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Proving Causation in Medical Liability: Evidentiary Asymmetry, Expert Evidence and Causal Uncertainty

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Abstract

Proving causation in medical liability is complicated by scientific uncertainty, informational asymmetry and the unequal distribution of evidence between patients and healthcare providers. Medical outcomes frequently result from multiple interacting factors, while the evidence necessary to reconstruct the course of treatment is often generated and controlled by the healthcare provider. These difficulties raise a fundamental question concerning how causal uncertainty should be managed without either imposing an unrealistic evidentiary burden on patients or allowing uncertainty itself to substitute for proof of causation.

Using a doctrinal and comparative legal method, this article examines the standard of proof, the allocation of the burden of proof, the evidentiary function of medical documentation and expert opinion, and alternative responses to residual causal uncertainty. It argues that these mechanisms should be understood as distinct but interconnected components of an integrated evidentiary framework. Within that framework, the burden of proof may require conditional and issue-specific adjustment where informational asymmetry or evidentiary deficiencies materially impair causal reconstruction. The article further develops a causal adequacy approach to expert evidence, under which the probative significance of medical opinion depends not merely on the certainty of its conclusion, but on its capacity to provide a methodologically grounded, individualised and legally relevant basis for causal inference.

The article concludes that material contribution, increased risk and loss of chance respond to different forms of causal uncertainty and should not operate as interchangeable substitutes for conventional proof. A differentiated evidentiary framework allows medical uncertainty to be managed without abandoning causation as an independent condition of



civil liability, thereby reconciling evidentiary flexibility with the need for disciplined legal attribution.

Keywords: medical liability; causal uncertainty; burden of proof; informational asymmetry; expert evidence; causal adequacy; loss of chance.

Introduction

Proving causation is among the most difficult evidentiary problems in medical liability. An adverse medical outcome may reflect the progression of an underlying disease, the patient's individual risk profile, complications inherent in treatment, the interaction of multiple clinical decisions, or a failure in diagnosis, monitoring or intervention. Even where a departure from the required standard of medical care can be established, it may remain uncertain whether that departure caused the harm for which compensation is sought. The difficulty is therefore not confined to identifying a causal relationship in medical terms. It also concerns the conditions under which uncertain medical evidence is sufficient to establish causation as a matter of law.

This problem is intensified by the evidentiary structure of medical disputes. The information necessary to reconstruct the course of treatment is rarely distributed equally between the parties. Medical professionals and healthcare institutions ordinarily possess the relevant records, technical knowledge and direct information concerning the clinical decision-making process, while the patient must frequently establish causation through evidence created, recorded and preserved by the opposing party. Deficiencies in medical documentation may further restrict the possibility of reconstructing what occurred. At the same time, the technical complexity of medical causation makes expert evidence indispensable in many cases, although an expert opinion cannot itself determine whether the legally required causal connection has been established. Medical probability and legal proof consequently remain related but distinct categories.

These difficulties expose a broader problem in the conventional allocation of evidentiary risk. Requiring the patient to establish causation according to an inflexible model of proof may make a legitimate claim practically impossible where uncertainty has been generated or intensified by informational inequality, deficient documentation or the inherent limitations of medical science. Conversely, lowering the causal threshold whenever medical uncertainty exists risks transforming negligence into liability for an adverse outcome and weakening causation as an independent condition of civil responsibility. The central problem is therefore not whether causal uncertainty should simply favour one party or the other, but how that uncertainty should be allocated and managed without abandoning the requirement of a legally sufficient causal connection.

Existing legal approaches have addressed different aspects of this problem through rules concerning the standard and burden of proof, presumptions arising from evidentiary deficiencies, the admissibility and evaluation of expert evidence, and alternative models such as increased risk and loss of chance. These mechanisms, however, raise a common underlying question: how should a legal system structure the proof of causation when

conventional causal reconstruction is constrained by scientific uncertainty and unequal access to evidence? Examining these mechanisms within a common framework makes it possible to distinguish justified evidentiary adjustment from an impermissible substitution of uncertainty for proof.

Against this background, this article asks how the standard and burden of proving causation should be structured in medical liability where informational asymmetry, evidentiary deficiencies and scientific uncertainty prevent the claimant from establishing causation through conventional proof. It argues that causal uncertainty should be managed through an integrated evidentiary framework rather than through the indiscriminate relaxation of factual causation. Within that framework, the allocation of the burden of proof may require adjustment where the evidentiary position of the parties is materially unequal, while expert evidence should be assessed according to its causal adequacy rather than merely the categorical form of its conclusion. Causal adequacy, in this sense, concerns the capacity of expert reasoning to provide a methodologically grounded and legally relevant basis for connecting the alleged medical failure with the harm.

The article adopts a doctrinal and comparative legal method. It examines the relationship between medical probability and the legal standard of proof, the effect of informational asymmetry and deficiencies in medical documentation on the allocation of the burden of proof, and the evidentiary function of expert medical opinion. It then considers alternative responses to causal uncertainty, including increased risk and loss of chance, in order to determine the circumstances in which such models may supplement conventional causal proof without dissolving its normative limits.

The analysis proceeds in four parts. Part I examines the standard of proving causation under conditions of medical uncertainty and distinguishes scientific certainty from legally sufficient proof. Part II considers informational asymmetry, medical documentation and the dynamic allocation of the burden of proof. Part III examines expert evidence and develops the concept of causal adequacy as a framework for assessing the evidentiary significance of medical opinion. Part IV considers alternative models of proof under causal uncertainty and their implications for the scope and proportionality of medical liability. Taken together, these dimensions support an approach in which evidentiary flexibility responds to the particular difficulties of medical litigation while causation remains an independent and disciplined condition of civil responsibility.

I. Proving Causation under Conditions of Medical Uncertainty

The requirement to prove causation performs a distinct function in medical liability. Proof that a healthcare professional departed from the applicable standard of care does not establish that the departure caused the patient's injury. Nor does the temporal sequence between treatment and an adverse outcome provide a sufficient causal basis for liability. The claimant must establish a connection between the relevant act or omission and the harm according to the applicable civil standard of proof. The particular difficulty of medical

litigation lies in applying that requirement to biological processes that are frequently multifactorial, probabilistic and only partially reconstructable after the event.¹

The conventional starting point remains the but-for test. The inquiry asks whether, on the balance of probabilities, the harm would have occurred in the absence of the defendant's wrongful conduct.² This counterfactual structure preserves an important distinction between negligence that merely forms part of the factual history and negligence that has causal significance for the injury. In medical cases, however, the counterfactual may be unusually difficult to reconstruct. A patient's condition may already carry a substantial risk of deterioration, several therapeutic or pathological factors may operate simultaneously, and the consequences of an omitted intervention may be expressed only in probabilistic terms. The resulting uncertainty does not eliminate the causal requirement, but it complicates the evidentiary process through which that requirement is satisfied.

It is therefore necessary to distinguish scientific certainty from the legal standard of proof. Civil liability does not ordinarily require proof that excludes every medically possible alternative explanation. The balance of probabilities asks whether the causal proposition advanced by the claimant is more likely than not when the evidence is assessed as a whole.³ This is a legal standard for resolving factual uncertainty, not a scientific claim that the underlying biological mechanism has been demonstrated with absolute certainty. Medical science may identify competing mechanisms, ranges of probability or limits in existing knowledge without being able to reconstruct the patient's course with complete precision. The court must nevertheless determine whether the available evidence is sufficient to support the causal inference required by law.

The distinction is important in both directions. Scientific uncertainty should not automatically defeat causation merely because medicine cannot provide a deterministic account of how the injury occurred. Equally, uncertainty cannot itself become evidence of causation. The fact that negligent conduct could have caused an injury, or that it increased a medical possibility of harm, is analytically different from establishing that the conduct probably caused or materially contributed to the injury under the applicable legal test.⁴ Treating possibility as proof would weaken causation as an independent element of liability

¹ HLA Hart and Tony Honoré, *Causation in the Law* (2nd edn, Oxford University Press 1985); Richard W Wright, 'Causation in Tort Law' (1985) 73 *California Law Review* 1735.

² *Clements v Clements* 2012 SCC 32, [2012] 2 SCR 181 [8]; *Hasan v Trillium Health Centre (Mississauga)* 2024 ONCA 586 [14]-[16].

³ *Hasan v Trillium Health Centre (Mississauga)* 2024 ONCA 586 [14]-[16]; *Sampson v MEC for Health, Western Cape* (11661/2021) [2025] ZAWCHC 30 [3]-[4].

⁴ Richard W Wright, 'Causation, Responsibility, Risk, Probability, Naked Statistics, and Proof: Pruning the Bramble Bush by Clarifying the Concepts' (1988) 73 *Iowa Law Review* 1001; *Runciman v University Hospital Southampton NHS Trust* [2024] EWHC 1800 (KB) [95]-[96].

and risk converting the occurrence of an adverse outcome following negligent treatment into a presumption of causal responsibility.

Difficulties become particularly acute where several factors may have contributed to a single injury. In such cases, strict counterfactual reasoning may be incapable of isolating the effect of one causal factor even though the evidence demonstrates that the defendant's conduct contributed to the process producing the harm. The doctrine of material contribution responds to this difficulty in defined circumstances by recognising causal significance where a wrongful factor made a contribution to the injury that was more than negligible.⁵ Its function, however, should not be understood as dispensing with causal proof whenever the but-for inquiry is difficult. The distinction between material contribution to injury and a mere increase in the risk of injury remains essential. A flexible approach to causal reasoning cannot justify liability solely because negligence exposed the patient to a greater possibility of the outcome that subsequently occurred.⁶

The evidentiary standard must consequently operate between two undesirable extremes. At one extreme, requiring complete scientific reconstruction would impose a level of certainty that civil adjudication does not demand and that the nature of medicine may make unattainable. At the other, treating statistical association, temporal sequence or increased risk as sufficient proof would allow probability to substitute for the legally required causal connection. The appropriate inquiry remains whether the evidence, considered in its factual and medical context, provides a sufficiently persuasive basis for attributing causal significance to the defendant's conduct.

This distinction also clarifies the respective functions of medical and legal reasoning. Medical evidence identifies plausible mechanisms, evaluates the natural course of disease, assesses the probable consequences of alternative treatment and explains the degree of uncertainty surrounding those conclusions. It does not determine the legal standard by which causation is established. The translation of medical probability into legally sufficient proof remains a judicial task. The court must evaluate whether the medical evidence, together with the remaining evidentiary record, satisfies the applicable standard without demanding scientific certainty and without treating scientific uncertainty as a substitute for proof.

Causal uncertainty in medical liability therefore does not call for the abandonment of conventional proof, but for a disciplined account of what conventional proof requires. The balance of probabilities permits adjudication in the presence of uncertainty, while the causal requirement prevents uncertainty from becoming an independent basis of liability. Where ordinary causal reconstruction becomes genuinely inadequate, any adjustment must be

⁵ *Runciman v University Hospital Southampton NHS Trust* [2024] EWHC 1800 (KB) [95]-[96]; *Holmes v Poeton Holdings Ltd* [2023] EWCA Civ 1377.

⁶ *Gregg v Scott* [2005] UKHL 2, [2005] 2 AC 176; *Runciman v University Hospital Southampton NHS Trust* [2024] EWHC 1800 (KB) [96]; *Zgonec-Rozej v Pereira* [2025] EWCA Civ 171.

justified by identifiable features of the evidentiary problem rather than by the seriousness of the patient's injury alone. This provides the foundation for the next question: whether unequal access to the evidence necessary to prove causation can justify a corresponding adjustment in the allocation of the burden of proof.

II. Informational Asymmetry and the Dynamic Allocation of the Burden of Proof

The standard of proof determines the degree of persuasion required to establish causation, whereas the burden of proof determines which party bears the consequences when the available evidence does not reach that standard. In medical liability, the distinction assumes particular importance because the evidence necessary to reconstruct causation is rarely distributed equally between the parties. As a general rule, the claimant must establish the elements of the claim, including the causal connection between the relevant medical failure and the harm suffered.⁷ Yet the formal allocation of that burden may become problematic where the claimant depends upon information generated, recorded and retained almost entirely within the defendant's sphere of control.

This evidentiary imbalance reflects more than a difference in professional knowledge. Healthcare providers ordinarily control the contemporaneous record of diagnosis, monitoring, treatment decisions and clinical response. The patient may know what symptoms were experienced and what information was communicated, but will frequently lack access to the technical basis on which particular decisions were made or omitted. Medical documentation therefore performs a dual function. It supports the continuity and safety of treatment, but it also preserves the factual material from which the legality and causal significance of medical conduct may later be reconstructed. Where that record is incomplete, inconsistent or absent, the resulting difficulty of proof may fall disproportionately upon the party who had no responsibility for creating or preserving it.⁸

The legal significance of deficient documentation should nevertheless be defined with precision. An incomplete medical record does not itself prove that negligent treatment occurred, still less that the deficiency caused the patient's injury. Documentation failure and causal responsibility remain analytically distinct. The evidentiary relevance of the deficiency arises because the absence of information may prevent proof of whether a medically required measure was undertaken, when it was undertaken, or how the patient's condition responded. The appropriate consequence is therefore not automatic substantive liability, but an evidentiary response directed to the uncertainty created by the missing record.

⁷ Mariami Kvirkvia, 'Allocating the Burden of Proof in Medical Liability: A Comparative Perspective' (2025) 17 *Przegląd Prawniczy Uniwersytetu im. Adama Mickiewicza* 33, 33-51, doi:10.14746/ppuam.2025.17.02. [PRESSto](#)

⁸ Bürgerliches Gesetzbuch (BGB) §§ 630f, 630h(3); the German statutory framework requires documentation of medically relevant measures and connects failure to document an essential measure with an evidentiary presumption. [Gesetze im Internet](#)

German law provides a particularly structured illustration of this approach. Under § 630h of the German Civil Code, failure to record a medically required major measure and its result may generate a presumption that the measure was not performed. The provision also recognises more extensive causal presumptions in defined circumstances, including certain cases involving a gross treatment error capable of producing the type of injury that occurred.⁹ The significance of this model lies in its differentiation between distinct evidentiary defects. It does not treat every documentation failure or treatment error as sufficient to reverse the burden of proving causation. Instead, the evidentiary consequence corresponds to the nature and seriousness of the deficiency.

This distinction supports a dynamic rather than purely static understanding of the burden of proof. The claimant may remain responsible for establishing an initial factual basis for the allegation, while the burden relating to a particular issue may shift once circumstances are demonstrated that place the relevant evidence peculiarly within the defendant's control or show that the defendant's own conduct has materially impaired causal reconstruction.¹⁰ Such adjustment is not an exception to causation itself. It concerns the allocation of evidentiary risk when insisting upon the ordinary distribution of proof would require one party to establish facts that the opposing party was institutionally responsible for documenting and is materially better positioned to explain.

A stronger justification for adjustment may arise where a serious medical error creates uncertainty about the counterfactual course of the patient's condition. If negligent treatment or a failure to obtain and preserve necessary diagnostic information makes it impossible to determine what would probably have occurred under proper care, placing the entire evidentiary consequence of that uncertainty upon the patient may allow the evidentiary consequences of the defendant's conduct to defeat the claim. At the same time, reversal cannot follow merely from the seriousness of the eventual harm or from the existence of medical uncertainty. The circumstances triggering the adjustment must be sufficiently defined to prevent a procedural mechanism from becoming a presumption of substantive liability.

The same reasoning applies where several plausible causes of harm coexist. The defendant's superior access to medical information may justify requiring an explanation of the clinical basis for the treatment selected or of an alternative causal account supported by the records. It does not follow, however, that the inability of the defendant to identify another cause automatically proves the claimant's causal case. An absence of a persuasive alternative explanation may strengthen an inference already supported by affirmative

⁹ BGB § 630h(3), (5). Under para 5, where a gross treatment error is in principle capable of causing an injury of the kind actually sustained, causation is presumed; the provision also addresses certain failures to obtain or preserve medically required findings. [Gesetze im Internet](#)

¹⁰ Kvirkvia (n 1) 33-51. [PRESSto](#)

evidence, but negative reasoning cannot replace the initial evidentiary basis required to connect the alleged medical failure with the injury. The distinction is essential if burden adjustment is to correct evidentiary inequality without converting causal uncertainty into liability by default.

The central question is therefore not whether medical liability should generally reverse the burden of proving causation. A general reversal would disregard substantial differences between cases and could impose responsibility even where the evidentiary difficulty derives from the natural complexity of the patient's condition rather than from any informational advantage or evidentiary failure attributable to the defendant. A more defensible model is conditional and issue-specific. Relevant considerations include control over the evidence, the existence and quality of required medical documentation, the seriousness of the alleged treatment error, the extent to which that error impaired causal reconstruction, and the claimant's ability to establish an initial evidentiary foundation for the causal allegation.¹¹

This approach also provides a basis for greater legal predictability. Where courts alleviate or shift the burden of proof without clearly identifying the conditions that justify doing so, flexibility may protect claimants in individual cases but leave the boundaries of the doctrine uncertain. Explicit criteria can preserve the corrective function of burden adjustment while reducing the risk that it will operate as an undeclared form of strict liability. Comparative approaches that connect presumptions to defined evidentiary circumstances demonstrate that procedural protection of the patient and preservation of the causal requirement need not be competing objectives.¹²

Informational asymmetry therefore matters to causation not because inequality between patient and healthcare provider independently establishes liability, but because it determines who can realistically produce and explain the evidence from which causation must be inferred. Medical documentation becomes central to that allocation: it records the clinical facts, preserves the possibility of retrospective causal analysis and may determine which party should bear the consequences when reconstruction becomes impossible. The remaining question is how the technical medical evidence derived from those records should itself be evaluated. That question concerns the role of expert opinion and, more specifically, whether its evidentiary significance should depend upon the certainty of its conclusion or upon its causal adequacy for the legal issue before the court.

III. Expert Evidence and the Causal Adequacy of Medical Proof

Expert evidence occupies a distinctive position in the proof of medical causation. Questions concerning the natural progression of disease, the probable effect of treatment, the consequences of delayed intervention and the interaction of multiple physiological factors

¹¹ Kvirkvia (n 1) 33-51; BGB § 630h. [PRESSto](#)

¹² BGB § 630h; Kvirkvia (n 1) 33-51.

ordinarily depend upon knowledge beyond the competence of the court. Expert opinion therefore provides the evidentiary bridge between the clinical facts of the case and the causal propositions on which legal responsibility may depend.¹³ Its importance, however, does not make expert evidence self-sufficient. The expert explains medical causation; the court determines whether the evidence establishes causation according to the applicable legal standard.

The first requirement is methodological reliability. An opinion concerning causation should rest upon sufficient factual material, medically defensible principles and a reasoned application of those principles to the circumstances of the individual patient.¹⁴ A conclusion derived from abstract statistical association, unsupported assumption or a general description of what could occur does not necessarily explain what probably occurred in the case before the court. The distinction is particularly important in medical litigation because population-level evidence and clinical probabilities may inform an individual causal assessment without conclusively resolving it. An expert must therefore do more than identify a medically possible mechanism. The reasoning should explain why that mechanism is relevant to the patient's actual clinical course and how competing explanations affect the causal inference.

Reliability, however, does not exhaust the evidentiary inquiry. An expert opinion may employ a sound methodology and still have limited value for the particular causal question the court must decide. This article describes the additional inquiry as one of **causal adequacy**. Causal adequacy concerns the capacity of expert reasoning to support the specific causal proposition required for legal adjudication. It asks whether the opinion identifies the relevant causal mechanism, relates that mechanism to the individual facts, addresses material alternative explanations and expresses the resulting inference at a level capable of contributing to the applicable standard of proof. The concept is therefore functional rather than terminological: the strength of an expert opinion should depend upon the reasoning connecting medical knowledge to the disputed injury, not merely upon the verbal certainty with which the conclusion is expressed.

This distinction becomes evident when medical experts formulate conclusions in probabilistic language. Expressions such as "possible", "probable" or "to a reasonable degree of medical certainty" may communicate different levels of confidence, but terminology alone cannot substitute for the reasoning underlying the opinion. Contemporary medical

¹³ *Medical Center of Central Georgia, Inc v Turner*, 372 Ga App 376, 904 SE2d 604 (Ga Ct App 2024); *Moton v Emory Healthcare, Inc*, Court of Appeals of Georgia, Case No A25A1134 (2025). Both decisions treat medical causation as ordinarily requiring specialised expert knowledge. [Justia Law](#)

¹⁴ Georgia Code § 24-7-702(b)(2)-(4) (2025), requiring sufficient facts or data, reliable principles and methods, and reliable application of those principles and methods to the facts. [Justia Law](#)

malpractice jurisprudence illustrates this point by requiring more than a bare possibility while declining to make a particular verbal formula an absolute condition of causal proof.¹⁵ The relevant question is whether the expert provides a realistic and reasoned assessment of the likelihood that the alleged medical failure caused or contributed to the injury. A categorical conclusion unsupported by analysis may therefore possess less causal value than a carefully qualified opinion that explains the evidentiary basis, competing causes and limits of medical knowledge.

Causal adequacy should consequently be assessed through several interconnected considerations. First, the opinion must correspond to the causal issue actually in dispute. Evidence that a treatment error generally increases a particular risk does not, without further reasoning, establish that the error caused the patient's injury. Second, the opinion should be individualised by reference to the patient's condition, chronology, diagnostic findings and relevant clinical characteristics. Third, material alternative causes should be addressed to the extent permitted by the available evidence. This does not require the expert to exclude every theoretical possibility, but unexplained alternatives may materially weaken the inference advanced. Fourth, the opinion should disclose the basis and limits of its probability assessment rather than conceal uncertainty behind categorical language. Finally, the reasoning must remain within the expert's medical competence and leave the ultimate determination of legally sufficient causation to the court.

The evidentiary record must also be considered as a whole. Medical causation need not always be established through a single expert capable of reconstructing every stage of the causal sequence. Different experts may address distinct components of the same process, and their evidence may acquire causal significance when read together with medical records, chronology and other established facts.¹⁶ This is particularly important in complex cases involving several specialties or successive stages of treatment. Causal adequacy should therefore not be confused with evidentiary self-sufficiency. The relevant inquiry is whether an expert opinion makes a methodologically defensible contribution to a causal inference that the totality of the evidence is capable of supporting.

The same approach explains why expert disagreement does not transfer the adjudicative function from the court to the medical profession. Competing experts may differ in their interpretation of clinical data, the probability assigned to alternative mechanisms or the expected effect of an omitted intervention. The court must evaluate the reasoning supporting those conclusions, their compatibility with the factual record and their relevance

¹⁵ *Medical Center of Central Georgia, Inc v Turner* (n 1). The court distinguished reasonable medical probability from mere medical possibility and explained that a particular formula such as “reasonable degree of medical certainty” is not itself the controlling requirement. [Justia Law](#)

¹⁶ *Moton v Emory Healthcare, Inc* (n 1). The Court of Appeals expressly recognised that causation may be established by linking the testimony of different experts and evaluating it in light of the evidentiary record as a whole. [Justia Law](#)

to the applicable causal standard. An expert cannot determine that legal responsibility follows merely because a medical causal relationship is considered plausible or probable. Conversely, the presence of uncertainty in an expert opinion does not automatically deprive it of evidentiary value where the uncertainty is scientifically justified and the reasoning remains capable of supporting the necessary causal inference.

The causal adequacy approach thus supplements, rather than replaces, established requirements of expert reliability. Reliability asks whether the opinion is grounded in sufficient facts and dependable methods. Causal adequacy asks what the reliable opinion proves about the causal issue before the court. Keeping these questions distinct prevents two opposite errors. It prevents formally admissible expert evidence from being treated as sufficient proof merely because it satisfies methodological requirements, and it prevents scientifically responsible expressions of uncertainty from being rejected merely because an expert declines to state a conclusion with artificial certainty.¹⁷

Expert evidence should therefore function as a source of medically grounded causal reasoning rather than as a substitute for judicial judgment. Its evidentiary weight depends upon the quality of the inferential connection it establishes between the alleged medical failure and the patient's harm. By focusing on that connection, causal adequacy provides a structured means of translating medical expertise into legal proof while preserving the distinction between scientific assessment and normative adjudication. Yet even methodologically reliable and causally adequate expert evidence may leave genuine uncertainty where medicine cannot reconstruct the counterfactual course of the patient with sufficient probability. It is in those residual cases that the legal system must confront whether, and under what conditions, alternative models of causal proof are justified.

IV. Alternative Models of Proof under Causal Uncertainty

The preceding analysis assumes that causal uncertainty can ordinarily be managed through the standard of proof, appropriate allocation of the evidentiary burden and methodologically adequate expert evidence. Some medical cases, however, present a residual form of uncertainty that these mechanisms cannot fully resolve. A negligent delay may coincide with the natural progression of a serious disease, an omitted intervention may have deprived the patient of a possibility of recovery without making the ultimate outcome more likely than not attributable to the omission, or several causal factors may interact in a manner that medical science cannot retrospectively separate. In such circumstances, the question is whether conventional causal proof should remain decisive or whether alternative

¹⁷ Georgia Code § 24-7-702(b); *Medical Center of Central Georgia, Inc v Turner* (n 1); *Moton v Emory Healthcare, Inc* (n 1).

models may respond to uncertainty without abandoning causation as a condition of liability.¹⁸

The first distinction is between material contribution to injury and an increase in the risk of injury. They are not interchangeable concepts. Material contribution concerns a wrongful factor that has contributed to the injury itself, even though the precise extent of its causal operation cannot be isolated through ordinary counterfactual analysis. An increase in risk, by contrast, establishes that the defendant's conduct made the harmful outcome more likely without necessarily demonstrating that the conduct contributed to the injury that actually occurred.¹⁹ The distinction is fundamental because allowing an increased risk alone to establish causation would move liability from proof of injury caused by the defendant toward liability for exposure to a possibility of harm.

Contemporary clinical negligence jurisprudence accordingly treats material contribution as a limited response to particular causal difficulties rather than as a general alternative to the but-for test. Where the evidence permits the court to determine factual causation on the balance of probabilities, the ordinary counterfactual inquiry remains applicable.²⁰ Material contribution becomes relevant where the causal process cannot be separated in conventional terms but the evidence nevertheless supports the conclusion that the wrongful factor made a contribution to the injury that was more than negligible. The doctrine therefore responds to an evidentiary limitation in reconstructing causal contribution; it does not authorise the court to infer causation merely because negligent conduct generated a material risk.

The position of increased risk requires separate treatment. Evidence that negligence materially altered the patient's risk profile may be highly relevant to causal analysis. It may strengthen an inference when combined with individual clinical evidence, chronology and the absence or weakness of competing explanations. It may also demonstrate why a particular medical failure was capable of producing the injury in question. Yet an increase in risk should not ordinarily operate as a freestanding substitute for proof that the wrongful conduct caused the injury.²¹ The evidentiary significance of risk must therefore be

¹⁸ Richard W Wright, 'Causation, Responsibility, Risk, Probability, Naked Statistics, and Proof: Pruning the Bramble Bush by Clarifying the Concepts' (1988) 73 *Iowa Law Review* 1001; *Gregg v Scott* [2005] UKHL 2, [2005] 2 AC 176.

¹⁹ *Runciman v University Hospital Southampton NHS Trust* [2024] EWHC 1800 (KB) [95]-[97]; *Zgonec-Rozej v Pereira* [2025] EWCA Civ 171 [78]-[80]. [BAILII](#)

²⁰ *Zgonec-Rozej v Pereira* [2025] EWCA Civ 171 [78]-[80]. The Court of Appeal held that where factual causation can be determined on a but-for basis, material contribution does not arise. [casenode.ai](#)

²¹ *Gregg v Scott* [2005] UKHL 2, [2005] 2 AC 176; *Runciman* (n 2) [96]-[97]. The latter expressly distinguishes material contribution to injury from a material increase in risk in clinical negligence. [BAILII](#)

distinguished from a rule that transforms the creation of risk into proof of the realised outcome.

Loss of chance addresses causal uncertainty through a different conceptual structure. Rather than treating the final adverse outcome as the only legally relevant injury, the doctrine focuses upon the patient's lost probability of obtaining a more favourable medical outcome. In a delayed diagnosis case, for example, the available evidence may be insufficient to establish that timely diagnosis would probably have prevented death or disability, while still demonstrating that the delay reduced a measurable prospect of survival, recovery or therapeutic benefit. The causal inquiry then concerns whether the defendant's conduct caused the loss of that opportunity rather than whether it caused the ultimate medical outcome in its entirety.²²

This reconstruction has an important attraction. It avoids the binary effect of an all-or-nothing causal rule in cases where medical prognosis is inherently probabilistic. A patient whose pre-negligence prospect of recovery was below the conventional probability threshold may otherwise receive no compensation even where negligent treatment substantially reduced that prospect. By identifying the lost chance itself as the relevant interest, the doctrine can align liability more closely with the degree of causal impairment attributable to the defendant. It may therefore provide a form of proportional response to uncertainty rather than requiring the court either to attribute the whole adverse outcome to the defendant or to deny causal responsibility altogether.

The conceptual advantage, however, is accompanied by significant evidentiary difficulties. A compensable chance cannot consist merely of a speculative possibility of a better result. Its existence and magnitude require a sufficiently reliable evidentiary foundation. Contemporary research on medical loss of chance continues to identify difficulties in scientifically estimating the lost probability and translating that probability into an appropriate measure of compensation.²³ Statistical survival data may provide relevant evidence, but population-level probabilities do not automatically establish the prognosis of an individual patient. The assessment must therefore remain connected to the patient's clinical characteristics, stage of disease, available treatment and the quality of the medical evidence from which the counterfactual prospect is derived.

²² Todd S Aagaard, 'Identifying and Valuing the Injury in Lost Chance Cases' (1998) 96 *Michigan Law Review* 1335; Nana Uznadze, 'The Problematic Aspects of Compensation for Damage Caused by a Doctor's Omission in Medical Law' (2025) *Journal of Law*, doi:10.60131/jlaw.1.2025.9279. [Michigan Law Scholarship Repository](#)

²³ M Pallocci, P Passalacqua, GM Coppola, M Treglia and LT Marsella, 'Loss of Chance in Medical Professional Liability: The Measure of Our Ignorance' (2025) 176 *La Clinica Terapeutica* 48, doi:10.7417/CT.2025.5187. The study identifies continuing difficulties concerning reliable estimation of the chance and its economic valuation.

Loss of chance should also be distinguished from a procedural reduction in the standard of proof. If the doctrine is recognised, its logic is not simply that a claimant may prove ordinary causation with less persuasive evidence. Rather, the object of the causal inquiry changes. The claimant must still establish, according to the applicable standard of proof, that the defendant's wrongful conduct caused the loss of a real and legally cognisable chance. This distinction preserves evidentiary discipline: uncertainty concerning the ultimate outcome does not eliminate the need to prove the existence and causal loss of the chance itself.

The alternative models considered in this section therefore operate at different doctrinal levels. Material contribution addresses circumstances in which wrongful conduct contributed to an injury although conventional causal separation is unavailable. Increased risk describes a change in the probability of harm and may have evidentiary significance without necessarily establishing causation independently. Loss of chance reconceptualises the relevant harm by focusing on the destruction or reduction of a prospect of a better outcome. Treating these models as interchangeable would obscure the different problems they are designed to address and risk weakening the analytical structure of medical causation.

Their legitimate role is consequently supplementary and carefully bounded. Causal uncertainty may justify doctrinal adaptation where the limitations of conventional proof would otherwise prevent the law from recognising a medically meaningful causal contribution or loss. It does not justify abandoning the distinction between a harmful outcome, an increased probability of that outcome and a legally proven causal connection. The appropriate response depends upon the source and structure of the uncertainty: whether the difficulty lies in separating contributing causes, proving the realisation of an increased risk, or evaluating the loss of a measurable prospect of a better medical outcome.

Viewed together with the preceding analysis, these models complete a broader evidentiary framework for medical causation. The standard of proof determines when the available evidence is sufficiently persuasive; burden allocation determines which party bears the consequences of evidentiary uncertainty; expert evidence provides the specialised reasoning through which medical probability is connected to the individual case; and alternative causal models address defined residual situations in which conventional reconstruction reaches its limits. The objective is not to eliminate uncertainty from medical litigation, which is neither scientifically nor legally possible, but to determine how that uncertainty may be managed without allowing it either to defeat justified claims automatically or to become an independent basis of liability.

Conclusion

Causal uncertainty is not an exceptional feature of medical liability but a recurring consequence of the conditions in which medical harm occurs and is subsequently reconstructed. Disease progression, individual patient characteristics, multiple contributing factors and the probabilistic character of medical knowledge may prevent a complete account of how an adverse outcome developed. The legal problem is therefore not how to

eliminate uncertainty, but how to determine its evidentiary consequences without either making legitimate claims impossible to prove or allowing uncertainty itself to substitute for causation.

This article has argued that this problem should be addressed through an integrated evidentiary framework. The standard of proof, the allocation of the burden of proof, the evaluation of expert evidence and alternative models of causal proof perform different functions within that framework. They should not be collapsed into a general relaxation of causation. The balance of probabilities permits factual adjudication without requiring scientific certainty, while preserving the requirement that the claimant establish a legally sufficient causal connection between the relevant medical failure and the harm.

The allocation of the burden of proof requires particular attention where access to causal evidence is materially unequal. Informational asymmetry and deficiencies in medical documentation may justify evidentiary adjustment where the healthcare provider controls the information necessary for causal reconstruction or where its own evidentiary failure has materially impaired that reconstruction. Such adjustment should nevertheless remain conditional and issue-specific. A general reversal of the burden would risk transforming an evidentiary mechanism into a presumption of substantive responsibility. The appropriate objective is to allocate the consequences of uncertainty according to the evidentiary position of the parties without dispensing with the need for an initial factual basis for the causal allegation.

Expert evidence occupies a similarly important but limited position. Medical expertise is indispensable for explaining mechanisms of injury, alternative causes, prognosis and the probable consequences of treatment or omission, but it does not determine legal causation. The causal adequacy approach developed in this article provides a framework for distinguishing methodological reliability from the evidentiary capacity of an expert opinion to support the causal proposition before the court. The relevant question is not simply how confidently an expert states a conclusion, but whether the reasoning is individualised, methodologically grounded, responsive to material alternative explanations and capable of contributing to the applicable legal standard of proof. This preserves the value of scientifically responsible uncertainty while preventing medical possibility from being treated as legal proof.

Alternative models become relevant only where genuine residual uncertainty remains after these ordinary evidentiary mechanisms have been applied. Material contribution, increased risk and loss of chance respond to different causal problems and should not be treated as interchangeable doctrines. Material contribution concerns contribution to injury, increased risk concerns an alteration in the probability of harm, and loss of chance shifts the causal inquiry towards the destruction or reduction of a prospect of a better outcome. Their legitimate use therefore depends upon identifying the particular structure of uncertainty that conventional causal analysis cannot adequately resolve.

The broader implication is that flexibility in the proof of medical causation is compatible with, and may be necessary for, preserving causal discipline. A system that demands

complete scientific reconstruction may place an impossible burden upon patients, particularly where relevant information lies within the control of the healthcare provider. A system that responds by treating uncertainty, statistical risk or an adverse outcome as sufficient proof creates the opposite distortion. Neither approach adequately reflects the relationship between medical knowledge and civil responsibility.

The more coherent solution is to manage causal uncertainty through differentiated evidentiary mechanisms. The standard of proof determines the degree of persuasion required; dynamic burden allocation responds to justified evidentiary inequality; causal adequacy structures the legal evaluation of expert medical reasoning; and carefully bounded alternative models address residual forms of uncertainty that conventional reconstruction cannot resolve. Together, these mechanisms provide a framework in which uncertainty is allocated and evaluated rather than ignored or converted into liability. Causation consequently remains an independent condition of medical liability while the law retains sufficient flexibility to respond to the evidentiary realities of modern medical practice.

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