. [FN16] This section addresses the potentially distorting effects of various analytical biases on the interpretation of data that charts the effects of delayed diagnosis on the prognosis for different types of cancers in various populations. Furthermore, this section briefly discusses the need to incorporate the conjunction principle into the process by which a plaintiff's interests are calculated. Finally, this section offers some observations on the scope of the loss-of-a- chance doctrine.

Almost twenty years ago, when the predecessor to this Article was written, very little developed case law existed to help guide and enrich analysis. As a consolation perhaps, the author was afforded extra dispensation because he was writing on a fairly blank slate. The purpose of revisiting this topic is to suggest possible refinement of the doctrine in light of its evolution. As was true back then, this will not be the final, or even the most sensible, word on the matter. As Alexander Pope wrote, "So pleased at first the towering Alps we try, . . . But ***497** those attained, we tremble to survey . . . Hills peep o'er hills, and Alps on Alps arise!" [FN17]

II. Conceptual Framework

A. Torts Elements and Valuation

There are five elements necessary to support a claim for negligence or other unintentional tortious conduct. [FN18] First, the defendant must have owed a duty to the victim. [FN19] Generally, everyone has a duty not to engage in active tortious conduct that creates an unreasonable, unacceptable, or otherwise liability-supporting risk of foreseeable harm. A duty may also be owed to persons with whom a defendant shares a legally-sufficient relationship or whose interests the defendant undertakes to serve or protect (and under certain other special circumstances). [FN20] This latter duty may apply not only to one's active conduct but may also impose a duty to act. [FN21]

Second, the defendant must have failed to exercise reasonable care [FN22] or must have engaged in conduct that would support the imposition of strict liability. [FN23] In negligence claims, for example, proof is required that the defendant failed to conform to the requisite standard of care.

Third, there must be a cause and effect (often called a "but for") relationship between the tortious conduct and the injury or loss. [FN24] The causation requirement consists of four dimensions. The first is the test of causation. The usual rule is the so-called but for test, whereby the plaintiff is generally required to establish that but for the tortious conduct the harm ***498** for which damages are sought would not have occurred. [FN25] The second dimension is the standard of proof. This defines the degree of certainty by which causation must be established. The usual standard of proof is by a preponderance of the evidence. Quantified, this means that it must appear more likely than not that the defendant caused the harm in question. The third dimension is the sufficiency of the evidence, which relates to the requirement and form of expert testimony. Expert testimony is often required to guide the jury in deciding causation questions. When required, such expert testimony must be in a form sufficient to support a conclusion that it was more likely than not that but for the defendant's tortious conduct the

harm in question would have been averted. Finally, there is the matter of the burden of proof. Although some courts may, in some circumstances, shift the burden to the defendant, generally the burden of proving causation is placed on the plaintiff. [FN26]

Fourth, the defendant's tortious conduct must have been the proximate cause of the plaintiff's loss. [FN27] Although proximate cause is sometimes used as a synonym for causation, they ***499** are distinctly different concepts. Proximate cause requires that the injury be within the foreseeable risk that was created by the defendant's negligence. [FN28]

Finally, the victim must have suffered compensable harm. [FN29] This Article will refer to the process of identifying and measuring the compensable interest destroyed or impaired as valuation.

Essentially, the outcome of the loss-of-a-chance issue depends on the appropriate role of these elements, particularly causation and valuation. Should the causation requirement be applied so broadly that recovery for the tortious reduction of the likelihood of a better outcome is precluded except when that likelihood was reduced by at least fifty-one percent? The question is essentially one of the relative purviews of concepts of causation and valuation.

B. Development of the Loss-of-a-Chance Doctrine

1. Background

The traditional approach to claims involving a lost chance for some more favorable outcome is known as the all-or-nothing rule. A victim's claim is viewed exclusively in terms of causation. The plaintiff must prove that it was more likely than not that but for the defendant's actionable conduct the plaintiff would have received the claimed-for benefit. [FN30] If the plaintiff satisfies that requirement, the plaintiff receives the entire value ***500** of the lost opportunity as though it had actually materialized. [FN31] Conversely, if the proof falls short--if the tortious conduct reduced the likelihood of a more favorable outcome by less than fifty-one percent--the plaintiff receives nothing for the lost opportunity. [FN32]

Shortly after the turn of the century, glimmers of change in the way courts thought about chance started to appear. One case credited with a new way of thinking about lost opportunities was the 1911 British contract case of Chaplin v. Hicks. [FN33] The defendant was a well-known London theatrical manager who had become frustrated with the deluge of applications from aspiring actresses. He decided to conduct a contest with the winners receiving three- year acting contracts. The plaintiff was selected as one of fifty finalists. Twelve winners were selected from the pool of fifty finalists. The plaintiff was never considered for one of the twelve positions, however, because the defendant allegedly breached his contract by failing to give the plaintiff adequate, timely notice of the schedule for the personal interviews.

The court held that the plaintiff was entitled to recover even though there was no proof that she had lost a better-than-even chance of winning. [FN34] The plaintiff's lost "opportunity of competition" was recognized as having monetary value. [FN35] One judge noted that the jury should have considered that the plaintiff had approximately a "one out of four" chance and assessed damages accordingly. [FN36] The Chaplin case, in effect, reified chance; what had theretofore been disregarded as an abstraction was treated as a material object worthy of legal redress. [FN37]

***501** Chaplin received mixed reception in personal injury cases in both the United States and the United Kingdom. [FN38] Most cases to address the loss-of-a-chance issue have arisen in the torts context and have involved medical malpractice claims alleging delayed diagnosis. Typically, a patient already suffers from a preexisting condition that places the patient at risk for some adverse outcome or premature death. Thereafter, the plaintiff alleges that the defendant-physician negligently failed to take appropriate measures to arrest the condition, thereby destroying or reducing the plaintiff's opportunity or chance of avoiding some adverse outcome.

The traditional all-or-nothing rule is well-illustrated in the Ohio case of Cooper v. Sisters of Charity, Inc. [FN39] In Cooper, a teenager suffered a basal skull fracture resulting from a bicycle accident. The fracture was not initially diagnosed, and the child died due to an intracranial hemorrhage and cerebral pressure. One of the plaintiff's experts stated that there was no way to ascertain with any degree of certainty whether the child would have survived with timely diagnosis and treatment. Plaintiff's other expert testified that there was about a fifty percent chance that the victim would have survived with prompt surgery. The Ohio Supreme Court affirmed a directed verdict for the defendant, holding that the plaintiff had to prove that it

was more likely than not (in other words, a likelihood of more than fifty percent) that prompt diagnosis and surgery would have averted death. [FN40]

The court viewed the problem in Cooper exclusively in terms of causation. The plaintiff was required to prove that it was more likely than not that but for the defendant's negligence the plaintiff would have received the claimed-for benefit. If the plaintiff satisfied this requirement, she received the entire value of the lost opportunity as though it had actually materialized. ***502** If the proof fell short, the plaintiff received nothing for the lost opportunity.

The traditional all-or-nothing rule went largely unchallenged in United States personal injury cases until about fifteen years ago. Since then, however, there has been a dramatic shift in the law, especially in the setting of medical malpractice.

2. Factual Variations

The loss of a not-better-than-even-chance question may arise from a number of factual permutations. These are briefly summarized below.

a. Timing of the Harm

Some claims involve a loss of a chance of achieving a better outcome (or of avoiding some adverse outcome) in the past and entail a retrospective focus. In this type of situation, the defendant's tortious conduct (such as a delay in diagnosis and treatment) results in adverse consequences from a preexisting condition actually materializing. [FN41] To illustrate, assume that a sixty- five-year-old male patient dies as a result of a ruptured abdominal aortic aneurysm that was negligently misdiagnosed. Assume further that had the patient received prompt surgical intervention he would have had only about a forty percent chance (likelihood) of surviving surgery.

A second type of situation involves a loss of a chance of averting an adverse outcome (or of achieving a more favorable outcome) in the future. It thus entails a prospective focus. The victim has not yet experienced the full effects of the tortious conduct for which damages are sought but alleges that the conduct--such as a negligent delay in diagnosis--increased the ***503** risk that such harmful effects will materialize in the future. [FN42] In the breast cancer scenario, for example, the patient might allege that the cancer progressed because of the doctor's negligent delay in diagnosing her breast cancer, thereby increasing the likelihood that it would recur in the future. [FN43]

b. Operation of the Tortious Conduct--Actively and Passively Reduced Likelihoods

Claims based on the loss of a chance may be engendered either passively by failures to take appropriate measures in a timely fashion (omissions) or actively by inflicted injuries (commissions). The loss-of-a-chance issue has received the most explicit judicial attention in cases arising from passively destroyed or reduced chances. The most common example involves a negligent delay in the diagnosis and treatment of a serious preexisting condition, such as cancer or heart disease. The plaintiff alleges that, as a result of the delay, his likelihood of a more favorable outcome, or even a cure, has been reduced or destroyed. [FN44]

Claims for actively destroyed or reduced chances might arise in the medical context, for example, if a patient being treated for adult respiratory distress syndrome dies from cardiac arrest caused by a lacerated pulmonary artery occurring during an attempt to replace a chest tube. [FN45] The issue would be how ***504** to value the patient's life when the patient only had a thirty percent likelihood of surviving from his preexisting condition had his artery not been lacerated. Conversely, a defendant's tortious conduct may actively inflict an injury that creates a chance of future consequences. A victim may receive a traumatic head injury that creates a risk that the victim will experience seizures in the future. What if the likelihood of this victim's trauma-related seizures is twenty percent?

3. Types of Damages Claimed

There are three types of damages that may be claimed in loss-of-a-chance situations. First, the patient may claim damages directly resulting from the loss of a chance of achieving a more favorable outcome. [FN46] These damages might result from the progression or anticipated progression of the preexisting condition itself. In a situation involving the delayed diagnosis of

cancer, for example, this claim might encompass the harm from the effects of the cancer itself. Second, the patient may claim damages from the mental distress suffered as a result of the effects or anticipated effects of the adverse consequences the chance or likelihood of avoidance of which the defendant tortiously reduced. [FN47] Damages might also be claimed for the mental distress from the realization that the patient's prospects of avoiding adverse past or future harm were tortiously destroyed or reduced. Finally, when the ***505** defendant's negligence contributed to the creation or perpetuation of a risk of the materialization of adverse future consequences, a plaintiff may claim damages for the medical costs of monitoring the condition in order to detect and respond to a recurrence or complications should they materialize. [FN48] The first of the three types of damages has received the most attention by the courts and is most directly implicated in the loss-of-a-chance question. Thus, this Article focuses primarily on damages directly resulting from the loss of a chance to achieve a more favorable outcome.

a. Harm Directly Resulting from Loss-of-a-Chance of a More Favorable Outcome

i. Various Approaches to Lost Chances

(a) The Traditional "All-or-Nothing" More-Likely-Than-Not Rule

The type of damages that has generated the most analysis of the loss- of-a-chance question has involved a claim for harm attributable to the lost chance of achieving a more favorable outcome (or avoiding adverse consequences). The most common factual setting has involved allegations that a delay in diagnosis caused a patient a lost opportunity to avoid harm from the progression of a preexisting disease. [FN49] Essentially, there are three different approaches to the tortiously destroyed chance situation. [FN50]

Under the traditional approach, which still commands substantial support, [FN51] the courts view the plaintiff's loss in all-or-nothing ***506** terms. The plaintiff must prove that, as a result of the defendant's negligence, he was deprived of a better-than-even chance of a more favorable outcome than the result that actually occurred. Take, for example, the sixty-five-year-old patient who dies from a negligently misdiagnosed ruptured abdominal aortic aneurysm. [FN52] If the patient had only a forty percent likelihood of survival with accurate, timely diagnosis, the plaintiff would not recover for the lost opportunity of survival under the all-or-nothing rule. If, however, the plaintiff proved "causation" by a preponderance of the evidence by establishing that the patient's likelihood of a better outcome absent negligence was at least fifty-one percent, damages would be calculated as though that likelihood was a certainty (100 percent).

The all-or-nothing rule seems largely to be a function of the sanctity of the causation element in personal injury tort litigation. Unless it appears more likely than not (i.e., by a preponderance of the evidence) that some more favorable result would have been achieved but for the defendant's tortious conduct, there simply is no loss. One appeal of the all-or-nothing rule is probably its perceived ease of application. The rule also is based on an expansive notion of causation and a narrow view of what might constitute a compensable loss. The all-or-nothing rule may also reflect courts' lack of confidence in the ability of attorneys, expert witnesses, and juries to value lost opportunities.

(b) Relaxed Proof Variations

A few courts have adopted relaxed proof variations of the traditional rule, while usually retaining its basic all-or-nothing features. [FN53] They continue to characterize the issue solely in ***507** causation terms and refuse to recognize the lost chance as a discrete interest or injury. But they have attempted to relax the proof requirements in various ways. Courts following this approach have stated that proof that the defendant negligently increased the risk of harm or destroyed a substantial possibility of achieving a more favorable outcome is enough to permit the plaintiff to present his case to the jury. [FN54] At the same time, although the opinions are not clear or in agreement on this, [FN55] the relaxed proof approach as originally conceived apparently continued to require that the jury decide whether the defendant's negligence was more likely than not a cause of the ultimate injury claimed. [FN56] In other words, under at least one version of the relaxed proof approach, the plaintiff's right to recover would still depend on whether the trier of fact found ***508** that it was more likely than not that the better outcome would have been achieved but for the defendant's negligence.

Under the relaxed proof approach, the plaintiff in the example of the delayed diagnosis of an aneurysm [FN57] would at least be entitled to have the jury decide whether the delay in diagnosis was a cause of the death, notwithstanding that the patient

had only a forty percent chance of survival with timely diagnosis. It would then be up to the jury to weigh all of the evidence, including the expert testimony, and decide whether the defendant's conduct should be deemed a cause of the patient's death. The relaxed proof approach represents the worst of both worlds. It continues the arbitrariness of the all-or-nothing rule, but by relaxing the proof requirements, it increases the likelihood that a plaintiff will be able to convince a jury to award full damages.

(c) The Loss-of-a-Chance (Reduced Likelihood) Doctrine

A third approach, the loss-of-a-chance doctrine, relies on a broader analysis beyond causation that encompasses the valuation sphere. Instead of viewing the loss exclusively in all-or-nothing terms of ultimate outcomes, the concept of loss has been more broadly conceived to include the loss of a chance of achieving a more favorable outcome. The importance of this approach lies in the fact that it may support damages for lost opportunities or reduced prospects when it is not possible to prove that it was more likely than not that but for the defendant's tortious conduct the ultimate injury would have been averted or that some more favorable outcome would have been achieved. [FN58] This approach has gained support during the past fifteen years, especially in medical malpractice actions. [FN59] Thus, a plaintiff may receive damages if he can prove that the ***509** defendant caused the loss of a chance of avoiding the ultimate injury despite the fact that the chance or likelihood of achieving a better outcome was not better than even. Damages should reflect the value of the lost chance or the extent of its reduction, usually by estimating the percentage by which the defendant's tortious conduct reduced the likelihood of achieving some more favorable result. Some courts limit application of the loss-of-a-chance doctrine to "substantial" chances. [FN60]

Under the loss-of-a-chance doctrine, the plaintiff in the previous aneurysm example [FN61] would be awarded damages for the lost opportunity of avoiding the adverse consequences--the death of the patient. Damages for that lost opportunity would be based on the extent to which the likelihood of a more favorable outcome was tortiously reduced. Thus, in the example, assuming that the patient's chance of survival would have been forty percent had he received a timely diagnosis, the recovery would be equal to forty percent of the value of the patient's life.

ii. Future Consequences

The loss-of-a-chance question sometimes arises in the context of allegations that the defendant's negligence increased the risk or likelihood of future harm. The plaintiff may allege that the defendant actively created or increased the risk of future harm. Alternatively, the plaintiff may contend that he suffered from a preexisting condition that posed a risk of future harm and that the defendant tortiously contributed to the perpetuation of that risk, such as by failing to diagnose and arrest the progress of a preexisting cancer. [FN62] In either event, the loss claimed ***510** may be based on the reduced likelihood of avoiding the materialization of adverse consequences in the future.

The outcome of claims for future consequences may often be affected by which of the various approaches to the loss-of-a-chance doctrine the court adopts and whether special requirements are applied in future harm cases. The courts are divided on the plaintiff's right to recover absent proof that the defendant's tortious conduct made the likelihood of the development of the future condition better than even. [FN63] The outcome of such claims frequently depends on whether or not the court applies the loss-of-a-chance doctrine in the future consequences context. [FN64] Moreover, it is not clear that a court otherwise approving the loss-of-a-chance doctrine for a completed harm [FN65] would be willing to extend it to claims for future harm. Likewise, it is not clear that a court approving of the doctrine for claims of future harm would consider applying the doctrine for completed harms. Although generalizations are difficult and the cases are divided, plaintiffs' prospects for damages for an increased risk of future harm may be improved, according to some approaches, when the victim has suffered a present physical injury and the court views the future consequences as simply a part of the present injury. [FN66] Under some views, however, even in cases involving present physical injury, the right to damages for a not-better-than-even chance of future harm may depend on whether the court has ***511** chosen to apply the loss-of-a-chance doctrine to future consequences claims. [FN67]

Some courts have attempted to partially circumvent the problem of future consequences by allowing more than one lawsuit: allowing one suit now for currently experienced harm if present, while preserving the right to sue again later should an additional injury arise. [FN68] This multiple-lawsuit solution may, however, be precluded or limited by single-controversy

rules or statutes of limitations as applied in some states. [FN69] These matters are beyond the scope of this Article. Moreover, even if multiple lawsuits were permitted, the loss-of-a-chance question might still have to be addressed once harmful effects actually materialize. [FN70]

b. Mental Distress

When a victim has suffered some physical harm and the traditional all-or- nothing more-likely-than-not rule has been satisfied by proof that a more favorable outcome would have been achieved but for the defendant's tortious conduct, the plaintiff's damages frequently include damages for mental distress. [FN71] Moreover, even when the traditional more-likely-than-not rule cannot be satisfied, if the loss-of-a-chance doctrine has been adopted, victims may generally recover damages for mental distress engendered by the knowledge that they were deprived ***512** of a not-better-than-even chance of a more favorable outcome [FN72] and for at least part of the pain and suffering associated with the adverse outcome. Unless the court has recognized the loss-of-a-chance doctrine, the right to damages for mental distress for the reduced likelihood of avoiding adverse consequences is more problematic in the absence of proof that such harm more likely than not would have been averted but for the defendant's negligence. [FN73]

Courts have increasingly allowed recovery for negligently caused mental distress even in the absence of an initial physical injury or physical impact. [FN74] They have employed a variety of tests. [FN75] Some courts allow mental distress damages when the victim was within the negligently created zone of physical danger, [FN76] when the mental distress resulted from a negligent failure to satisfy a preexisting duty that caused an unreasonable foreseeable risk of mental distress, [FN77] or under some version of a general negligence-foreseeability test. [FN78] Some courts have imposed one or more additional prerequisites, such as a requirement that the victim suffer physical consequences from the mental distress (or fall within specific exceptions), [FN79] or that ***513** the mental distress be serious or severe (sometimes as judged by, according to some courts, reasonable person standards). [FN80]

Claims for mental distress may be based on the fear of future consequences. Some courts have required not only proof that the victim was either subject to an immediate risk of harmful physical contact or suffered a physical impact or actual exposure to a potentially harmful substance, condition, or disease, but also one or more of the following: that the plaintiff have suffered a present physical injury directly from the impact or exposure, that the loss-of-a-chance doctrine be applicable to such claims, that future consequences be more likely than not to develop as a result of the defendant's tortious conduct, or that other special justifications for such damages be present. [FN81] In addition, courts frequently require that the mental distress over a fear of future consequences be reasonable (presumably based on a scientifically established increase in risk attributable to the contact or exposure) or, according to some courts, at ***514** least genuine. [FN82] Not all courts require that the victim suffer an initial physical impact or actual exposure to a potentially harmful substance, condition, or disease in order to recover for mental distress over fear of future consequences. [FN83] Some courts rely on various reasonableness tests, [FN84] with or without an impact or actual exposure requirement, largely instead of special preconditions for mental distress claims based on fear of future consequences. Some courts also require (sometimes in addition to other prerequisites) that there have been subsequent physical consequences or manifestations resulting from the mental distress, at least in the absence of an initial physical impact or present physical injury directly from the exposure itself. [FN85]

One solution to claims for mental distress based on the anxiety over future consequences would be, as some courts have recognized, to allow the plaintiff to bring an action in the future in the event the feared consequences actually materialize [FN86] and include in the damages at that time recovery for the fear experienced. That approach may not be a perfect answer, ***515** however, because it fails to recognize that the mental distress suffered over anticipation of future consequences is a present harm even if the dreaded condition never materializes.

c. Medical Monitoring

When the defendant's tortious conduct creates a risk of future harm or contributes to the perpetuation of such a risk, a plaintiff may claim damages for reasonable medical monitoring costs. A number of courts have recognized the plaintiff's right to damages for medical monitoring and surveillance, at least when the victim suffered a traumatic contact or was exposed [FN87] to a potentially harmful substance, condition, or disease, and such monitoring was reasonable. [FN88] The courts are divided on whether, in addition to the exposure, the victim must also have suffered some present physical injury. [FN89]

The loss-of-a-chance question has seldom been addressed expressly or figured centrally in the outcome of claims for medical monitoring. Although divided, most courts discussing medical monitoring claims usually seem to treat the extent of the increased risk of future harm as one of the relevant factors, ***516** rather than as a basis for a mathematical cutoff. [FN90] Thus, under the more sensible view, entitlement to medical monitoring costs (when otherwise warranted) usually should not depend on a finding that the future harm was more likely than not to develop nor upon whether or not the loss-of-a-chance doctrine has been adopted.

III. Refinements and Elaboration

A. "Reduction of Likelihood" Reformulation

1. Distinguishing Causation and Valuation:

The "Bean Jar" Paradigm

It may be helpful in charting a course through this analytical forest to consider a series of permutations drawn from a fairly simple factual context. For this purpose, a "bean jar" illustration is set forth below. The factual variations, especially numbers Four and Five, may facilitate analysis of the underlying situation that the House of Lords struggled with in Hotson v. East Berkshire Area Health Authority. [FN91]

Variation One:

Assume that seventy gold beans and thirty blue beans are placed into a jar. Paula Plaintiff receives a ticket that entitles her to draw one bean from the jar. According to the rules of the contest, if a blindfolded contestant draws a gold bean, she is awarded $100,000. If she draws a blue bean, she receives nothing. Paula entrusted her ticket to her lawyer for safekeeping, but he lost it. What was that lost ticket worth?

***517** Variation Two:

Now assume that there were thirty gold beans and seventy blue beans. What was Paula's lost ticket worth?

Variation Three:

Assume that the contest was created by a seed store. A blindfolded contestant was given one chance to draw a bean from a jar containing a total of 100 beans consisting of gold beans and blue beans that had been randomly swept from the floor of the seed store. Paula Plaintiff won the right to draw a bean because she was the one-millionth customer. The jar was duly filled with beans on the designated date. On the morning of the contest, the sponsors of the contest negligently discarded the jar.

No one knew for sure the ratio of gold beans to blue beans. Three experts were available. The first expert knew the approximate number of pounds of each type of bean sold from the bins at the seed store this time of year. This expert believed that there were thirty gold and seventy blue beans in the jar. The second expert had observed the filled jar and formed an impression that there were forty gold and sixty blue beans in the jar. The third expert testified about the location in the store from which the beans were swept. That expert believed that there were sixty-five gold and thirty-five blue beans in the jar.

What if the jury decided that the jar probably contained forty gold beans and sixty blue beans? Is the plaintiff entitled to anything? If so, how much was her lost chance worth?

Variation Four:

Assume that the drawing (from jars described in Variations Two and Three) occurred on a balcony overlooking a plaza. Assume further that while still blindfolded, Paula was negligently bumped by an employee administering the contest as Paula carried the bean she had drawn and the jar to the platform. ***518** This caused the bean and jar to fall over the balcony onto the plaza, where rain and pedestrians quickly dispersed the beans. Should it make any difference that Paula had actually drawn a

bean?

Variation Five:

Assume the same facts as in Variation Four. In addition, assume that a witness observed the "mystery bean" as it hit the railing of the balcony after falling from the plaintiff's hand. According to this witness, the bean appeared to be a blue bean. The witness also stated, however, that it was possible, although improbable, that the mystery bean had actually been a gold bean that only appeared blue because it happened to fall on an area of the railing where rain water had collected. Assume further that the triers of fact concluded, based on the circumstances of the bean's fall, including its trajectory, that the likelihood that the mystery bean was actually gold, despite its blue appearance, was thirty percent. Assume further that the trier of fact concluded that immediately prior to the drawing, the jar contained forty gold and sixty blue beans.

The outcome of the victim's claim in each of the five situations may depend on whether the crucial issue is perceived as a question of causation or a question of valuation. The traditional all-or-nothing approach would deny damages for the lost opportunity to participate or complete her participation in the bean jar contest unless the plaintiff proved that the likelihood of her drawing (or having drawn) a gold bean was better than even. Thus, Paula Plaintiff would be denied any recovery in Variation Two, and in Variations Three and Four if the jury concluded that the jar only contained forty gold beans. Nor would Paula have recovered in Variation Five, assuming that the trier of fact concluded that the evidence had not established that Paula probably had selected a gold bean.

Even if one accepts to some extent the loss-of-a-chance doctrine in principle, there exists some uncertainty regarding the appropriate purview of that doctrine. Specifically, some courts have had difficulty deciding the appropriate demarcation ***519** between the causation and valuation concepts. In the bean jar example, a court might apply the loss-of-a-chance doctrine to Variations One, Two, and Three but nevertheless balk at its application in Variations Four and Five, concluding that at this juncture there was no chance. As will be elaborated, such distinctions are unwarranted and arbitrary, and they unnecessarily inject uncertainty into the loss allocation decision. If the defendant tortiously reduced the likelihood that the victim would otherwise have achieved a more beneficial outcome, the plaintiff should recover damages, at least when the defendant's duty was based on a special relationship or other basis supporting a preexisting duty to protect the victim's interests in question or the defendant actively caused some injury leaving only the question of its value. Damages should be calculated to reflect the degree to which the tortious conduct reduced that likelihood. Thus, for the reasons developed more fully in the following subsections, the loss-of-a-chance doctrine should be adopted to entitle the plaintiff to appropriate damages not only in the first three variations above, but also in Variations Four and Five.

2. Clarifying the Elusive Line Between Causation and Valuation

Even if a court were sympathetic in principle to the idea of compensating for the loss-of-a-chance, it will still have to face the questions of whether there is a conceptually sound basis for separating causation and valuation, and if there is, where the line should be drawn. Courts in some cases seem to have fallen into a semantic trap in their analysis of the causation-valuation dichotomy by insisting on a literal definition of "chance." [FN92] To varying degrees, these cases have preempted the loss-of- a-chance doctrine by applying causation principles to some components of the victim's lost prospects. The end result is essentially a finding that the victim probably had no chance, or at least that the plaintiff failed to introduce sufficient evidence ***520** that the victim had a real chance. Thus, irrespective of whether a court has expressly repudiated the loss-of-a-chance doctrine in principle, or whether or not it is sympathetic to the doctrine, the net effect of this type of analysis is to severely restrict possible application of the loss-of-a-chance doctrine. In so doing, it may allow the reemergence of the all-or-nothing approach.

3. The Literal-Chance Fallacy

a. The Hotson Example

The British House of Lords decision in Hotson v. East Berkshire Area Health Authority [FN93] illustrates how requiring proof that the defendant's alleged negligence destroyed a literal chance can largely nullify the loss-of- a-chance doctrine, subsuming it into all-or-nothing causation principles. Hotson demonstrates just how elusive the conceptual dynamics separating causation and valuation can be. [FN94]

In Hotson, a thirteen-year-old schoolboy fell twelve feet from a rope while swinging from a tree. The fall caused a fractured left femoral epiphysis. [FN95] Although the child was taken promptly to a hospital (for whose conduct the defendant health authority was apparently legally responsible) and examined, no x-ray examination of the hip was made at that time. As a result of continuing pain, the child was returned to the hospital five days later, at which time x-rays taken of the hip revealed the fracture. The plaintiff sued a number of defendants, including the defendant health authority, alleging that the delay in diagnosing his fracture was negligent and resulted in ***521** avascular necrosis of the femoral epiphysis, [FN96] producing permanent deformity and disability of his left hip. More specifically, the plaintiff contended that the delay in diagnosis allowed bleeding of ruptured blood vessels into the joint, causing pressure that, in turn, compressed the remaining intact blood vessels. [FN97] According to the plaintiff, that pressure-induced occlusion of the remaining intact blood vessels supplying the epiphysis caused or destroyed the chance of avoiding the irreversible avascular necrosis. [FN98]

In the trial court, Judge Brown found that even had the plaintiff's fracture been timely diagnosed and treated at the initial examination, there was a high probability, which he put at seventy-five percent, "that the plaintiff's injury would have followed the same course as it in fact has." [FN99] Thus, Judge Brown found the likelihood that the avascular necrosis and disability could have been averted to be only twenty-five percent. [FN100] The trial court also noted parenthetically that it was "improbable" that the fall had left intact enough blood vessels to keep the epiphysis alive, even had prompt surgical intervention arrested the bleeding and thus prevented the compression ***522** of the remaining blood vessels. [FN101] Based on essentially these findings, the trial court held that the plaintiff was entitled to recover damages for twenty-five percent of the value of avoiding the permanent disability to his hip. [FN102]

Judge Brown explained that children have three sets of blood vessels supplying the epiphysis. [FN103] The experts agreed that the blood vessels running along the back of the femoral neck, carrying twenty percent of the blood supply, would have been ruptured by the fall, while those running through the round ligament and carrying less than thirty percent of the blood supply would not have. [FN104] Apparently, the experts disagreed on whether the remaining one-half of the blood supply running along the femoral neck would have been ruptured by the fall. [FN105] Extrapolating from the trial court's findings of fact, Lord Ackner (in the House of Lords) apparently believed that the availability or lack of availability of half of the blood vessels would have made the difference in whether early treatment would have been successful. [FN106] Plaintiff's expert, although not entirely clear on this, apparently believed that there was a substantial likelihood that prompt surgery would have averted the necrosis. [FN107] Defendant's expert apparently believed that insufficient blood vessels remained intact [FN108] and that the ***523** nature of the injury made the harm an inevitable part of the surgery. [FN109]

It is not clear by what mental process Judge Brown arrived at his twenty-five percent finding. There are two possible interpretations. Judge Brown might have thought that there was a twenty-five percent likelihood that the child had sufficient blood vessels intact to have avoided the disability with timely diagnosis. Alternatively, he might have meant that of 100 children with an injury similar to what was known to be the plaintiff's condition following the fall, twenty-five would have had sufficient blood vessels remaining to have been successfully treated if promptly diagnosed. It can be debated whether these conclusions are essentially the same or whether they represent discretely different cognitive processes. The point is that it should not matter in terms of a victim's right to be compensated for the tortious destruction of his prospects. Under either cognitive process, the victim's loss should be based on twenty-five percent of the value of the plaintiff's condition free of his hip disability. That was the finding of the trial court, which held that the plaintiff was entitled to recover twenty-five percent of the value of his condition free of the hip disability. [FN110]

On appeal, the court articulated the issue as whether a plaintiff in a personal injury negligence case could recover damages for the "loss of a chance or loss of opportunity." [FN111] The court of appeals held that the plaintiff was entitled to recover for damages attributable to the lost chance of avoiding the avascular necrosis and resulting disability. [FN112] The "fundamental question," according to Judge Dillon, was "what is the ***524** damage . . . the plaintiff has suffered?" [FN113] He elaborated, "Is it the onset of the avascular necrosis or is it the loss of the chance of avoiding that condition?" [FN114] Judge Dillon considered it to be the latter. Therefore, according to the judge, causation posed "no difficulty" because the lost chance was proven on a balance of probabilities to have been caused by the defendant's negligence. [FN115]

On further appeal, the House of Lords reversed the lower courts' decisions. [FN116] In one opinion, Lord Bridge held, "Unless the plaintiff proved on a balance of probabilities that the delayed treatment was at least a material contributory cause of the avascular necrosis he failed on the issue of causation and no question of quantification could arise." [FN117] Lord

Bridge described the plaintiff's condition following the accident:
(T)he failure of the blood supply to the epiphysis which caused the avascular necrosis could itself only have been caused in one of two ways: either the injury sustained in the fall caused the rupture of such a high proportion of the vessels supplying the epiphysis with blood that necrosis was bound to develop, or the blood vessels remaining intact were sufficient to keep the epiphysis alive but were subsequently occluded by pressure within the joint caused by . . . (bleeding into the joint). [FN118]

***525** Lord Bridge concluded that because the evidence had established that there was only a twenty-five percent likelihood that sufficient blood vessels remained intact following the accident to render the plaintiff amenable to curative treatment even if promptly diagnosed, it therefore did not appear that the plaintiff would have avoided the necrosis even with prompt, appropriate medical intervention (i.e., even if the bleeding had been stopped). [FN119] Based on this finding, according to Lord Mackay, the plaintiff "had no chance." [FN120] Therefore, Lord Bridge saw no need to address the question of how to handle the loss of a chance.

While the trial court believed that the question presented was one of "quantification," Lord Bridge saw the question solely as one of "causation." [FN121] Essentially, under Lord Bridge's view, the causation concept trumped the analysis of the valuation process. Lord Ackner also viewed the controversy as ultimately a causation problem. [FN122]

b. Rationales of the House of Lords in Hotson

The House of Lords resolved the case by applying causation principles and thus reached an all-or-nothing outcome. The rationale for its decision is less evident. Hints of reliance on at least two rationales appear in the opinions, particularly in the opinion of Lord Ackner. First, some of Lord Ackner's language attempts to draw a distinction between completed events and ***526** future events, addressing the former under a causation analysis, while at least leaving open the possibility of addressing the latter under a valuation analysis. [FN123] The trial court viewed the factual question in terms of "what would have happened"? [FN124] Whereas, the House of Lords viewed the situation not as a matter of predicting what would have happened, but in terms of ascertaining what had in fact already happened--were there sufficient blood vessels intact to permit medical salvation of the child's epiphysis? This rationale, based on a distinction between past and future events, may stem from a semantic pitfall that views the notion of "chance" in a very literal, technical sense, necessarily contemplating only circumstances in which a victim's outlook has not yet been determined. Past events are distinguished from future events. The former are addressed under a causation analysis, while the conceptual framework for the latter is left open with the possibility of a different analysis.

Lord Ackner sought to distinguish cases like Chaplin v. Hicks. [FN125] As noted earlier, the Chaplin court applied a valuation approach to a claim that the defendant's breach of contract had deprived the plaintiff of a not-better-than-even chance to compete in a beauty contest for an acting position. [FN126] There seemed to be a tacit sense that the Hotson and Chaplin situations were conceptually different (even apart from the fact that one was a personal injury claim and the other a contract claim). Lord Ackner seemed influenced by the perception that in Hotson, at the time of the alleged negligent misdiagnosis, fate had already spoken and that the courts simply lacked the tools of discernment to ascertain precisely what the condition of the victim's blood vessels was and what fate had preordained for his hip. Lord Ackner noted, "(T)he debate on the loss of a chance cannot arise where there has been a positive finding that before the duty arose the damage complained of ***527** had already been sustained or had become inevitable." [FN127] In other words, a specific number of blood vessels in fact remained intact following the child's accident. The court lacked, however, the means of determining that number because of the five day delay in diagnosis. On the other hand, Chaplin may have been perceived as categorically different because the plaintiff had never actually participated in the contest. Thus, in Hotson, the facts were completed but hidden from view. In contrast, the relevant events in Chaplin were perceived as not completed because the plaintiff never competed in the contest.

This author believes that Lord Ackner's attempts to distinguish Chaplin and to rely on a distinction between past and future events were misguided for several reasons. First, such reasoning ignores the reality that the plaintiff's prospects in Chaplin may also have been preordained at the moment of the breach of contract. All of the characteristics of the contestants and the judges, and the events that would shape them, were already in place. All other forces that would influence the outcome were presumably already in motion. As a practical matter, however, they were hidden from view because the triers of fact, like the rest of humanity, lacked perfect knowledge. Thus, there may really be no conceptual difference between situations perceived as involving completed events and events that never transpired. Therefore, no conceptual difference may exist between the

situation in Hotson, in which the untoward events actually transpired, and the situation in Chaplin, in which the events were never allowed to completely unfold. Presumably, if one accepts predestination or determinism, [FN128] the outcome in both situations was preordained. The problem in both instances is one of imperfect or limited knowledge. As leading historical figures in mathematics have maintained, "(P)robabilities measure human ignorance, not genuine chance." [FN129] Thus, probabilities ***528** have been characterized as "states of mind rather than states of the world, the makeshift tools of intellects too feeble to penetrate immediately to the real nature of things." [FN130] According to this deterministic view, "necessary causes, however hidden, govern() all events." [FN131]

Lord Ackner apparently regarded the fact that the plaintiff in Chaplin never participated in the final phase of the contest as placing that situation in the future events category. In a subsequent House of Lords decision, Wilsher v. Essex Area Health Authority, [FN132] the court applied a causation analysis to a situation in which a premature infant, who allegedly was negligently administered excessive oxygen, suffered severe irreversible visual impairment. The parties disagreed on whether, or to what extent, the eye damage was caused by the excessive oxygen or by inherent effects of prematurity (for which the defendant bore no responsibility). In essence, the House of Lords held (in an opinion written by Lord Bridge in which Lord Ackner concurred) that on retrial, the plaintiff would be entitled to recover only if he could prove that negligently administered excess oxygen probably caused or materially contributed to the patient's visual impairment. [FN133]

Apparently, Lord Ackner would regard Wilsher as a completed-event situation, whereas he would deem Chaplin as a future-event situation, presumably because the plaintiff in the latter case never competed in the final phase of the contest. In both situations, however, the harm to the plaintiffs was fully materialized, and the question remained unanswered whether the same adverse results would have ensued absent the defendants' actionable conduct. Would the plaintiff in Wilsher, because of his prematurity, still have suffered the visual impairment even without the allegedly negligent administration of oxygen; and would the plaintiff in Chaplin, because of the relative attributes of the contestants, still not have won the ***529** contest? Why should one situation be resolved by causation principles and the other, perhaps, viewed in valuation terms? In both situations, the only question should have been what value to assign the effects of the defendants' allegedly actionable conduct on the plaintiffs' legally protected interests. The test for determining whether to apply a causation or valuation analysis should not depend on how far along some time line events had progressed. Rather, in situations like those in Hotson and Wilsher, where the defendants' duties to the victims were based on special preexisting relationships, the focus should be on whether the defendants' actionable conduct was the reason that the triers of fact cannot know the part played by that same actionable conduct on the outcome. Thus, valuation (loss-of-a-chance) principles should have been applied not only in Chaplin, but in Hotson and in Wilsher as well, regardless of whether the facts could be characterized as a completed or as a future-events situation.

Lord Ackner held open the possibility that he would value chance in a situation in which an injury was inflicted that posed a risk of future consequences, such as epilepsy from a traumatic head injury. [FN134] There seems to be no conceptually sound basis, however, for selectively applying the loss-of-a-chance doctrine in the future consequences context and not in the Hotson situation. The House of Lords essentially held that the child's fate in Hotson was sealed at the moment of his fall, although limited knowledge forced the court to draw conclusions based on a best estimate--a "balance of probabilities." [FN135] But is not the fate of a victim of head trauma also similarly sealed even if we lack the omniscience to be certain of the outcome? The physical effects of the head trauma are already in place and the forces are already in motion that will determine the future course of the disease and whether seizures ensue. Yet, Lord Ackner treated one set of facts as completed but the other as somehow undecided. If one assumes the existence of a finite universe of a limited number of molecules that ***530** act in a consistent manner (at least for these purposes), then to that extent there may be no such thing as chance in the literal sense of something that is not yet preordained. [FN136] It follows then that if one accepts determinism, the House of Lords's requirement of a literal chance, taken to its logical conclusion, would leave no room for the loss-of-a-chance doctrine, even for so-called future events. [FN137]

If this Article makes incorrect assumptions about the validity of physical determinism, then Lord Ackner's distinction becomes less vulnerable on purely conceptual grounds. [FN138] The important thing here is that this author's dissatisfaction with the House of Lords's approach does not depend on the validity of determinism. Rather, the House of Lords's literal-chance requirement and its corollary of completed versus future-events distinction are unsound regardless of whether one accepts determinism. It should make no difference whether determinism is or is not valid as a matter of quantum physics. The degree to which events are predetermined does not change the reality that given our finite information and limited

knowledge, we frequently have no way of knowing exactly what the victim's prospects were. The House of Lords essentially requires the existence of a literal "chance" as a prerequisite to the application of the loss-of-a-chance doctrine. This perspective is too ***531** one-dimensional because its preoccupation with causation fails to leave sufficient analytical space to consider the implications of imperfect knowledge. From the standpoint of the plaintiff, it matters not whether he was literally deprived of a real chance (even if there were such a thing) of twenty-five percent. The best solution is to arrive at a percentage estimate of the likelihood that the victim would otherwise have achieved a better outcome. [FN139] It is crucial to remember that the defendant's alleged negligence is the reason courts are confronted with the imponderable situation created by imperfect knowledge existing after the tortious conduct.

The literal-chance fallacy can be illustrated by the bean jar example. [FN140] In Variations Two and Three, Paula had not yet selected a bean before she lost the opportunity to draw one. In Variations Four and Five, Paula had already chosen a bean, but the negligence prevented her from discovering with certainty which color bean she had chosen. Under Lord Ackner's analysis in Hotson, Variations Two and Three might be distinguished from Variations Four and Five. He would apply causation principles, rather than the loss-of-a-chance doctrine, to Variations Four and Five. Lord Ackner leaves open the possibility in Hotson that he might prefer a different rule, perhaps even the loss-of-a- chance doctrine, for situations represented by Variations Two and Three. [FN141] But why should it matter whether Paula had actually reached and withdrawn a bean? In both the categories represented by Variations Two and Three and by Variations Four and Five, the defendant's negligence had the same practical effect--it prevented anyone from knowing Paula's fortune. The negligence prevented one from discovering which color bean Paula would have withdrawn in Variations Two and Three and which color bean she had in fact withdrawn in Variations Four and Five. Most importantly, ***532** in all four situations, the defendant's negligence was the reason the doors of the perceptions were closed.

A second possible rationale is suggested in Lord Ackner's reliance on perceived differences in the nature of the evidence. His choice of a causation analysis may have been driven in part by his belief that the child's prospects could be evaluated by individualized personal evidence. Specifically, Lord Ackner seems to distinguish between findings derived from what he perceived as individualized evidence and findings based primarily on impersonal statistical proof. [FN142] He emphasized that, according to the testimony of the defendant's expert, the blood vessels running along the back of the femoral neck (containing approximately one-half of the relevant blood vessels) must have been destroyed. [FN143] Under Lord Ackner's reasoning, findings based on individualized evidence are addressed by a causation (all-or-nothing) analysis. Thus, if the evidence relating to a plaintiff personally militates against the plaintiff so as to preclude a finding that it was more likely than not that the harm would have been avoided absent the defendant's negligence, the plaintiff does not recover. [FN144] This second rationale-- distinguishing between individualized and statistical evidence--would also broadly limit the loss-of-a-chance doctrine. It might call for a causation analysis not only for past facts, but also for future facts if there was sufficient personal evidence ***533** relevant to the likelihood by which future loss avoidance was reduced by the defendant's tortious conduct.

There are at least two problems with a rationale based on a distinction between individualized versus statistical evidence. First, whether evidence falls into one category or the other depends on one's level of perception. One type of proof inevitably blends into the other. More importantly, the fact remains that the defendant's tortious conduct destroyed both the victim's prospects and one's ability to know what those prospects were. The nature of the evidence should not matter except to aid the trier of fact in estimating the likelihood that the desired outcome would have been achieved but for the defendant's negligence. This likelihood determination should be an amalgam of all the evidence, both individualized and statistical.

The Hotson problem should be analyzed as follows. The victim's prospects, even though predetermined, were unknown, [FN145] but were appraised at twenty-five percent. The trial court's findings should not be interpreted as meaning that this victim actually had an existing, literal one-in-four chance of escaping the hip disability. Rather, the twenty-five percent finding meant that there was a twenty-five percent likelihood that the number of blood vessels remaining intact were such that prompt, appropriate medical intervention would have averted the necrosis and resulting disability. To the extent that the plaintiff's prospects were preordained prior to the negligence, one might be tempted, as apparently the House of Lords was, to conclude that the victim had no chance and to let that be an end to the matter. Yet, a preferable way of looking at the plaintiff's injury is to view it as the loss of the opportunity to allow events to play out in order to see if the plaintiff's condition was in fact amenable to restoration. The only sensible way to value that opportunity is to equate the loss with the likelihood that the better result would have been achieved.

***534** The loss-of-a-chance analysis should be reformulated in terms of the reduction of the likelihood of a better outcome. Instead of focusing on whether the victim probably had a viable existing chance in the literal sense, one should ask what value should be assigned to the plaintiff's prospects for a full recovery had he been timely treated. Thus, it would be more sensible to articulate the rule not in terms of an existing chance, but in terms of the best estimate of the plaintiff's prospects given the unrevealed facts inherent in the situation.

Lord Mackay, at one point, asks rhetorically how proponents of the loss-of-a- chance doctrine would distinguish a situation in which the parties disputed whether or not a plaintiff had in fact suffered a fall on the defendant's premises as opposed to at the plaintiff's home. [FN146] Presumably, Lord Mackay's concern was that the valuation approach might, if approved, compensate the plaintiff in the slip-and-fall situation based on the probabilities that his version of the facts was the correct one. The situation Lord Mackay poses, however, is distinguishable on policy grounds from the circumstances in Hotson. In Lord Mackay's hypothetical situation, the defendant's negligence did not destroy the plaintiff's opportunity to watch fate run its course. It did not, in other words, inflict on the plaintiff the imponderability inherent in a world of limited knowledge. [FN147] A crucial determinant for delineating the purview of the causation and the valuation loss-of-a-chance ***535** analyses should be whether or not the defendant's tortious conduct was the reason the trier of fact does not know how the victim otherwise would have fared. In Lord Mackay's example, the defendant was not responsible for creating the mystery of where the plaintiff had suffered his fall. But the defendant clearly was responsible for the mystery of what fate otherwise had in store for Stephen Hotson had his condition been accurately and promptly diagnosed.

Valuing the victim's lost prospects based on the best estimate of their likelihood does not mean that the courts must substitute a percentage recovery to reflect the degree of certainty of the trier of fact on issues of causation generally. The rule advocated by this Article would apply only if it were established (by a preponderance of the evidence) not only that the defendant's tortious conduct reduced the likelihood that the victim would otherwise have achieved a more favorable outcome, but also that the tortious conduct was the reason it was not feasible to know whether or not the more favorable outcome would have materialized but for the tortious conduct. Moreover, the loss-of-a- chance doctrine should be applied only (except for limited purposes for actively caused injuries) [FN148] to situations in which the duty owed by the defendant to the victim was based upon a special relationship or other basis supporting a preexisting duty.

c. Examples of the Literal-Chance Fallacy in the United States

A misdirected analysis, similar to that in Hotson, is occasionally found in some United States decisions. In Bishop v. Tri County Radiologists Ltd., [FN149] plaintiff alleged that one of the defendant's radiologists negligently misread her husband's x-rays, resulting in a four-month delay in diagnosing the decedent-patient's ***536** lung cancer. The plaintiff's claim was based on allegations that there was a ten to twenty percent chance that the patient's cancer was in Stage I or II when misdiagnosed, and that if so, the patient would have had a forty to fifty percent chance of long-term survival if the radiologist made the diagnosis initially. [FN150] Based on these alleged facts, the appeals court affirmed a directed verdict for the defendant. [FN151] It held that because there was at most a twenty percent likelihood that the patient was in Stage I or II, he therefore lacked the forty to fifty percent chance that patients in those stages would enjoy with timely diagnosis and treatment. [FN152]

The court seemed to arbitrarily split its analysis. Causation requirements were applied to one percentage finding--the ten to twenty percent likelihood that the patient had been in Stages I or II. But the court left open the possibility that a loss-of-a-chance analysis might have been applicable to the other percentage finding--the forty to fifty percent likelihood of survival of patients diagnosed in Stages I or II. [FN153] To have been consistent, the court's analysis should have been the same even if the plaintiff had established that it was probable that the patient had been in Stage I or II. Thus, if a patient were deemed ***537** to have had "no chance" because only a ten to twenty percent likelihood existed that he was in Stage I or II, why would the same conclusion not be compelled even if he were within Stage I or II because at best he would still have had only a fifty percent likelihood of long-term survival in those stages? Put somewhat differently, if a finding in Bishop that the patient probably was not still in Stages I or II meant that the patient probably had no chance, then a finding that a Stage I or II patient would have had at best only a fifty percent chance (e.g., a not-better-than- even one) of long-term survival would require a similar conclusion. Bear in mind that at the moment of the misdiagnosis, the die was cast. Either the patient had a chance or he did not. The problem is that one cannot know with certainty and therefore must place a value on those uncertain prospects.

Under the approach recommended by this Article, the court should focus on the fact that the defendant's negligence reduced the likelihood that the patient would have enjoyed long-term survival had his cancer been diagnosed at the time the x-rays were allegedly misinterpreted. The triers of fact should estimate the extent of that reduction. Given limited knowledge, the best they can do is base that appraisal on their estimate of the percentage likelihood, given the patient's condition (stage), that the patient would have enjoyed long-term survival had his cancer been timely diagnosed. [FN154] The ten to twenty percentage should not foreclose this analysis anymore than the forty to fifty percentage should.

Language in some of the cases approving the loss-of-a-chance doctrine might, if interpreted too literally, seem to suggest that the loss-of-a-chance doctrine requires a finding that the victim lost a literal chance. In Smith v. Louisiana Department of Health and Hospitals, [FN155] the victim suffered from ***538** lung cancer, the diagnosis of which was negligently delayed for fifteen months. The supreme court held that the plaintiff must prove by a preponderance of the evidence that the victim "had a chance of survival" at the time of the negligence and that the tortious conduct "deprived the victim of all or part of that chance." [FN156] The plaintiff in Smith could not prove that with timely diagnosis the patient would more likely than not have survived. Nevertheless, the court held, based on expert testimony, that the plaintiff had proven that he "had lost some chance of survival." [FN157]

The court in Smith is unclear as to what it means by its requirement of proof that the victim had a chance. At the time of the negligence, the cancer was either in a curable stage or it was not. The problem is that no one knows for sure. If the plaintiff cannot prove by a preponderance of the evidence that the cancer probably was in a curable stage, then how could the plaintiff be deemed to have proven that the victim probably had a literal chance? It is hard to reconcile a requirement of proof of a literal chance with the court's approval of a judgment for the plaintiff when the evidence established that the victim did not possess a better-than-even likelihood of recovery. Thus, it is possible that the Smith court may not have intended that the plaintiff prove the loss of a literal chance. Perhaps a more plausible interpretation is that the plaintiff must prove that the likelihood of a more favorable outcome was in fact tortiously reduced to some extent and that expert testimony will frequently be needed to establish that fact. Under this more sensible interpretation of Smith, the plaintiff could not recover damages under the loss-of-a-chance doctrine if there was no likelihood whatsoever of a different outcome absent the tortious conduct. Thus, if the degree to which the likelihood of a better outcome was zero (or the plaintiff could not prove otherwise), then, but only then, there would be no factual premise as to which the loss-of-a-chance doctrine could be applied.

***539** At least one court has based its conclusion that the victim had no chance on a finding that a cause for which the defendant was not responsible caused the harm. Assume, for example, that a defendant is alleged to have negligently delayed transporting the victim to the hospital, and as a result, the victim dies before effective treatment can be administered. [FN158] Also assume that there were two possible alternative causes of death--one condition that the expert testimony established was inevitably fatal under the circumstances and one for which there was some likelihood of a cure with prompt treatment. If the trier of fact finds that it was 100% certain that the inevitably fatal condition was the cause, then there is no occasion for invoking the loss-of-a-chance doctrine. But what if the trier of fact concluded that although it was probable that the inevitably fatal condition was the cause, there was also, for instance, a thirty percent possibility that a sometimes curable condition was the cause instead? Under such circumstances, an all-or-nothing analysis should not be employed. Rather, the court should value the interest lost as thirty percent of the value of the decedent's life, discounted to reflect its value had he been suffering from the possibly curable condition and had he been promptly treated. Again, in opting for a valuation analysis over a causation analysis, the key consideration should be that the defendant's negligence was the reason one cannot know for certain how the decedent would have fared had he been transported to the hospital in a timely fashion.

One court applying the loss-of-a-chance doctrine employs (perhaps improvidently) metaphors in a way that seems to sow the seeds for emergence of the literal chance fallacy. In Wollen v. DePaul Health Center, [FN159] the court recognized the right to ***540** recover for a lost chance of survival for a patient who died from gastric cancer but allegedly would have had a thirty percent likelihood of cure with timely diagnosis and treatment. [FN160] In support of its holding, however, the court offered the following metaphor:

A patient with cancer . . . would pay to have a choice between three unmarked doors--behind two of which were death, with life the third option. A physician who deprived a patient of this opportunity, even though only a one- third chance, would have caused her real harm. [FN161]

The problem with this illustration is that it seems to presuppose that matters must not have yet been determined or

preordained. In other words, it presupposes the existence of a literal chance. While one may lack the omniscience to know whether David Wollen's gastric cancer was among the thirty percent that was curable, the fact remains that at the time of the alleged misdiagnosis, either it was or was not. The die was already cast, but by the time the correct diagnosis was made, there was no way of knowing exactly how this patient would have fared with proper diagnosis.

The following reformulation seems more appropriately tailored to the facts alleged in Wollen by characterizing the loss in terms of the reduction of the victim's likelihood of success rather than in terms of the patient's chance:
A door holds the only escape for a victim otherwise doomed. By the time the victim discovers the door, it has been irreversibly locked. Given the past conduct of the innocent gatekeeper, there is a thirty percent likelihood that the door was in fact still unlocked at the moment when the defendant-guide negligently failed to discover its presence and to direct the victim to try it.

The defendant-guide deprived the victim of his prospects, whatever they were. The best estimate of the value of those prospects ***541** would reflect the thirty percent likelihood that the door was still unlocked at the moment of negligence. It is true that, although only the gatekeeper knows the status of the lock at the moment of negligence, it was in fact either locked or unlocked. While one could contend, based on the thirty percent probability of success, that the victim probably had no chance or no prospects at the moment of the negligence, the fact remains that because of the defendant's negligence the victim's prospects can never be known for certain, and their likelihood was negligently reduced.

Other language in Wollen also deserves some attention. In approving the loss- of-a-chance doctrine, the court noted, "(I)n the failure-to-diagnose case, the fact pleaded to show causation often has to be a statistic." [FN162] The court later added the following:
(T)he statistic cannot tell whether the decedent would have survived if properly diagnosed. A statistic of this kind typically predicts that, out of a random sample of a large number of people in decedent's circumstances--if properly diagnosed and treated--Y percent will live and Z percent will die. A specific individual, however, could be in either group. A jury could speculate as to which group a decedent would fall, but the statistical evidence--without more--does not give a jury a basis to believe that the decedent belongs to either the group that lives, or the group that dies. [FN163]

This Article agrees with the court's approval of the use of statistical evidence in loss-of-a-chance cases. But the question arises whether the court's language may also imply that if there were some "basis" apart from the statistical proof for indicating to which group this decedent belonged--the group of doomed patients or the group destined to survive with prompt diagnosis--then there may be no need to invoke the loss-of-a-chance doctrine. This harkens back to the Hotson rationale, which distinguished individualized (personal) from statistical evidence, ***542** and is subject to the same criticism. [FN164] It should not matter whether the victim's prospects are assessed by individualized or statistical evidence, or both. Once it has been proven that the defendant tortiously destroyed or reduced the likelihood of achieving those prospects, the victim's loss should be calculated based on the likelihood of a more favorable outcome but for the defendant's tortious conduct.

d. Reduced Likelihood Reformulation: A Synthesis

There are several problems with some courts' insistence on a literal chance as a precondition to the application of the loss-of-a-chance doctrine. There may be no such thing as a true chance in the literal sense. More importantly, the fallacy of a literal-chance analysis exists irrespective of whether or not such a truly undetermined state existed. The crucial consideration should be whether the defendant's tortious conduct destroyed the opportunity to know how the victim's prospects would have unfolded had the defendant's tortious conduct not intervened to short-circuit the process. Rather than requiring proof that the plaintiff lost some future "spin of a wheel" that was totally unresolved and unpredictable (a literal chance), plaintiff's loss should be conceived of in terms of the reduced likelihood of achieving a more favorable outcome.

The loss-of-a-chance doctrine should operate when all of the following criteria are present: (1) the defendant tortiously failed to satisfy a duty owed to the victim to protect or preserve the victim's prospects for some more favorable outcome; (2) either (a) the duty owed to the victim was based on a special relationship, undertaking, or other basis sufficient to support a preexisting duty to protect the victim's likelihood of a more favorable outcome, or (b) the only question was how to reflect the presence of a preexisting condition in calculating the damages for a materialized injury that the defendant is proven to have probably actively tortiously caused; (3) the defendant's tortious conduct reduced the likelihood that the victim would

***543** otherwise have achieved a more favorable outcome; and (4) the defendant's tortious conduct was the reason it was not feasible to determine whether or not the more favorable outcome would have materialized but for the tortious conduct. The plaintiff's loss should be measured by the extent to which the percentage likelihood of the victim achieving a more favorable outcome was reduced by the defendant's tortious conduct.

In accordance with the preceding criteria, the loss-of-a-chance doctrine should have been applied in both the Hotson and Wilsher cases. The antidote to the temptation to resort to a causation analysis is found in the fact that the defendant's tortious conduct made it impossible to determine the causal roles played by the innocent and tortious forces.

A special relationship, undertaking, or other basis supporting a preexisting duty should not be required when a defendant's active tortious conduct is proven to have probably caused a materialized injury, and the only question is to what extent to reduce damages for that injury to reflect the fact that the victim suffered from a preexisting condition creating a possibility of harm independent of the tortious conduct. For example, the doctrine should be applied to a situation in which an ambulance transporting the victim to the hospital was struck by an eighteen-wheeler negligently operated by the defendant, and the victim was immediately killed. The fact that prior to the accident the victim was having a heart attack and had only a forty percent likelihood of surviving should not, under the loss-of-a-chance doctrine, completely preclude damages for the value of the victim's life. Instead, it would call for an appropriate reduction to reflect the effect of the preexisting condition on the interest destroyed by the negligent operation of the truck. This Article's suggested reformulation would not, except as noted under the four-part criteria above, dispense with the traditional causation requirement, nor would it replace the traditional more-likely-than-not preponderance of the evidence standard of proof with some sort of proportionate liability rule. [FN165] ***544** Thus, the loss-of-a-chance doctrine would not dispense with causation requirements where, for example, the defendant operated a percentage of the yellow cabs in town, and an unidentified hit-and- run driver had been operating a yellow cab.

When the preceding four criteria are present, but the victim has not yet experienced the full effects of the tortious conduct, the operation of the loss-of-a-chance doctrine should be suspended, with respect to the unmaterialized effects, until they actually materialize. Thus, the application of the doctrine would largely be limited to situations in which the harmful effects in question have materialized and either the defendant's duty is based on a special relationship with the victim or other basis supporting a preexisting duty or the defendant is proven to have actively caused the materialized injury. [FN166] The courts and legislatures in some jurisdictions may have to modify the statutes of limitations (or their interpretation) and rules regarding the splitting of causes of actions so as to ensure that a plaintiff's potential claim based on future consequences of past tortious conduct would not be precluded until an appropriate time after the effects had materialized and become reasonably discernible. Moreover, prior to the materialization of the actual harm, plaintiffs should be entitled, in appropriate circumstances, to be reimbursed for the reasonable costs of medical monitoring and perhaps for mental distress over fear of a scientifically confirmed increased risk of future consequences if some reasonable objective limits could be developed for such claims.

In attempting to resolve some of the confusion and distortion engendered by a literal chance requirement, this Article's ***545** suggested approach may be perceived as potentially impinging on traditional causation principles. On careful analysis, however, the loss-of-a-chance doctrine does not offend traditional notions of causation. The range of situations in which the doctrine would still apply, despite the fact that it did not appear probable that the defendant's tortious conduct (rather than a force for which the defendant bore no responsibility) was the cause of the victim's harm, has been circumscribed. For the doctrine to apply, the defendant's tortious conduct must have reduced the likelihood of achieving a better outcome and must have been the reason one does not know how the victim would have fared absent that tortious conduct. In addition, either the defendant must have probably been the cause of an actively inflicted injury on the victim or the defendant's duty must have been based on a preexisting relationship or undertaking. The right to avoid a tortiously caused "blind spot" in the ability to know the victim's prognosis can be deemed a legally protected interest in its own right. Most cases addressing the loss-of-a-chance doctrine have involved medical malpractice where the duty generally is based on a consensual relationship or undertaking. [FN167] This rule should not be limited, however, to the health care context. Rather, it should be extended to other special relationships or undertakings, as long as the resulting duty could reasonably be said to encompass the right to recover for the reduction of the likelihood of a more favorable outcome, [FN168] and to situations where the defendant actively inflicted an injury with the only question being how to reflect the presence of a preexisting condition in calculating damages. ***546** Having said that, this Article nevertheless stops short of recommending this approach for tortious conduct absent either a duty based on a preexisting relationship or undertaking or proof that the defendant probably actively caused

the harm that materialized. It is easier to view a tortiously inflicted blind spot as a part of the risk for which a defendant should be held accountable when the defendant's duty is based on a relationship or undertaking. While the loss-of- a-chance doctrine may have some continuing validity beyond the rule advocated here, this Article will not venture into those waters at this time.

The loss-of-a-chance doctrine, then, would operate in either of the following situations if the defendant's tortious conduct was responsible for making it infeasible to know what otherwise would have occurred to the victim's interest independent of the tortious conduct. First, the doctrine would be available when the defendant tortiously violated a duty based on a special relationship or other basis supporting a preexisting duty, and that conduct reduced the likelihood that a more favorable outcome would otherwise have been achieved. Second, when the defendant is proven to have probably actively caused an injury to the victim who suffered from a preexisting condition, the loss-of-a-chance doctrine would serve to determine the extent to which the tortiously caused injury reduced the pre-injury likelihood of a more favorable result.

B. Refining the Valuation of the Reduced Likelihood

1. Addressing Potential Statistical Biases

One's comfort level with the loss-of-a-chance doctrine may be influenced by the way the reduced likelihood of success (or the lost chance) is valued. [FN169] Despite the sound conceptual ***547** underpinnings of the doctrine, its successful application depends on the quality of the appraisal of the decreased likelihood of a more favorable outcome by the defendant's tortious conduct.

The most common factual settings involving the loss-of-a-chance doctrine have been malpractice claims arising out of delays in the diagnoses of patients' conditions, especially preexisting cancers. [FN170] For years, the public has accepted the mantra of "early diagnosis saves lives" without much question. Although not as universally or unqualifiedly accepted by the medical profession, this idea obviously has been endorsed by large and respectable segments of the profession, [FN171] perhaps with sound medical justification. The public has had little reason to question that assumption. Indeed, for doctors to raise questions about the extent of the benefits from the profession's efforts to achieve early diagnoses might appear contradictory, unconvincing, and dangerous, if not disingenuous. The perception of a universally strong correlation between early diagnosis and prognosis for cancer has not only driven the allocation of medical resources but also has in recent decades undergirded malpractice claims for delayed diagnoses. [FN172]

***548** On the other hand, a number of medical commentators have urged caution, suggesting that facile conclusions regarding the magnitude of the benefit from early diagnosis of some types of cancer may in some instances be oversimplifications yet to be clarified by adequate, controlled studies. [FN173] Public perceptions of the extent and universality of outcome-determinative correlations between the timeliness of diagnosis and survival prospects may be simplistic and sometimes even uninformed. That said, it is not this Article's purpose to attempt to address the merits of the complex medical issues regarding the efficacy of treatment or the effects of delays in diagnosis on prognoses for various types of cancers. Rather, this Article merely raises a cautionary flag about the quality of available information and about potentially distorting influences on the search for accurate information.

***549** A failure to make appropriate allowances for various potentially confounding biases in the interpretations of data leads to potentially distorting influences in the public perception regarding the effect of delays in diagnosis and treatment. [FN174] An important step in improving the process of evaluating the effect of treatment delays on outcomes is to address possible confounding biases that may confuse and distort appraisal of a victim's likelihood of success and the effects of the tortious conduct on the likelihood of achieving a successful outcome.

One of the more common biases that could potentially skew assumptions about the effects of delays in disease diagnosis and treatment is the lead time bias. It is based on "the time advantage in diagnosis offered by screening over the natural course of the disease." [FN175] Thus, "(i)f the cancer is detected at an earlier stage than it would have been in the natural course of the disease, then the time between diagnosis and death is lengthened, making survival appear longer." [FN176] Dealing with ***550** lead time bias requires designing studies that can determine in which categories of patients and to what extent long-term survival following treatment is truly a function of the greater effectiveness of medical intervention at an earlier stage, rather

than merely reflective of the fact that the cancer was detected earlier in its natural progression. [FN177] One must avoid the temptation to merely compare the outcomes of those diagnosed "early" with those diagnosed "late" without making an appropriate adjustment that measures the survival from a common stage in the natural progression of the disease.

A length bias is based on the fact that all cancers do not grow at a uniform speed and that cancers that naturally grow more slowly are more likely to be discovered than more rapidly developing ones. [FN178] Thus, if more cancers with more favorable prognoses (because they are naturally slower- growing) are detected, it might lead to the assumption that the early diagnoses were responsible for the better outcomes. But, the better outcomes may have been attributable, at least in part, to the fact that slower-growing cancers, being present in the body ***551** for a greater period of time, have an increased chance of detection. [FN179]

An overdiagnosis bias may arise "because of the detection of many early lesions that might never have progressed to clinical importance, once again making the screened group appear superior." [FN180] The potential distorting effect of the overdiagnosis bias is based on the fact that some tumors may be discovered that, because of their biology or slow-growing characteristics, would not have produced mortality or morbidity nor would they have harmed some patients because those patients would have died from other causes first. [FN181] These less aggressive cancers may be around to be detected longer simply because they do not kill off their hosts as quickly. Thus, "if screening detects more cancers with favorable prognoses, then the survival in the screened group will appear to be improved as well." [FN182]

A starting time bias is based on the fact that the "failure to identify a common starting time for exposure or illness may lead to systematic misclassification." [FN183] The goal, even if elusive, should be to measure long-term survival of cancers from a common stage in their natural progression. Researchers ***552** should seek a means of, in effect, "carbon-dating" the cancer at the time of diagnosis.

Attitudes about the relative efficacy of early diagnosis and treatment of cancers, especially the acceptance of a delay-outcome correlation, may also be shaped by long-held assumptions about the characteristics of various types of cancer and their methods of spreading and progression. For example, for decades the therapeutic approach of radical mastectomy pioneered by William Halsted guided the treatment of breast cancer. [FN184] The biological premise for Halsted's approach was that metastases occur by centrifugal and contiguous spread from the primary tumor and that as a result, improved local control should decrease the frequency of metastases and death. [FN185] Today, however, the old biological theories are being questioned for some types of cancers, representing a change in attitude that some authorities have characterized as a major "paradigmatic shift." [FN186] A question that must be addressed with respect to specific types of cancers is how do metastases occur? In breast cancer, for example, to what extent does cancer develop or spread by centrifugal extension from the primary tumor, by micrometastases, or by some combination of both? [FN187]

***553** The treatment options available must also be factored into the equation. For example, the extent to which early local therapy may benefit some subgroups of cancer patients more than others should be examined. [FN188] More systemic therapies, such as adjuvant chemotherapy, have become increasingly important in cancer treatment. [FN189] Moreover, the emphasis of some major cancer research and treatment enterprises in treating some types of cancer has shifted from the goal of a complete cure to life-sustaining treatment and management of the disease. [FN190] It is crucial to inquire to what extent the effectiveness of various therapies are enhanced by their timing.

On a more general level, the successful application of the loss-of-a-chance doctrine depends on the quality of the expert medical testimony. [FN191] Although this topic is beyond the scope of this Article, the importance of qualified, well-informed expert testimony bears emphasis. Given the complexity and public ***554** dread of cancer and the potential for misconceptions, [FN192] the need for sound expert guidance is especially compelling.

2. Conjunction Principle

The extent to which a victim's likelihood of a more favorable outcome was reduced by a defendant's tortious conduct may often depend on a number of constituent factual conclusions. The courts have seldom addressed the implications of this multi-factorial reality in the loss-of-a-chance context. If constituent probabilities are conjoined, the resulting probability is decreased exponentially. [FN193] Thus, for example, the probability of throwing an ace with a single die is one in six (or

approximately 16.6%). Whereas, the probability of throwing two aces with a simultaneous throw of two dice is one in thirty-six (or approximately 2.7%). The conjunction principle should also determine the probability of an ultimate event that depends on two or more interdependent events. Thus, "the probability that both of two events will occur is equal to the probability that the first event will occur, multiplied by the conditional probability that the second event will occur when it is known that the first event (has occurred or) is certain to occur." [FN194]

Incorporation of the conjunction principle into the loss-of-a-chance doctrine can be illustrated by the following example. Assume that a family practitioner fails to recommend an appropriate diagnostic procedure for his fifty-seven- year-old patient ***555** during a physical examination despite the fact that the patient's signs, symptoms, and history warranted such a procedure. Cancer is discovered eighteen months later and is determined to have spread to the point that it is now terminal. Further assume that medical experts believe that at the time of the patient's prior physical exam the cancer was detectable by appropriate test. Also assume that the patient would have had a 55% chance of achieving a long-term survival had the cancer been diagnosed and treated at that time (eighteen months ago). But, also assume that considering the location of the cancer and nature of the patient's tissue and configuration, there would have been a 15% false negative rate for the test for this patient at his physical exam eighteen months ago. Using the conjunction principle, the patient's likelihood of long-term survival had the test been done eighteen months earlier would not have been 55%, but rather .55 times .85, equalling 46.75%.

Under the traditional rule, use of the conjunction principle would decisively change the outcome in the preceding situation from proof of the loss of a better-than-even chance to a not-better-than-even one, with the result being that the patient would receive nothing for his lost opportunity. [FN195] Under the loss-of-a-chance doctrine, the patient would not be completely barred from redress for the lost opportunity in the preceding situation. In this situation, the conjunction principle should be incorporated into the calculus. [FN196] Thus, the extent to which ***556** the plaintiff's likelihood of a better outcome was tortiously reduced would be approximately 46% of the value of his life had he been cured, rather than 55% of the value without the conjunction principle.

Not only does the conjunction principle enhance the accuracy of the estimation of the plaintiff's damages under the loss-of-a-chance doctrine, it also provides a clear mechanism for including all of the relevant facts bearing on the reduced likelihood of a better result.

3. Better-Than-Even Likelihoods

Under the traditional all-or-nothing rule, if a defendant's negligence destroyed a better-than-even chance, the plaintiff received damages for the entire chance as though he had lost all of the underlying interest. A seldom addressed question is what happens when the loss of chance doctrine has been adopted, and the lost chance was a better-than-even one? [FN197] Ideally, loss-of-a-chance principles should continue to operate in that situation as well. If so, then the loss-of-a-chance rule could actually reduce damages in some cases below the level that would be awarded under the traditional all-or- nothing rule.

Assume that at the time of misdiagnosis, the patient had a seventy percent likelihood of surviving, but that by the time the actual diagnosis occurred, his cancer was at a terminal stage, leaving him with no real prospects of survival. Assume also that the value of the plaintiff's life, if he had been cured or achieved long-term survival, would have been one million ***557** dollars. Under the traditional rule, the plaintiff's loss would be valued at one million dollars. If, however, one applied the loss-of-a-chance doctrine in this better-than-even situation, the plaintiff would receive $700,000 for his lost opportunity. If the loss-of-a-chance doctrine is sound in principle, then there seems to be no convincing reason not to also apply the doctrine in the better-than-even settings.

4. Non-substantial Likelihoods

Application of the loss-of-a-chance doctrine will likely result in an increase in the number of successful personal injury claims. Furthermore, because the damages will be discounted so that they are based on the degree to which the victim's likelihood of a more favorable outcome was reduced, it is possible that the amount of damages in some of these additional claims may be relatively small. [FN198] Thus, the loss-of-a-chance doctrine raises the specter of an increase in the total number of claims with a larger proportion of relatively smaller claims. Considering the high transaction costs and inefficiencies of the tort system, [FN199] the possibility of many additional claims smaller than the typical recoveries under

the all-or-nothing rule is a concern. The emotional toll on doctors defending malpractice claims-- the type of litigation in which the loss-of-a-chance doctrine has most commonly been applied--has also been noted. [FN200]

In reaction to such concerns, some courts have limited the scope of the loss-of-a-chance doctrine by restricting its application to situations in which the defendant's negligence deprived the patient of at least a substantial chance, although courts are ***558** divided on whether to adopt such a limitation. [FN201] Under this qualification to the loss-of-a-chance doctrine, the plaintiff could recover for the loss of a not-better-than-even chance as long as it was deemed substantial.

On balance, concerns about transaction costs and perpetuating inherent inefficiencies of the torts system probably do not outweigh the advantages of the loss-of-a-chance doctrine. Nor do such concerns justify any form of substantial likelihood threshold on the doctrine. First, the considerable costs and uncertainties of proving professional negligence will, as a practical matter, discourage the litigation of claims involving smaller potential recoveries. Second, adopting some form of substantial likelihood threshold would require a determination of where to draw the line. Courts preferring such a limitation on the loss-of-a-chance doctrine commonly have not clarified what minimum threshold is required. [FN202] Such thresholds raise the possibility of either the kinds of arbitrary line drawing that characterizes the all-or- nothing rule, or at the very least, uncertainty.

IV. Conclusion

The loss-of-a-chance doctrine has gained substantial support in personal injury litigation, at least in the medical malpractice ***559** setting, over the past two decades. Nevertheless, a number of conceptual fallacies have emerged that threaten to undermine and obfuscate the doctrine. Foremost among these has been some courts' fixation with the notion that the doctrine depends upon a finding of a literal chance as a precondition to its application. As this Article has attempted to explain, a literal-chance requirement is ill- advised for several reasons. First, there may be no such thing as a truly literal chance in the sense of a condition totally unpredictable. Rather, what has typically been referred to in chance parlance is better understood as simply a reflection of the reality of our limited perception and fund of knowledge. Second, and more importantly, whether or not there is or is not a literal chance should not be the determining factor in deciding whether or not to invoke the doctrine. Rather, whether a claim is addressed by causation or valuation (loss-of-a-chance) principles should be guided by whether the defendant's tortious conduct was the reason the trier of fact was unable to know the effect of the defendant's tortious conduct on the victim's interests. The line separating the reach of causation from valuation principles should not be based on the variable perceptions of whether the issue related to past or future events or the extent to which the evidence was deemed personal as opposed to statistical.

Under the approach suggested herein, a defendant would be subject to the loss-of-a-chance doctrine at least in situations in which all of the following are established: (1) the defendant tortiously failed to satisfy a duty owed to the victim to protect or preserve the victim's prospects for some favorable outcome; (2) either (a) the duty owed to the victim was based on a special relationship, undertaking, or other basis sufficient to support a preexisting duty to protect the victim's likelihood of a more favorable outcome, or (b) the only question was how to reflect the presence of a preexisting condition in calculating the damages for a materialized injury that the defendant is proven to have probably actively tortiously caused; (3) the defendant's tortious conduct reduced the likelihood that the victim would otherwise have achieved a more favorable outcome; and (4) the defendant's tortious conduct was the reason it was not feasible ***560** to determine precisely whether or not the more favorable outcome would have materialized but for the tortious conduct. The operation of the loss-of-a-chance doctrine should be suspended, however, in situations in which the defendant's tortious conduct created a risk of future consequences, until the harmful effects actually materialize. When necessary, appropriate rule changes should be made to remove potential limitations and restrictions, if any, on bringing such claims at a later time.

This Article has offered some suggestions for improving other aspects of the loss-of-a-chance doctrine. Specifically, it recommends that greater sensitivity be given to the potentially distorting effects of various analytical biases that may affect the interpretation of data regarding the effects of the timing of diagnosis on the prognosis for different types of cancers in various populations. Additionally, this Article has also briefly addressed the need to incorporate the conjunction principle into the process of calculating the value of the lost chance. Finally, this Article discusses a few of the author's observations regarding the scope of the loss-of-a-chance doctrine in an effort to assist those addressing this complex issue.

[FNa1]. UTK Distinguished Professor, University of Tennessee College of Law. Research for this Article was supported by a generous summer research stipend from the College.%

[FN1]. See Joseph H. King, Jr., Causation, Valuation, and Chance in Personal Injury Torts Involving Preexisting Conditions and Future Consequences, 90 Yale L.J. 1353 (1981).

[FN2]. See id. at 1354.

[FN3]. See id.

[FN4]. See id.

[FN5]. Some of the ideas in this Article evolved from the author's preparation for a September 1995 presentation entitled "The Loss of a Chance in Breast Cancer Litigation," delivered at a conference sponsored by the Departments of Surgery of Hartford Hospital, Deaconess Hospital, Harvard Medical School, the University of Connecticut School of Medicine, and the Risk Management Foundation of the Harvard Medical Institutions, Inc.

[FN6]. Although this Article suggests a reformulation of the loss-of-a- chance doctrine, see infra Part III.A, the author will continue to refer to his basic proposition as the loss-of-a-chance doctrine. This is done to avoid confusion because the loss-of-a-chance nomenclature is the terminology most commonly used by the courts in addressing whether to compensate the loss of a not-better-than-even chance (a tortious reduction by less than 51%) of avoiding the adverse outcome.

[FN7]. See Vern R. Walker, Preponderance, Probability and Warranted Factfinding, 62 Brook. L. Rev. 1075, 1128-29 (1996).

[FN8]. For cases and arguments relating to the loss-of-a-chance doctrine, see Gary D. Elliston & Elizabeth C. Powell, Loss of Chance in Medical Malpractice Actions, For the Def., Aug. 1994, at 2; Michael J. Fox, The Loss of Chance Doctrine in Medical Malpractice, 33 A.F. L. Rev. 97 (1990); Michael Hayes & Melissa Schwerin, Recent Developments in "Loss of Chance," 28 J. Health & Hosp. L. 173 (1995); Darrell L. Keith, Loss of Chance: A Modern Proportional Approach to Damages in Texas, 44 Baylor L. Rev. 759 (1992); Helene Swartz Klein, The Lost Chance of Survival Doctrine: Giving Value to Prompt Diagnosis, 42 Med. Trial Tech. Q. 137 (1995); Saul Levmore, Probabilistic Recoveries, Restitution, and Recurring Wrongs, 19 J. Legal Stud. 691 (1990); Lisa Perrochet et al., Lost Chance Recovery and the Folly of Expanding Medical Malpractice Liability, 27 Tort & Ins. L.J. 615 (1992); Walter Scott, Causation in Medico-Legal Practice: A Doctor's Approach to the 'Lost Opportunity' Cases, 55 Mod. L. Rev. 521 (1992); Jane Stapleton, The Gist of Negligence: Part II, 104 Law Q. Rev. 389 (1988); Robert S. Bruer, Comment, Loss of a Chance As a Cause of Action in Medical Malpractice Cases, 59 Mo. L. Rev. 969 (1994); Jennifer P. Keller, Note, Torts--Medical Malpractice-- Loss of Chance Not a Cognizable Cause of Action in Tennessee, 62 Tenn. L. Rev. 375 (1995); Stephanie J. Malbrough, Note, Smith v. State Department of Health and Hospitals: The Louisiana Supreme Court Chooses a Method of Valuation for Lost Chance of Survival, 42 Loy. L. Rev. 805 (1997); Jeffrey D. Migit, Note, The Supreme Court of Texas Refuses to Adopt the "Loss of Chance" Doctrine, 35 S. Tex. L. Rev. 365 (1994); Melissa Moore Thompson, Comment, Enhanced Risk of Disease Claims: Limiting Recovery to Compensation for Loss, Not Chance, 72 N.C. L. Rev. 453 (1994); Kevin Joseph Willging, Note, Falcon v. Memorial Hospital: A Rational Approach to Loss-of-Chance Tort Actions, 9 J. Contemp. Health L. & Pol'y 545 (1993); Martin J. McMahon, Annotation, Medical Malpractice: Measure and Elements of Damages in Actions Based on Loss of Chance, 81 A.L.R.4th 485 (1990 & Supp. 1997).

[FN9]. (1987) 1 App. Cas. 750 (appeal taken from C.A.). For a discussion of Hotson, see infra Part III.A.3.a.

[FN10]. See Delaney v. Cade, 873 P.2d 175, 178 (Kan. 1994).

[FN11]. See infra Part III.A.3.

[FN12]. Throughout this Article, the term "valuation" refers to the process of identifying and measuring the compensable interests destroyed or impaired.

[FN13]. See infra Part III.A.

[FN14]. For a more detailed discussion of the suggested approach, see infra Part III.A.3.d.

[FN15]. See supra text accompanying note 14.

[FN16]. See infra Part III.B.

[FN17]. Alexander Pope, An Essay on Criticism, in The Oxford Authors Alexander Pope 225, 299, 232 (Pat Rogers ed. 1993).

[FN18]. See, e.g., Bradshaw v. Daniel, 854 S.W.2d 865, 869 (Tenn. 1993). See generally Diamond et al., Understanding Torts (1996) (discussing the five elements of negligence).

[FN19]. See Diamond et al., supra note 18, §§ 8.01-8.05.

[FN20]. See id. § 8.02.

[FN21]. See id.

[FN22]. See id. §§ 3.03-3.06.

[FN23]. See id. §§ 16.01-16.03.

[FN24]. See id. §§ 11.01-11.04.

[FN25]. See id. § 11.02. Some courts recognize an exception to the but for requirement when two or more forces concurrently operate to produce the harm and either force alone would have otherwise been sufficient to constitute a but for cause. See Restatement (Second) of Torts § 432(2) (1965).

[FN26]. See, e.g., Pillsbury-Flood v. Portsmouth Hosp., 512 A.2d 1126, 1129-30 (N.H. 1986); Restatement (Second) of Torts § 433B(1) & cmt. a (1965); W. Page Keeton et al., Prosser and Keeton on the Law of Torts § 41, at 269 (5th ed. 1984). Some courts have shifted the burden of proof on causation (or some aspect of causation) to the defendant in some types of situations to ameliorate the perceived unfairness when the circumstances (especially the defendant's alleged conduct) make it impossible to determine what would otherwise have transpired absent the tortious conduct. See, e.g., Sweet v. Sisters of Providence, 895 P.2d 484, 491 (Alaska 1995) (approving rule of shifting the burden when absence of medical records hinders plaintiff's ability to establish prima facie case and records are missing due to the defendant's negligence or fault); Fosgate v. Corona, 330 A.2d 355, 358 (N.J. 1974) (concluding that when there is a negligent delay in diagnosis, the burden of proof is shifted to the defendant to "demonstrate that the damages for which he is responsible are capable of some reasonable apportionment and what those damages are"); Restatement (Second) of Torts § 433B(2), (3) (1965); Keeton et al., supra, § 41, at 271, § 52, at 350-51. For developments in New Jersey following Fosgate, see, for example, Anderson v. Picciotti, 676 A.2d 127, 136 (N.J. 1996).

[FN27]. See Diamond et al., supra note 18, § 12.01.

[FN28]. See id. § 12.03. Consider the following illustration. A physician delays her examination ten minutes while she tries to locate part of the patient's chart that she had misplaced. She finally locates the notes and completes the examination of the patient. As the patient is crossing the street to return to his auto, he is struck by a motorist whose brakes fail. The doctor's negligence in misplacing her notes was a contributing cause of the accident in that if there had not been the ten minute delay, the patient would not have been crossing the street at the precise moment that the auto suffered brake failure. But it was not the proximate cause because the risk of an accident was not a foreseeable component inherent in the risk of a ten minute delay in locating a misfiled set of notes.

[FN29]. See Diamond et al., supra note 18, § 3.01.

[FN30]. See infra Part II.B.3.a.i.(a).

[FN31]. See infra Part II.B.3.a.i.(a).

[FN32]. See infra Part II.B.3.a.i.(a).

[FN33]. (1911) 2 K.B. 786 (Eng. C.A.).

[FN34]. See id. at 792 (William, L.J.). The court reasoned that "the jury must do the best they can" in calculating the amount of the plaintiff's loss. Id. (William, L.J.).

[FN35]. Id. at 793 (William, L.J.).

[FN36]. Id. at 796-97 (Moulton, L.J.).

[FN37]. See Dan B. Dobbs, Law of Remedies § 3.4 (2d ed. 1993).

[FN38]. See infra Part III.A.3.b.

[FN39]. 272 N.E.2d 97 (Ohio 1971), overruled by Roberts v. Ohio Permanente Med. Group, Inc., 668 N.E.2d 480 (Ohio 1996).

[FN40]. See id. at 103.

[FN41]. See, e.g., Perez v. Las Vegas Med. Ctr., 805 P.2d 589 (Nev. 1991) (involving delay in diagnosis of cerebral hemorrhage); Vern R. Walker, Direct Inference in the Lost Chance Cases: Factfinding Constraints Under Minimal Fairness to Parties, 23 Hofstra L. Rev. 247, 249 (1994) (describing situation in terms of tortiously causing the plaintiff "to incur an increase in risk for that same injury, and the plaintiff in fact suffers subsequently the injury").

[FN42]. There are two variations in this type of situation. First, it will sometimes appear probable that the future harm will in fact occur, but the plaintiff may not be able to establish that the defendant's negligence was what made such future occurrence more likely than not. Second, the plaintiff may not be able to prove that the future condition in question probably will occur. In this latter situation, because the plaintiff cannot prove that the future condition probably will occur, by definition the plaintiff cannot prove that the defendant's negligence will more likely than not be a cause of the future consequence.

[FN43]. See, e.g., DeBurkarte v. Louvar, 393 N.W.2d 131 (Iowa 1986).

[FN44]. See id. at 132.

[FN45]. See, e.g., Dickey v. Daughety, 905 P.2d 697 (Kan. Ct. App. 1995), aff'd, 917 P.2d 889 (Kan. 1996).
Some courts appear to take a more restrictive approach to the loss-of-a-chance concept (at least when the defendant seeks to benefit from it) where the defendant actively inflicted the injury rather than where the defendant's alleged negligence passively reduced the likelihood of a better outcome. See, e.g., Anderson v. Picciotti, 676 A.2d 127 (N.J. 1996). In Anderson, the plaintiff alleged, inter alia, that the defendant negligently misdiagnosed the patient's condition as osteomyelitis, necessitating amputation of the patient's toe, when in fact the patient suffered from a less serious condition amenable to less drastic treatment. Apparently, the court was reluctant to apply the chance-valuation idea to the benefit of the defendant unless the defendant established (presumably by a preponderance of the evidence) the existence of a preexisting condition that would have reduced the value of the lost interest (the patient's toe). The role for the chance-valuation doctrine, if the existence of osteomyelitis had been proven, is not clear from the opinion.

[FN46]. See infra Part II.B.3.a.

[FN47]. See infra Part II.B.3.b.

[FN48]. See infra Part II.B.3.c.

[FN49]. Damages would cover past and future medical expenses, lost earnings, and pain and suffering attributable to those adverse consequences that can be proven.

[FN50]. For a case summarizing various approaches to the loss-of-a-chance question, see Delaney v. Cade, 873 P.2d 175, 183-85 (Kan. 1994).

[FN51]. See, e.g., Williams v. Spring Hill Mem'l Hosp., 646 So. 2d 1373, 1375 (Ala. 1994); Jones v. Owings, 456 S.E.2d 371, 374 (S.C. 1995); Kilpatrick v. Bryant, 868 S.W.2d 594, 603-04 (Tenn. 1993); Kramer v. Lewisville Mem'l Hosp., 858 S.W.2d 397, 406 (Tex. 1993). But see Wood v. Newman, Hayes & Dixon Ins. Agency, 905 S.W.2d 559, 564 (Tenn. 1995) (arguably implying right to recover for the lost opportunity to protect property based on failure of insurance agent to notify client of lack of coverage). In some states the traditional rule has been mandated by statute. See, e.g., Mich. Comp. Laws Ann. § 600.2912a(2) (West 1997) ("(T)he plaintiff (in a medical malpractice action) cannot recover for loss of an opportunity to survive or an opportunity to achieve a better result unless the opportunity was greater than 50%.").

[FN52]. See supra Part II.B.2.a.

[FN53]. See, e.g., Thompson v. Sun City Community Hosp., Inc., 688 P.2d 605, 615 (Ariz. 1984); Sacks v. Mambu, 632 A.2d 1333, 1335-36 (Pa. Super. Ct. 1993); Griffett v. Ryan, 443 S.E.2d 149, 152 (Va. 1994). See generally Stephen A. Bullington, Arizona's Loss of a Chance Doctrine--Not a Cause of Action, But More Than an Evidentiary Rule, Ariz. Att'y, Jan. 1997, at 28, 33- 34 (criticizing the rule and suggesting that it is less desirable than either the traditional all-or-nothing rule or the true loss of a chance doctrine).
Some courts seem to adopt a relaxed proof variation but struggle mightily to avoid unequivocally saying so. See Holton v. Mem'l Hosp., 679 N.E.2d 1202 (Ill. 1997). The majority opinion in Holton contains language that ostensibly supports the traditional view that "requires plaintiff to prove that defendant's negligence 'more probably than not' caused plaintiff's injury." Id. at 1207. But the court gravitates toward the relaxed proof variation by expressly rejecting a rule "that plaintiffs may not recover for medical malpractice injuries if they are unable to prove that they would have enjoyed a greater than 50% chance of survival or recovery absent the alleged malpractice." Id. at 1213. The concurrence criticized the majority's steadfast refusal to acknowledge its apparent embrace of the relaxed proof variation. See id. at 1220 (Heiple, C.J., concurring).

[FN54]. See cases cited supra note 53.

[FN55]. Some relaxed proof cases contain language suggesting not only that the plaintiff may be entitled to reach the jury by proving the loss of a substantial possibility of a better outcome but implying that such proof also allows the jury to award damages for such a loss without first finding that it was more likely than not that the victim would have achieved a better outcome with timely, reasonable care (such as prompt diagnosis). See, e.g., Mayhue v. Sparkman, 653 N.E.2d 1384, 1388 (Ind. 1995); Griffett v. Ryan, 443 S.E.2d 149, 152 (Va. 1994). But see Blondel v. Hays, 403 S.E.2d 340, 344 (Va. 1991).

[FN56]. See Mambu, 632 A.2d at 1335-36; Clayton v. Sabeh, 594 A.2d 365, 366-67 (Pa. Super. Ct. 1991); Bruer, supra note 8, at 976, 982.

[FN57]. See supra Part II.B.2.a.

[FN58]. See, e.g., Delaney v. Cade, 873 P.2d 175, 185 (Kan. 1994); Perez v. Las Vegas Med. Ctr., 805 P.2d 589, 592 (Nev. 1991); Roberts v. Ohio Permanente Med. Group, Inc., 668 N.E.2d 480, 484 (Ohio 1996). The preceding cases have approved the loss-of-a-chance approach for at least some types of personal injury claims.

[FN59]. See Delaney, 873 P.2d at 178.

[FN60]. See infra Part III.B.4.

[FN61]. See supra Part II.B.2.a.

[FN62]. See H. Christian L'Orange & Kevin C. Mayer, Future Disease, Emotional Distress, and Medical Monitoring in Chemical Exposure Litigation, For the Def., Aug. 1995, at 16; David Carl Minneman, Annotation, Future Disease or

Condition, or Anxiety Relating Thereto, As Element of Recovery, 50 A.L.R.4th 13 (1986 & Supp. 1997).

[FN63]. See L'Orange & Mayer, supra note 62, at 16-18.

[FN64]. A number of courts have applied the loss-of-a-chance doctrine in the future consequences situation. See, e.g., Petriello v. Kalman, 576 A.2d 474, 484 (Conn. 1990); United States v. Anderson, 669 A.2d 73, 78 (Del. 1995) (on certified question from federal court); DeBurkarte v. Louvar, 393 N.W.2d 131, 133 (Iowa 1986). Other courts have applied the traditional all-or-nothing more-likely-than-not rule, at least in failure to diagnose cases. See, e.g., Andersen v. Brigham Young Univ., 89 F.3d 849 (applying Utah law) (unpublished table decision), No. 95-4068, 1996 WL 355573, at *3 (10th Cir. June 27, 1996) (providing text of opinion); Fabio v. Bellomo, 504 N.W.2d 758, 762 (Minn. 1993); Kilpatrick v. Bryant, 868 S.W.2d 594, 603-04 (Tenn. 1993).

[FN65]. See supra Part II.B.2.a.

[FN66]. See Minneman, supra note 62, §§ 43-44, at 102-115.

[FN67]. See id.

[FN68]. See, e.g., Mauro v. Raymark Indus., Inc., 561 A.2d 257, 266-67 (N.J. 1989) (holding open possibility of asserting such claims in the future if the disease for which the victim was at risk ultimately materializes); Simmons v. Pacor, Inc., 674 A.2d 232, 237 (Pa. 1996) (discussing the so- called "two disease rule" and its scope in asbestos-exposure cases); see also Jay E. Znaniecki, Note, Cancerphobia Damages in Medical Malpractice Claims, 1997 U. Ill. L. Rev. 639, 664 (advocating a "separate disease rule" whereby damages for potential future disease would not be compensable at the present time but would not be precluded in the future).

[FN69]. Thus, the availability of the multiple-lawsuit solution may depend on a state's statute of limitations and applicable cases, as well as a state's approach to the question of whether a claim or injury may be split or must be brought in a single lawsuit.

[FN70]. For a summary of this Article's proposed approach, see infra Part III.A.3.d.

[FN71]. The comments in this subsection are limited to mental distress from unintentional tortious conduct.

[FN72]. See, e.g., DeBurkarte v. Louvar, 393 N.W.2d 131, 139 (Iowa 1986) (recognizing the mental distress caused by "the realization there was a chance that earlier diagnosis and treatment could have saved her life"); Claudet v. Weyrich, 662 So. 2d 131, 133 (La. Ct. App. 1995) (addressing the mental suffering component).

[FN73]. See, e.g., Kramer v. Lewisville Mem'l Hosp., 858 S.W.2d 397, 406 (Tex. 1993) (denying damages for mental distress from the loss of a not-better- than-even chance due to an alleged delay in diagnosing cancer).

[FN74]. See generally Diamond et al., supra note 18, § 10.01.

[FN75]. For a useful overview of the evolution of various approaches to claims for mental distress, see Douglas B. Marlowe, Comment, Negligent Infliction of Mental Distress: A Jurisdictional Survey of Existing Limitation Devices and Proposal Based on an Analysis of Objective Versus Subjective Indices of Distress, 33 Vill. L. Rev. 781 (1988).

[FN76]. See Diamond et al., supra note 18, § 10.01(B)(2).

[FN77]. See, e.g., Chizmar v. Mackie, 896 P.2d 196, 201-05 (Alaska 1995); Curtis v. MRI Imaging Servs. II, 941 P.2d 602, 603 (Or. Ct. App. 1997), review granted, 944 P.2d 949 (Or. 1997).

[FN78]. See, e.g., Camper v. Minor, 915 S.W.2d 437, 446 (Tenn. 1996).

[FN79]. See Diamond et al., supra note 18, § 10.01(B)(2), (3); Marlowe, supra note 75, at 794-802.

[FN80]. See, e.g., Chizmar, 896 P.2d at 204; Camper, 915 S.W.2d at 446.

[FN81]. See, e.g., Metro-North Commuter R.R. v. Buckley, 117 S. Ct. 2113, 2116-17 (1997) (FELA case); Simmons v. Pacor, Inc., 674 A.2d 232, 238-39 (Pa. 1996) (discussing the so-called "two disease rule" and its scope in asbestos-exposure cases); Eric Scott Fisher, Potter v. Firestone and the Infliction of Emotional Distress, 30 Tort & Ins. L.J. 1071 (1995); L'Orange & Mayer, supra note 62, at 16; Glen Donath, Comment, Curing Cancerphobia Phobia: Reasonableness Redefined, 62 U. Chi. L. Rev. 1113 (1995); Minneman, supra note 62, at 13.
In Potter v. Firestone Tire & Rubber Co., 863 P.2d 795 (Cal. 1993), the plaintiff allegedly was exposed to a toxic landfill. The court held that in order to recover for mental distress related to future consequences of such exposure, the plaintiff must prove exposure to a toxic substance and that the mental distress was reasonable. See id. at 816. In addition, the plaintiff must prove either a present physical injury; knowledge that it is more likely than not that the feared cancer will develop in the future; or that defendant's conduct consisted of oppression, fraud, malice, or intentional (or reckless) outrageous infliction of emotional distress. See id. at 800, 820; see also Macy's California, Inc. v. Superior Court, 48 Cal. Rptr. 2d 496, 499-503 (Cal. Ct. App. 1995) (discussing the Potter decision). In general, courts have been more cautious about such claims when the victim has not suffered a present physical injury or cannot prove the future consequences were more likely than not to materialize.
Some courts have suggested that a more lenient rule might be applied when the mental distress resulting from awareness of an enhanced risk of future consequences arose from negligence in the context of a "preexisting relationship." See, e.g., Klein v. Children's Hosp. Med. Ctr., 54 Cal. Rptr. 2d 34, 37-38 (Cal. Ct. App. 1996) (approving rule in principle but finding it inapplicable to instant case).

[FN82]. See Minneman, supra note 62, §§ 4-6.

[FN83]. See, e.g., Doe v. Northwestern Univ., 682 N.E.2d 145, 152 (Ill. App. Ct. 1997) (approving rule in principle that plaintiffs, who fear they have contracted AIDS because of a defendant's negligence, should recover damages for the time they reasonably feared a "substantial, medically verifiable possibility of contracting AIDS"); Williamson v. Waldman, 696 A.2d 14, 22 (N.J. 1997) (holding that to recover for emotional distress based on the fear of contracting HIV, a plaintiff must prove that the defendant's negligence proximately caused her emotional distress that would be experienced by a reasonable person with ordinary experience and current knowledge then available to the public); Illinois Court Seeks New Course in AIDS Phobia Cases, AIDS Pol'y & L., July 25, 1997, at 4; Recent Rulings by Other Courts in AIDS Phobia Claims, AIDS Pol'y & L., July 25, 1997, at 6.

[FN84]. Although many cases have required proof of either exposure or a channel of transmission or both in cases involving mental distress over fear of contracting an infectious disease, others have adopted a more flexible rule under a modified reasonableness approach with various limits on the scope of liability. See, e.g., Williamson, 696 A.2d at 22. See generally Minneman, supra note 62, § 4. Some courts have combined a general negligence approach with an actual exposure requirement in some infectious disease settings. See, e.g., Bain v. Wells, 936 S.W.2d 618, 624 (Tenn. 1997).

[FN85]. See Minneman, supra note 62, § 2; Znaniecki, supra note 68, at 661- 62.

[FN86]. See, e.g., Simmons v. Pacor, Inc., 674 A.2d 232, 238-39 (discussing the so-called two disease rule and its scope in asbestos-exposure cases). See generally Znaniecki, supra note 68, at 664-65 (advocating "two disease rule," but with a limited present right to sue for mental distress).

[FN87]. Most medical monitoring claims have arisen in situations in which the victim has been actually exposed. It is not clear whether proof of actual exposure would always be required when medical monitoring was otherwise reasonable.

[FN88]. See, e.g., Potter v. Firestone Tire & Rubber Co., 863 P.2d 795, 800 (Cal. 1993) (holding that medical monitoring costs are recoverable when expert testimony demonstrates that "the need for future monitoring is a reasonably certain consequence of the plaintiff's toxic exposure and that the recommended monitoring is reasonable"); Meyerhoff v. Turner Constr. Co., 534 N.W.2d 204, 206 (Mich. Ct. App. 1995) (reaffirming that medical monitoring costs are recoverable in toxic exposure cases when they are "reasonable and necessary" and discussing relevant factors), appeal granted in part, 562 N.W.2d 781 (Mich. 1997). See generally L'Orange & Mayer, supra note 62, at 20- 21; Susan L. Martin & Jonathan D.

Martin, Tort Actions for Medical Monitoring: Warranted or Wasteful?, 20 Colum. J. Envtl. L. 121, 122 (1995); Znaniecki, supra note 68, at 644-45; Allan L. Schwartz, Annotation, Recovery of Damages for Expense of Medical Monitoring to Detect or Prevent Future Disease or Condition, 17 A.L.R.5th 327 (1994) (analyzing cases in which courts have considered medical monitoring damages).

[FN89]. See Schwartz, supra note 88, § 4, at 343-46. Courts are increasingly willing to allow medical monitoring damages without proof of a present physical injury. See, e.g., Potter, 863 P.2d at 800.

[FN90]. See Martin & Martin, supra note 88, at 127-28; Schwartz, supra note 88, § 6, at 346-49.

[FN91]. (1987) 1 App. Cas. 750 (appeal taken from C.A.). For a discussion of Hotson, see infra Part III.A.3.a.

[FN92]. See infra Part III.A.3.a, c.

[FN93]. (1987) 1 App. Cas. 750 (appeal taken from C.A.). The Hotson case was chosen for illustration. No attempt has been made to systematically research or review British law on this topic, which is beyond the scope of this Article.

[FN94]. Nor should one be reassured by Lord Ackner's facile characterization of the case as a "relatively simple" one. Id. at 793 (Ackner, L.J.).

[FN95]. "The femoral epiphysis is a layer of cartilage separating the bony head from the bony neck of the femur in a growing body. Avascular necrosis results from a failure of the blood supply to the epiphysis and causes deformity in the maturing head of the femur." Id. at 779 (Bridge, L.J.).

[FN96]. The trial judge, Simon Brown, offered the following useful description of the relevant medical aspects of the injury:
The femoral epiphysis . . . is the spongy extremity of the upper femur, its surface being covered with cartilage, which slots into the cavity of the acetabulum to form the hip joint . . . . The major threat created by an injury such as the plaintiff's is that it will so interfere with the blood supply to the epiphysis that avascular necrosis will develop. This is a condition whereby through lack of sufficient blood the epiphysis becomes de-mineralized, weakened and softened and thus denser, distorted and deformed. When that occurs, not only does it cause misshapeness of the joint with associated pain, restriction in mobility and general disability, but it also carries with it the virtual certainty that osteo-arthritis will develop within the joint.
Hotson v. Fitzgerald, (1985) 1 W.L.R. 1036, 1038-39 (Q.B. 1985) (hereinafter Hotson Trial Court), aff'd sub nom. Hotson v. East Berkshire Health Auth., (1987) 2 W.L.R. 287 (C.A. 1986) (hereinafter Hotson Court of Appeals), rev'd, (1987) 1 App. Cas. 750 (appeal taken from C.A.) (hereinafter Hotson House of Lords).

[FN97]. See Hotson Trial Court, supra note 96, at 1041.

[FN98]. See id.

[FN99]. Id. at 1040.

[FN100]. See id. at 1041.

[FN101]. Id.

[FN102]. See id. at 1050.

[FN103]. See id. at 1041.

[FN104]. See id.

[FN105]. See Hotson House of Lords, supra note 96, at 791 (Ackner, L.J.).

[FN106]. Lord Ackner treated the question of whether the 50% supply of blood vessels running along the back of the femoral

neck remained intact immediately after the fall as the "essential question." Id. (Ackner, L.J.). It is not entirely clear, however, from the courts' opinions that the experts agreed that an intact 80% blood supply would have been sufficient and that a 30% supply would not.

[FN107]. Compare id. at 781 (Bridge, L.J.) (victim had a 60% likelihood), with id. at 785 (Mackay, L.J.) (victim had between 40 and 60% likelihood), and Hotson Court of Appeals, supra note 96, at 301 (Croom-Johnson, L.J.) (victim had a 40% chance).
The plaintiff's expert testified that the plaintiff had a "marginally better" or "small chance" of avoiding the disability if the condition had been promptly diagnosed. Later that expert stated that the plaintiff had over a 60% chance of avoiding the disability with prompt diagnosis. See Hotson House of Lords, supra note 96, at 780-81 (Bridge, L.J.).

[FN108]. See Hotson House of Lords, supra note 96, at 784 (Mackay, L.J.). The defendant's expert was emphatic that the disability was bound to result irrespective of early diagnosis. See id. at 781 (Bridge, L.J.).

[FN109]. See Hotson Court of Appeals, supra note 96, at 301 (Croom-Johnson, L.J.).

[FN110]. See Hotson Trial Court, supra note 96, at 1050.

[FN111]. Hotson Court of Appeals, supra note 96, at 290 (Donaldson, M.R.).

[FN112]. See id. (Donaldson, M.R.). Judges Donaldson and Dillon supported the plaintiff's loss of a not-better-than-even chance. The third judge, Croom- Johnson, also voted to affirm, but that judge's position on the loss-of-a- chance doctrine was not clear.

[FN113]. Hotson Court of Appeals, supra note 96, at 298 (Dillion, L.J.).

[FN114]. Id. (Dillion, L.J.).

[FN115]. Id. (Dillion, L.J.).

[FN116]. See Hotson House of Lords, supra note 96, at 751. Lord Bridge wrote for the majority; Lord Brandon concurred in the opinion of Lord Bridge; Lord Mackay voted to reverse and filed a separate opinion, although he also agreed with the Lord Bridge and Lord Acker opinions; Lord Ackner filed a separate opinion favoring reversal; Lord Goff concurred in the opinions of Lords Bridge, Mackay, and Ackner.

[FN117]. Id. at 782 (Bridge, L.J.). The Hotson decision has elicited varying reactions from commentators. Compare Timothy Hill, A Lost Chance for Compensation by the Tort of Negligence in the House of Lords, 54 Mod. L. Rev. 511, 518-19 (1991) (approving the all-or-nothing rule of Hotson), with Scott, supra note 8, at 523 (criticizing the holding of the House of Lords), and Stapleton, supra note 8, at 393 (bemoaning the failure of the House of Lords to approve the chance-valuation approach).

[FN118]. Hotson House of Lords, supra note 96, at 780 (Bridge, L.J.). A third possible cause for the necrosis was posited by the defendant's expert. He apparently opined that the severity of the victim's injury meant that surgery necessarily would cause the disability and, for that reason, the harm to the victim was unavoidable. See Hotson Court of Appeals, supra note 96, at 301 (Croom-Johnson, L.J.). Thus, the defendant's expert presumably based his opinion that the harm was inevitable upon grounds that insufficient blood vessels remained intact and that the severity of the injury made the disability an inevitable consequence of the surgery.

[FN119]. See Hotson House of Lords, supra note 96, at 782 (Bridge, L.J.).

[FN120]. Hotson House of Lords, supra note 96, at 789 (Mackay, L.J.).

[FN121]. Id. at 783 (Bridge, L.J.).

[FN122]. The "vital issue of fact," in this judge's mind, was "whether or not the fall left intact sufficient blood vessels to keep

the epiphysis alive." Id. at 791 (Ackner, L.J.). "If it did not, then the subsequent failure to diagnose and treat the injuries for a period of five days could not be responsible for the avascular necrosis." Id. (Ackner, L.J.).

[FN123]. See id. at 793 (Ackner, L.J.); id. at 785 (Mackay, L.J.).

[FN124]. Hotson Trial Court, supra note 96, at 1044.

[FN125]. (1911) 2 K.B. 786.

[FN126]. See supra text accompanying notes 33-37.

[FN127]. Hotson House of Lords, supra note 96, at 792 (Ackner, L.J.).

[FN128]. Determinism is defined as "the doctrine that everything . . . is the necessary result of a sequence of causes." Webster's New World Dictionary 375 (3d ed. 1988). See generally Gigerenzer et al., The Empire of Chance 11-13, 276-85 (1989) (discussing the various versions of determinism).

[FN129]. Gigerenzer et al., supra note 128, at 11.

[FN130]. Id.

[FN131]. Id.

[FN132]. (1988) 1 Eng. Rep. 871 (H.L. 1988).

[FN133]. See id. at 881-82 (Bridge, L.J.).

[FN134]. See Hotson House of Lords, supra note 96, at 794 (Ackner, L.J.).

[FN135]. Id. at 782 (Bridge, L.J.).

[FN136]. Voltaire observed, "'Chance is a work void of sense; nothing can exist without a cause.'" MacMillan Book of Proverbs, Maxims, and Famous Phrases 313 (Burton Stephenson ed., 1948) (quoting Francais Marie Arovet de Voltaire, Dictionnaire Philosophique (1764)).

[FN137]. For a discussion of this author's proposed approach to the problem of future consequences and the loss-of-a-chance doctrine, see infra Part III.A.3.d.

[FN138]. Indeed, some theorists have suggested that some modern views of quantum mechanics may undermine determinism. For a time in modern science, determinism seemed to be an "indispensable presupposition of the applicability of scientific method to nature." Gigerenzer et al., supra note 128, at 285. The sticking point for some, however, has been that recalcitrant experiments and observations in both the natural and moral sciences have failed to validate such presuppositions. See id. Thus, according to some views of modern quantum mechanics, "no determinate correspondence can be found between microstates and macroscopically observable properties of quantum systems." Id. Here too, however, one could argue that the absence of determinate correspondence by which to conclusively validate determinism simply reflects our ignorance of more cognitively elusive causal relationships.

[FN139]. "The story of probability and statistics is one of the domestication of unpredictable Fortuna." Id. at 292.

[FN140]. See supra Part III.A.1.

[FN141]. See Hotson House of Lords, supra note 96, at 792-94 (Ackner, L.J.).

[FN142]. See id. at 792 (Ackner, L.J.). For a discussion of this distinction, see generally Hill, supra note 117, at 512-14. See generally Walker, supra note 7, at 1129 (describing as a feature of typical loss-of-a- chance cases, a factual setting in which

"(t)here may be good reason to believe that no additional, unproduced information is available to either party by which the factfinder could determine that the plaintiff is probably a defendant-caused case or a baseline case").

[FN143]. See Hotson House of Lords, supra note 96, at 792 (Ackner, L.J.). It is unclear whether Lord Ackner might consider a different result if there had simply been no individualized (personal) evidence at all, only statistical proof.

[FN144]. A question under this rationale is what happens if there is only statistical, rather than dispositive personal, evidence one way or the other? In other words, what happens if the personal evidence does not rule out causation? Should relief be denied not only when individualized evidence rules out causation but also when the plaintiff fails to introduce a sufficient quantum of such evidence to establish that more likely than not the better outcome would have been achieved but for the defendant's negligence? See Hill, supra note 117, at 511-19.

[FN145]. As the court of appeals said, "(W)e can never know how that chance would have turned out had the examination of the plaintiff not been negligent." Hotson Court of Appeals, supra note 96, at 763 (Dillon, L.J.).

[FN146]. See Hotson House of Lords, supra note 96, at 785 (Mackay, L.J.).

[FN147]. Lord Mackay cited with approval the illustration by Justice Brachtenbach, who dissented in the Herskovits case. See id. at 789 (Mackay, L.J.) (citing Herskovits v. Group Health Coop., 664 P.2d 474, 489- 91 (Wash. 1983) (Brachtenbach, J., dissenting)). The illustration asks what if a victim is struck by an unidentified cab and the only proof is that 75% of the cabs are blue and the rest yellow. Again, by implication, the concern seems to be that valuing the prospects of the victim in Hotson would inexorably lead to the imposition of liability on the owner of the blue cabs. The fallacy here is that there is no proof that the blue cab company did in fact destroy the plaintiff's prospects for avoiding the harm, nor that it was even negligent at all or responsible for the inability to know the true source of the harm. The defendant's negligence in Hotson, however, did in fact destroy the plaintiff's post-accident prospects, whatever they were, and clearly was responsible for the lack of knowledge of the victim's true prognosis immediately following his accident.

[FN148]. See infra Part III.A.3.d (containing a synthesis of this Article's suggested approach).

[FN149]. 653 N.E.2d 421 (Ill. App. Ct. 1995). For a subsequent attempt to clarify the law in Illinois, see Holton v. Memorial Hospital, 679 N.E.2d 1202 (Ill. 1997), briefly discussed supra note 53.

[FN150]. See Bishop, 653 N.E.2d at 421-22.

[FN151]. See id. at 422. In addition, as a result of this analysis, the court concluded that it "need not determine whether Illinois should adopt the pure form of the loss of chance doctrine." Id.

[FN152]. See id.

[FN153]. A similar kind of split analysis seemed to be employed in another case arising out of a delay in diagnosing cancer. See Keppler v. Tufts, 649 N.E.2d 1139 (Mass. App. Ct. 1995). Plaintiff alleged, inter alia, that the diagnosis of her lung cancer was delayed for eight weeks as a result of the negligence of the defendant-pulmonary specialist. The court seemed to apply a causation analysis to the question of whether the cancer had metastasized, or "extended to other parts of her body, or progressed to a more advanced stage." Id. at 1142. If, however, the plaintiff had succeeded in proving that her cancer had not yet spread at the time of the alleged misdiagnosis but did so during the eight week delay, the court seemed to imply (although inconsistently) that the loss-of-a-chance (valuation) approach might be applied to the lost "substantial chance to survive." Id. (citations omitted). The court never clearly reached the question of whether or not to adopt the loss- of-a-chance doctrine because resolution of that question was, under the court's analysis, preempted by the plaintiff's failure to prove that the cancer had spread during the eight weeks. See id.

[FN154]. Under the conjunction principle, the final estimate of the value of the patient's prospects should be based on the product of the two percentages. See infra Part III.B.2 (explaining the calculation). This would produce a value for the patient's lost prospects between four and ten percent of the value of the patient's life had he survived long-term.

[FN155]. 676 So. 2d 543 (La. 1996).

[FN156]. Id. at 547.

[FN157]. Id.

[FN158]. This hypothetical was inspired in part by Mullins v. State, 686 So. 2d 940 (La. Ct. App. 1996). The facts are modified, however, to facilitate analysis. The facts found in Mullins were not sufficiently clear to determine with what level of certitude it was that the decedent's death was the result of one cause or the other. If the condition found to have been the cause of death was based on less than a 100% probability that it was the actual cause, this Article suggests using the analysis in the accompanying text as the suitable basis for deciding the case.

[FN159]. 828 S.W.2d 681 (Mo. 1992) (en banc).

[FN160]. The supreme court reversed dismissal of the plaintiff's action and held that the plaintiff had pleaded sufficient facts to be entitled to a trial on the merits under the loss-of-a-chance doctrine. See id. at 685.

[FN161]. Id. at 684.

[FN162]. Id. at 682.

[FN163]. Id. at 685-86.

[FN164]. See supra Part III.A.3.b.

[FN165]. But see John Makdisi, Proportional Liability: A Comprehensive Rule to Apportion Tort Damages Based on Probability, 67 N.C. L. Rev. 1063 (1989) (suggesting that the tort system dispense with the element of causation in fact and positing an alternative approach).

[FN166]. The rule proposed herein would not extend the loss-of-a-chance doctrine to future consequences even when they have materialized, unless the defendant's duty was based on a special relationship or other basis supporting a preexisting duty, except as noted below. If it were proven that the defendant's active, tortious conduct was probably a cause of the harm when it finally materialized, the loss-of-a-chance doctrine might still operate in a limited way. It would apply to the extent the defendant asserts that the victim's preexisting condition would have caused at some later date the harm independent of the active, tortious conduct, and the only question is how much the damages should be reduced to reflect that preexisting condition.

[FN167]. See Walker, supra note 7, at 1129 (noting that a feature of "many lost chance cases is that the defendant had entered into a special relationship with the plaintiff, usually a physician-patient relationship").

[FN168]. One recent decision limited the scope of the loss-of-a-chance doctrine further. The court not only restricted it to violations of duties based on special relationships but limited it to relationships in which the defendant was serving as a health care provider. See Hardy v. Southwestern Bell Tel. Co., 910 P.2d 1024, 1030 (Okla. 1996). The rule adopted by Hardy is too narrow. The broader question should have been whether the duty created by the special relationship or basis supporting a preexisting duty included protection of the victim from the tortious reduction of the likelihood of achieving a more favorable outcome.

[FN169]. Some commentators, who have supported the loss-of-a-chance doctrine in settings believed to be more amenable to accurate valuation of lost chances, have found the doctrine "much less attractive" where information with which to quantify lost chances is more elusive. See, e.g., Levmore, supra note 8, at 691. Levmore has noted that in cases other than medical malpractice cases, a probabilistic tort rule "is much less attractive . . . where there is a dearth of statistical information about the effectiveness of (the omitted conduct or safeguards,) statutory warnings and other safeguards." Id. at 720.

[FN170]. See generally Bill Clements, The Most Common Causes of Lawsuits and How You Can Protect Yourself. This

Week: Missed Cancers., Am. Med. News, July 25, 1994, at 15 ("Failure to diagnose cancer is among the most frequent and most expensive malpractice claims filed against physicians.").

[FN171]. As an example, recommendations for periodic mammogram screening for women in certain age groups are based on the premise that early diagnosis will save many lives. See Stephanie Stapleton, Wrong Focus for Mammogram Debate?, Am. Med. News, May 5, 1997, at 3. A 1992 article in the New England Journal of Medicine stated that screening with mammography can reduce breast cancer mortality by approximately 25%. See Jay R. Harris et al., Medical Progress: Breast Cancer, 327 New Eng. J. Med. 319, 324 (1992); see also J. William Eley et al., Racial Differences in Survival from Breast Cancer, 272 JAMA 947, 947 (1994).

[FN172]. See Jeff Barge, Suits Increasing for Failure to Spot Cancer, A.B.A. J., Aug. 1995, at 16 (stating that cancer lawsuits are spurred by "studies that make it easier to prove to a jury's satisfaction that an early diagnosis would have extended life; a higher awareness on the part of patients that early detection can lead to a cure; and an increase in cure rates for several forms of cancer, including Hodgkin's disease, leukemia, and breast cancer"); Clements, supra note 170, at 15 ("Failure to diagnose cancer is among the most frequent and most expensive malpractice claims filed against physicians."). The acceptance of the correlation between delay in diagnosis and survival rates is frequently endorsed in the legal literature. See, e.g., Irwin M. Ellerin et al., Handling a Failure to Diagnose Breast Cancer Case, Trial, May 1996, at 31, 32, 36 (assuming a correlation between delay in diagnosis and treatment and reduction or destruction of "the patient's chance of long-term survival"). Statements like the following are not uncommon: "Generally, the longer the delay, the stronger the likelihood that the cancer could have been successfully treated at an earlier stage." Id. at 32; see also Levmore, supra note 8, at 715 ("The probability of successfully treating the patient and arresting the cancer was undoubtedly decreased by the substantial delay before correct diagnosis . . . .").

[FN173]. See, e.g., David R. Arbutina et al., Multifocality in the Earliest Detectable Breast Carcinomas, 127 Archives of Surgery 421 (1992); John S. Spratt, Realities of Breast Cancer Control, Public Expectations, and the Law, in 3 Medicolegal Controversies in Breast Cancer: Biologic Basis and Risk Prevention 25, 28 (Blake Cady & Kenneth A. Kern eds., 1994). Even in the area of mammography screening for breast cancer, the matter is not free of controversy. Both the National Cancer Institute and the American Cancer Society recommend periodic mammogram screenings for women in specified age groups. Nevertheless, there has been some wavering in their positions and apparently some disparity on their recommendations with respect to intervals for screening mammography. See Charles Marwick, Medical News & Perspectives, Final Mammography Recommendation?, 277 JAMA 1181 (1997). There also appears to be some disagreement among various groups on whether to recommend routine mammograms for women in younger age categories and about the evidence of benefits for routine mammograms for younger age groups. See Traci Watson, The Politics of Breast Cancer, U.S. News & World Rep., Apr. 7, 1997, at 12.

[FN174]. See generally Leon Eisenberg, Health Care Politics, 331 New Eng. J. Med. 1461 (1994) (reviewing Louise B. Russell, Educated Guesses: Making Policy About Medical Screening Tests (1994)); David L. Sackett, Bias in Analytic Research, 32 J. Chron. Dis. 51 (1979) (cataloging 35 biases that may arise in sampling and measurement).

[FN175]. Victoria J. Dorr et al., An Evaluation of Prostate-Specific Antigen as a Screening Test for Prostate Cancer, 53 Archives Internal Med. 2529, 2535 (1993).

[FN176]. Dorr et al., supra note 175, at 2529; see also Kenneth A. Kern, Historical Trends in Breast Cancer Litigation, in 3 Medicolegal Controversies in Breast Cancer: Biologic Basis and Risk Prevention 1, 18 (Blake Cady & Kenneth A. Kern eds., 1994) (discussing lead time bias); Matthew S. Wayne et al., Colorectal Cancer: A Practical Review for the Primary Care Physician, Archives Fam. Med., Apr. 1995, at 357, 361-62.
Courts addressing the loss-of-a-chance doctrine seldom have discussed the potential effect of various biases. In one rare instance, a court applying the loss-of-a-chance doctrine expressly rejected the defendant's attempt to rely on the lead time bias theory. See Borgren v. United States, 716 F. Supp. 1378, 1382 (D. Kan. 1989) (non-jury case applying Kansas law). In rejecting the lead time bias theory, the court characterized that theory as contending that a
breast cancer patient will die at the same time, regardless of the time the cancer is diagnosed and treated. This is because the lead time bias theory holds that metastasis into the lymph nodes and other parts of the body occurs . . . long before it can be reliably detected by mammogram.

Id. The court then noted that the lead time bias theory, as characterized by the court, is "in direct opposition to the mainstream of thinking in the medical community at this point." Id. The court noted that various entities, including the American Cancer Society and the National Cancer Institute, "each hold the view that early detection of cancerous tumors by mammogram can significantly increase a patient's chance of surviving disease free." Id. The court's impatience with the lead time bias idea may have stemmed from a misconception about the appropriate role of the theory. The court almost seems to assume that the lead time bias theory could operate only by categorically foreclosing any correlation between delay in diagnosis and prognosis. The purpose of considering the various possible bias theories, however, is not to absolutely preclude such correlations but rather to help assure that assumptions about such correlations are supported by credible scientific bases.

[FN177]. See Eisenberg, supra note 174, at 1461. Comparisons in survival outcome "should be adjusted by subtracting the lead time from the group with test-based diagnoses." William C. Black & H. Gilbert Welch, Advances in Diagnostic Imaging and Overestimation of Disease Prevalence and the Benefits of Therapy, 328 New Eng. J. Med. 1237, 1239 (1993).

[FN178]. See Eisenberg, supra note 174, at 1461. See generally Wayne et al., supra note 176, at 357. Wayne notes, "(T)umors that are present preclinically in individuals for long periods, are slow growing, and are less aggressive are going to be easier to detect than fast-growing aggressive tumors." Id. at 631-62. If no adjustment is made to eliminate length bias, screening that detects more cancers with favorable prognoses may lead to a distorted estimate of the extent to which survival in the screened group was improved because of earlier diagnosis. See Dorr et al., supra note 175, at 2529.

[FN179].
Length bias refers to the fact that long-duration preclinical disease has a higher probability of being detected by screening at various time intervals than does shorter-duration disease, leading to an over representation of slower-growing preclinical disease among detected cases. These "good prognosis" cases would, even in the absence of screening, have a more favorable outcome. Thus, if screening detects more cancers with favorable prognoses, then the survival in the screened group will appear to be improved as well.
Id.

[FN180]. Wayne et al., supra note 176, at 362. To reduce the effects of these distortions, mortality comparisons must be made between groups that underwent diagnostic screening and similarly situated groups that did not. See id.

[FN181]. See Dorr et al., supra note 175, at 2529. Some authorities refer to a similar idea as the "length-time bias," based on the fact that "tumors that are present preclinically are going to be easier to detect than fast-growing aggressive tumors." Wayne et al., supra note 176, at 631-32.

[FN182]. Dorr et al., supra note 175, at 2535.

[FN183]. Sackett, supra note 174, at 61.

[FN184]. See I. Craig Henderson, Editorials: Paradigmatic Shifts in the Management of Breast Cancer, 332 New Eng. J. Med. 951, 951 (1995).

[FN185]. See id. As an example of the acceptance of these kinds of assumptions that sometimes occurs in malpractice litigation, see Kilpatrick v. Bryant, 868 S.W.2d 594, 615 (Tenn. 1993) (Doughtrey, J., dissenting) (describing the nature of the patient's loss as a claim for "alleged malpractice in the failure to diagnose her cancer before it metastasized").

[FN186]. Henderson, supra note 184, at 951.

[FN187]. For example, if metastases occur in breast cancer by centrifugal and contiguous spread from the primary tumor, then improved local control should decrease the frequency of metastases and death (the Halsted theory). See id. Some segments of the legal community seem to have accepted this assumption. See, e.g., Ellerin et al., supra note 172, at 32, 36 (seeming to assume that cancer spreads by local extension, or at least failing to expressly acknowledge the possibility of micrometastasis, and recommending that by "using markers or a pointer, your expert can show the jurors how cancer grows and spreads in the body"). If, however, micrometastases may occur in distant organs early in the disease, before diagnosis, then to that extent at least, achievement of good local control may sometimes be less effective in preventing metastases. The

possibility of early micrometastases may underscore the need for systemic therapy as an adjuvant to surgery. See Henderson, supra note 184, at 951. Thus, an important question in evaluating the management and prognosis of breast cancer is whether or to what extent, in its early stages, it is a localized disease in which early treatment can actually avert the onset of metastasis or a systemic disease from the outset with metastases occurring very early. See Harris et al., supra note 171, at 324-25. See generally Arbutina et al., supra note 173, at 423; Gianni Bonadonna et al., Adjuvant Cyclophosphamide, Methotrexate, and Fluorouracil in Node-Positive Breast Cancer, 332 New Eng. J. Med. 901, 905 (1995); Joan A. Jacobson et al., Ten- Year Results of a Comparison of Conservation with Mastectomy in the Treatment of Stage I and II Breast Cancer, 332 New Eng. J. Med. 907, 907 (1995).

[FN188]. See Daniel F. Hayes, Medical Oncologists and Risk Management in Breast Cancer, in 3 Medicolegal Controversies in Breast Cancer: Biologic Basis and Risk Management 151-52 (Blake Cady & Kenneth A. Kern eds., 1994). See generally Jacobson et al., supra note 187, at 907 (discussing treatment of breast cancer); Herman Kattlove et al., Benefits and Costs of Screening and Treatment for Early Breast Cancer, 273 JAMA 142, 146 (1995) (same).

[FN189]. See Bonadonna, et al., supra note 187, at 907; Harris et al., supra note 171, at 319; Hayes, supra note 188, at 159; Henderson, supra note 184, at 951; Kattlove et al., supra note 188, at 145.

[FN190]. See Stephen D. Moore, Zeneca's Cancer Approach Catches On: Drug Maker Stresses Treatment Rather Than Cure, Wall St. J., June 10, 1997, at B8.

[FN191]. There are indications that trial judges are beginning to assume more effective control over the quality of expert evidence in personal injury litigation. See Richard B. Schmitt, Witness Stand: Who Is an Expert? In Some Courtrooms, The Answer Is "Nobody," Wall St. J., June 17, 1997, at A1.

[FN192]. For an interesting discussion of the evolution of litigation involving claims based on allegations of cancer induced by a single traumatic impact, see Kenneth A. Kern, Historical Trends in Breast Cancer Litigation, in 3 Medicolegal Controversies in Breast Cancer: Biologic Basis and Risk Management 1 (Blake Cady & Kenneth A. Kern eds., 1994). Dr. Kern notes that the abatement in this type of traumatic breast cancer litigation occurred "only because credible expert opinion shifted to reject a single episode of trauma as a causal agent in cancer." Id. at 9.

[FN193]. "(M)athematical probability obeys a multiplicative conjunctive principle, whereby the probability that two independent events both occur is equal to the mathematical product of their individual probabilities." L.J. Cohen, The Probable and the Provable 51-52 (1977).

[FN194]. Paul G. Hoel, Elementary Statistics 51 (4th ed. 1976).

[FN195]. For an example of a case applying the traditional all-or-nothing more-likely-than-not rule in which the court did not apply the conjunction principle, see Bottoms v. Smith, 923 S.W.2d 247 (Tex. App. 1996). Both of the plaintiff's experts couched their opinion in terms of two constituent conclusions without applying the conjunction principle. The court impliedly approved of that result by holding that essentially such testimony was sufficient to create a question for the jury on the causation issue. See id. at 252.

[FN196]. The case of Bishop v. Tri County Radiologists Ltd., 653 N.E.2d 421 (Ill. App. 1995), would have been an appropriate factual setting for application of the conjunction principle. For a discussion of Bishop, see supra notes 149-52 and accompanying text.
The appeals court affirmed a directed verdict for the defendant. See Bishop, 653 N.E.2d at 422. The court preempted application of the loss-of-a-chance doctrine by splitting its analysis and applying a causation analysis to the question of whether the plaintiff's cancer was in an early stage. See id. Had the court, however, applied the loss-of-a-chance doctrine, then it also would have been reasonable to use the conjunction principle in estimating the degree to which the alleged negligence reduced the likelihood of a more favorable outcome. That likelihood of a more favorable outcome would be calculated by multiplying the 10 or 20% by the 40 or 50% figure, depending on which figures were ultimately found by the jury, coming to somewhere between 4 and 10%.

[FN197]. A number of cases have approved the application of the loss-of-a- chance doctrine to situations in which the

victim's likelihood of success was reduced by at least 51%. See, e.g., Gordon v. Willis Knighton Med. Ctr., 661 So. 2d 991, 998-99 (La. Ct. App. 1995), cert. denied, 666 So. 2d 679 (La. 1996). But see Donnini v. Ouano, 810 P.2d 1163, 1168 (Kan. Ct. App. 1991).

[FN198]. For example, a victim's likelihood of success might have been reduced by as little as one percent (or even less). If the value of the otherwise anticipated outcome was small (such as $10,000) and if the defendant's negligence produced a one percent reduction, that would warrant an award of only $100.

[FN199]. See Thomas A. Eaton & Susette M. Talarico, A Profile of Tort Litigation in Georgia and Reflections on Tort Reform, 30 Ga. L. Rev. 627, 673- 80 (1996).

[FN200]. See Perez v. Las Vegas Med. Ctr., 805 P.2d 589, 598 (Nev. 1991) (Steffen, J., dissenting) (noting some of the complications that may arise under such a rule, including "subjecting physicians to hellish litigation that has little or no merit").

[FN201]. A number of cases have adopted a threshold limitation to the application of the loss-of-a-chance doctrine. See Delaney v. Cade, 873 P.2d 175, 186 (Kan. 1994); Wollen v. DePaul Health Ctr., 828 S.W.2d 681, 685 n.3 (Mo. 1992) (en banc); Perez, 805 P.2d at 592. Others seem to have rejected such a qualification to the doctrine. See Smith v. Louisiana Dept. of Health & Hosp., 676 So. 2d 543, 546-47 (La. 1996). See generally Bruer, supra note 8, at 982 (discussing legal standards for recovery under loss-of-a-chance doctrine); Levmore, supra note 8, at 707 ("There might be some connection or forgiveness for very low probabilities where the administrative or litigation costs are large relative to the risks that would be controlled.").

[FN202]. See Delaney, 873 P.2d at 186 ("(N)or do we attempt to draw a bright line rule on the percentage of lost chance that would be sufficient for the case to be submitted to the jury."); Perez, 805 P.2d at 592 ("We need not now state exactly how high the chances of survival must be, in order to be 'substantial.' . . . There are limits, however, and we doubt that a ten percent chance of survival . . . would be actionable."); Wollen, 828 S.W.2d at 685 n.3 ("(A)ction will be limited to those cases in which the chance of recovery lost was sizeable enough to be material, which must be so found by the jury").

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