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Do Courts Engage in a Sufficiency Analysis When Making Daubert Rulings in Toxic Tort Cases?

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Do Courts Engage in a Sufficiency Analysis When Making *Daubert* Rulings in Toxic Tort Cases?

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Courts and commentators continue to wrestle with how questions concerning the admissibility of expert testimony relate to questions of sufficiency of the evidence. In an earlier article, we explained that many courts determine the admissibility of an expert opinion based on whether the scientific evidence proffered by the expert supports a reasonable inference of causation. What's more, we claimed that this is not a bad thing and better than using inappropriate Daubert *factors to decide admissibility. A key distinction to appreciate is that between global sufficiency and local sufficiency. Just as courts may take a case from the jury if there is insufficient evidence to permit a reasonable fact finder to reach a certain outcome, a judge should exclude an expert when the data upon which the expert relies is insufficient to support the expert's conclusion. We defend this approach against several normative critiques.*

The earlier paper relied on anecdotal case examples to support our descriptive claim. This paper draws upon two samples of cases to ascertain the prevalence of courts employing a sufficiency analysis when deciding whether to admit expert testimony. We find that in toxic tort cases when courts exclude expert testimony, a significant majority of them do engage in a local sufficiency analysis.

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Do Courts Engage in a Sufficiency Analysis When Making *Daubert* Rulings in Toxic Tort Cases?

JOSEPH SANDERS & MICHAEL D. GREEN*

INTRODUCTION

In *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,[1] the United States Supreme Court established a new method of assessing the admissibility of expert testimony in federal courts.[2] *Daubert*, and two subsequent opinions,[3] have fundamentally changed the likelihood that the testimony of expert witnesses in civil cases will be excluded prior to trial.[4] As a result, the testimony of hundreds, perhaps thousands, of experts has been excluded in whole or in part. However, confusion persists as to how trial courts should approach the decision to admit or exclude expert testimony.

In an earlier article, we argued that much of the confusion exists because of the continuing uncertainty about the relationship of two related concepts in the *Daubert* analysis: admissibility and sufficiency.[5] We then went on to "argue that the best way to clarify the issue is to appreciate that most admissibility decisions regarding expert testimony are best understood as sufficiency judgments about the scientific evidence supporting the expert's

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[1] 509 U.S. 579 (1993).

[2] *Id.* at 587–95 (outlining the new test and underlying reasoning for the change in admissibility standards).

[3] *See* General Elec. Co. v. Joiner, 522 U.S. 136 (1997) (holding that abuse of discretion is the appropriate standard to review a court's decision to admit or exclude expert evidence); Kumho Tire Co. Ltd. v. Carmichael, 526 U.S. 137 (1999) (holding that *Daubert* applies to all expert testimony and that courts should focus on "the case at hand"). The *Daubert* trilogy applies only to admissibility rulings in the federal courts. However, over time most state courts have followed suit. *See* Michael Morgenstern, Daubert v. Frye—*A State-by-State Comparison*, THE EXPERT INSTITUTE (2017), https://www.theexpertinstitute.com/daubert-v-frye-a-state-by-state-comparison/? [https://perma.cc/GDC2-4GRB] (listing thirty-nine states that have adopted a *Daubert*-like test).

[4] The effect has been much less profound in criminal cases. Michael D. Green & Joseph Sanders, *Admissibility Versus Sufficiency: Controlling the Quality of Expert Witness Testimony*, 50 WAKE FOREST L. REV. 1057, 1057 (2015); *see also* Joseph Sanders, *Applying* Daubert *Inconsistently?: Proof of Individual Causation in Toxic Tort and Forensic Cases*, 75 BROOK. L. REV. 1367, 1368–69 (2010) (noting an ongoing discussion surrounding inconsistencies found within jurisdictions, specifically between civil and criminal cases); Julie A. Seaman, *A Tale of Two* Dauberts, 47 GA. L. REV. 889, 890–93 (2013) (discussing the claim that the *Daubert* test is applied "more lackadaisically" in criminal cases, specifically in reference to expert testimony put forth by the prosecution).

[5] Green & Sanders, *supra* note 4, at 1057, 1095.

testimony."[6] We argued that this is the best way to approach the issue under Federal Rule of Evidence 702,[7] and we also argued that a "close reading of opinions reveals that many courts do adopt a sufficiency approach when making admissibility rulings."[8] In support of our position, we offered up multiple cases in which the court employed a sufficiency rationale in its *Daubert* decision. Our proposal has been met with several criticisms. In this Article, we clarify our position and respond to those critiques.

The earlier article did not attempt to conduct a systematic review of *Daubert* cases to test this hypothesis. In this Article, however, we attempt just that task. We report the results of reviewing a sample of cases to determine whether when judges exclude all of a party's experts, they have determined that the proffered scientific data is insufficient to support an expert's conclusion and, when the testimony of the expert is essential to the party's case, the data is insufficient to support a verdict for the party seeking to introduce the testimony.

Part II of this Article reviews the three Supreme Court opinions and our argument that together they may be understood as being about sufficiency. We note that revised Rule 702 permits courts to incorporate sufficiency considerations when ruling on admissibility. Finally, Part II provides illustrative examples from our first article of opinions that explicitly or implicitly rule on *Daubert* admissibility based on sufficiency considerations.

Part III addresses two types of criticisms of our position. The first critique is normative. It argues that for various reasons it is important to maintain a bright line between the concepts of admissibility and sufficiency. The second critique is empirical. This critique argues that our anecdotal approach cherry-picked examples of opinions adopting a substantive approach. As we discuss below,[9] some courts do explicitly state that admissibility does not involve a sufficiency analysis.[10]

We briefly review and respond to the normative objections and then turn our attention to the primary focus of the Article: whether courts do routinely adopt a sufficiency analysis when deciding whether to admit expert testimony.

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[6] *Id.* at 1057, 1095.

[7] FED. R. EVID. 702. This is not necessarily the case for admissibility decisions under Rules 401, 701, or 703.

[8] Green & Sanders, *supra* note 4, at 1058.

[9] *See infra* text accompanying notes 58, 95–99.

[10] *See* Milward v. Acuity Specialty Prod. Grp., Inc., 639 F.3d 11, 22 (1st Cir. 2011) ("In addition, the alleged flaws identified by the court go to the weight of Dr. Smith's opinion, not its admissibility. There is an important difference between what is *unreliable* support and what a trier of fact may conclude is *insufficient* support for an expert's conclusion."). For a critique of *Milward* and other liberal admissibility decisions, see David E. Bernstein, *The Misbegotten Judicial Resistance to the* Daubert *Revolution*, 89 NOTRE DAME L. REV. 27, 31–41 (2013) (discussing admissibility rules prior to *Daubert*).

Before proceeding, we should explain that our earlier article observed that the *Daubert* factors were not "well-suited" to determine the reliability of expert testimony about scientific causation.[11] For example, there is no way to determine an error rate for epidemiologic or toxicologic studies nor even for secondary evidence such as adverse reaction reports or chemical structure similarity.[12] Similarly, determining specific causation—whether the agent caused the plaintiff's disease—is not a matter that scientists interested in causation explore and thus, the publication and peer review factors, among others, are not helpful in assessing the reliability of such testimony.[13] This mismatch produced conflict, confusion, and incoherence[14] in the cases, which, of course, was part of the motivation for writing the first article. In Part IV, we discuss several ways in which this confusion manifests itself. In the process, we refine our understanding of what it means to adopt a sufficiency approach to admissibility. We then set forth our effort empirically to assess a group of cases to test whether courts actually use a sufficiency approach as we now understand it, and we report our findings.

Part V briefly compares the results of our analysis of these cases with a group of cases where we believe the court's use of a non-sufficiency analysis would be greatest. Part VI concludes with a discussion of how these results relate to our original argument, both methodologically and normatively.

I. THE *DAUBERT* TRILOGY

A. *Before* Daubert

Prior to the rise of mass torts, exclusion of expert testimony in civil cases was extremely rare.[15] The *Frye* general-acceptance limitation on expert

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[11] Green & Sanders, *supra* note 4, at 1068.

[12] *Id.* at 1070.

[13] *Id.* at 1094.

[14] *Id.* at 1057 (introducing the issues stemming from the creation of the *Daubert* analysis).

[15] *See* Paul C. Giannelli, Daubert*: Interpreting the Federal Rules of Evidence*, 15 CARDOZO L. REV. 1999, 2008 (1994) (reporting that "*Frye* had been applied almost exclusively to criminal cases and was not applied in a federal civil case until 1984"); Kenneth J. Cheseboro, *Galileo's Retort: Peter Huber's Junk Scholarship*, 42 AM. U.L. REV. 1637, 1695 (1993) ("There [was] not a single case decided by the federal appellate courts prior to 1975 that applied the *Frye* rule in a civil case of any kind. As of April 7, 1993, only three such decisions had been reported, two of which were decided in 1991."). One of these cases was the circuit court opinion in *Daubert*. Daubert v. Merrell Dow Pharm., Inc., 43 F.3d 1311 (9th Cir. 1995). Another case cited by Cheseboro is *Christophersen v. Allied-Signal Corp.*, 939 F.2d 1106, 1110–12 (5th Cir. 1991), *cert. denied*, 503 U.S. 912 (1992). Whether *Christophersen* really "relies" on *Frye* might be questioned, since the court listed four considerations, of which *Frye* is only one. The final case is *Barrel of Fun, Inc. v. State Farm Fire & Casualty Co.*, 739 F.2d 1028, 1031 (5th Cir. 1984). As Susan Haack notes, *Barrel of Fun* is a fire insurance fraud case excluding "psychological stress evaluation" testimony, "which the court held to be essentially similar to polygraph evidence, which was the kind of evidence at issue in *Frye*." Susan Haack, *Proving Causation: The Holism of Warrant and the Atomism of* Daubert, 4 J. HEALTH & BIOMEDICAL L. 253, 258 n.24 (2008).

testimony was employed almost exclusively in criminal cases.[16] The norm was simply to admit all expert testimony and allow juries to give it the weight they felt it deserved. To some extent, the modern "gatekeeping" adopted by *Daubert* was not needed in an era before the rise of mass toxic torts and the liberalization of the admissibility of expert testimony in the Federal Rules of Evidence.[17] Things began to change due to a series of opinions in two mass toxic torts, *Agent Orange*[18] and the Bendectin cases,[19]

Our own research found two additional toxic substances cases that mention *Frye*. One is *Brock v. Merrell Dow Pharm., Inc.* In that case, Judge Higginbotham cited *Frye* in his dissent to the denial of a rehearing en banc. 884 F.2d 167, 168–69 (5th Cir. 1989) (Higginbotham, J., dissenting). The other case, *Ellis v. International Playtex, Inc.*, cited *Frye* critically and concluded that the dispute over the validity of the methodology in certain epidemiologic studies should be submitted to the jury, rather than decided by the judge. 745 F.2d 292, 303–04 (4th Cir. 1984).

[16] Giannelli, *supra* note 15, at 2008 ("The civil cases, spurred by toxic tort litigation, also came later. *Frye* had been applied almost exclusively to criminal cases and was not applied in a federal civil case until 1984.").

[17] *See* MICHAEL D. GREEN, BENDECTIN AND BIRTH DEFECTS: THE CHALLENGES OF MASS TOXIC SUBSTANCES LITIGATION 306 (1996) (discussing how the expansion of liability theories resulted in courts becoming "chronically overwhelmed" by the new flood of litigation).

[18] *See In re* Agent Orange Prod. Liab. Litig., 611 F. Supp. 1223 (E.D.N.Y. 1985). In the *Agent Orange* litigation, Judge Weinstein granted defendants summary judgment in individual suits brought by veterans who opted out of the class action settlement. *Id.* at 1264. He based his opinion on Rule 703, concluding that the facts and data (i.e., scientific evidence) relied on by plaintiff's experts did not suffice as a basis for their opinions: "If the underlying data are so lacking in probative force and reliability that no reasonable expert could base an opinion on them, an opinion which rests entirely upon them must be excluded." *Id.* at 1245.

Peter Schuck has chronicled the *Agent Orange* litigation and explained why Judge Weinstein, in order to protect a global class-wide settlement that he had largely masterminded through his appointed special master, Kenneth Feinberg, felt the necessity to dismiss all of the opt-out claims by veterans. PETER H. SCHUCK, AGENT ORANGE ON TRIAL: MASS TOXIC DISASTERS IN THE COURTS 226–45 (1986) (discussing in depth Judge Weinstein's approach to the opt-out cases); *see also* Charles Nesson, Agent Orange *Meets the Blue Bus: Factfinding at the Frontiers of Knowledge*, 66 B.U.L. REV. 521, 536–37 (1986) (discussing how Judge Weinstein avoided a "long road" through the use of his settlement strategy).

[19] The critical issue in all of the Bendectin cases was whether Bendectin caused the birth defects, most typically limb reduction defects, in children who were exposed to it in utero. Among the many relevant Bendectin cases, we should call special attention to one: *Richardson v. Richardson-Merrell, Inc.*, 649 F. Supp. 799 (D.D.C. 1986), *aff'd*, 857 F.2d 823 (D.C. Cir. 1988). One of the plaintiff's experts, Dr. Alan Done, testified that Bendectin was a tertatogen and that it caused the plaintiff's birth defect. Unlike Judge Weinstein in *Agent Orange*, Judge Jackson denied the defendant's motion for a summary judgment and tried the case. Defense experts countered with a group of epidemiologic studies that found no significant increase in limb defects in infants whose mothers used Bendectin. After a jury verdict, Judge Jackson granted judgment for the defendant relying on the epidemiologic evidence proffered by the defendant's experts and discounting non-epidemiologic evidence relied on by the plaintiff's experts because it was neither published nor peer reviewed. *Id.* at 801–02.

The court of appeals affirmed the trial court decision, but it did so by ruling that the plaintiffs' experts' testimony was inadmissible because it lacked an adequate foundation. Richardson v. Richardson-Merrell, Inc., 857 F.2d 823, 829 (D.C. Cir. 1988). Like Judge Weinstein in *Agent Orange*, the court of appeals employed Rule 703 to assess the bases for an expert's opinion: "Thus, the question for us is not whether there was *some evidence*, but whether, in terms of 'the actual quantum and quality of proof necessary to support liability,' there was *sufficient evidence* upon which a jury could properly

which used Rules 702 and 703 to restrict the admissibility of expert testimony.[20]

Prior to the Supreme Court's *Daubert* opinion, however, the method of analysis courts employed when ruling on admissibility remained in flux. Some courts focused their analysis on Rule 703.[21] Others focused on Rule 702.[22] Still others created an admissibility rule that was an amalgam of both rules and the *Frye* test.[23] Regardless of the rationale, in many of these cases expert opinions were excluded perhaps due to the growing conviction that without some judicial policing adversarial expert witnessing was out of control.[24]

Only one court relied purely on the old *Frye* test to exclude an expert. That court was the Ninth Circuit in *Daubert*.[25]

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base a verdict for the Richardsons. . . . We conclude that Dr. Done's opinion lacks an adequate basis and therefore, whether viewed alone or in conjunction with those of the other experts, did not provide the 'substantial probative evidence' that would require us to leave the verdict as the jury rendered it." *Id.* at 828–29 (emphasis in original; citations omitted).

Two other courts relied on sufficiency of the evidence to decide as a matter of law for Bendectin's manufacturer. *See* Turpin v. Merrell Dow Pharm., Inc., 959 F.2d 1349, 1353 (6th Cir. 1992) (stating that "[t]his case, we believe, should be decided on the rules of the sufficiency of evidence of causation on summary judgment"); Merrell Dow Pharm., Inc. v. Havner, 953 S.W.2d 706 (Tex. 1997) (discussing various scientific and statistical methods in regard to a sufficiency of evidence standard).

[20] *See* Michael D. Green, *Expert Witnesses and Sufficiency of Evidence in Toxic Substances Litigation: The Legacy of* Agent Orange *and Bendectin Litigation*, 86 NW. U.L. REV. 643 (1992) (explaining the impact of the Agent Orange and Bendectin litigations in raising concerns about expert testimony and fueling more restrictive rules about their admisssibility). These two litigations were not alone. *Christophersen* involved exposure to fumes created in the process of manufacturing batteries that allegedly caused the plaintiff's decedent's colon cancer. Christophersen v. Allied-Signal Corp., 939 F.2d 1106, 1108. In *Viterbo v. Dow Chemical Co.*, 826 F.2d 420, 421–22 (5th Cir. 1987), the plaintiff claimed that exposure to a pesticide caused a number of ailments.

[21] Both *Agent Orange* and *Richardson* used Rule 703 to exclude the expert testimony. At the time, the language of Rule 703 was:

> The facts or data in the particular case upon which an expert bases an opinion or inference may be those perceived by or made known to the expert at or before the hearing. If of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject, the facts or data need not be admissible in evidence.

FED. R. EVID. 703. After *Daubert*, Rule 703 was relegated to the sidelines. One might speculate about whether the course of expert admissibility law would have run smoother had the Supreme Court relied on this rule rather than Rule 702.

[22] DeLuca v. Merrell Dow Pharm., Inc., 911 F.2d 941, 953 (3d Cir. 1990).

[23] Christophersen, 939 F.2d at 1110.

[24] Peter W. Huber, if not single-handedly responsible for concerns about the quality of expert testimony, surely beat the loudest drum on this subject. *See* PETER HUBER, GALILEO'S REVENGE: JUNK SCIENCE IN THE COURTROOM (1991).

[25] *See* Daubert v. Merrell Dow Pharm., Inc., 951 F.2d 1128, 1129–30 (9th Cir. 1991), *vacated*, 509 U.S. 579 (1993).

B. Daubert

The trial court opinion, quoting an earlier Ninth Circuit criminal law opinion,[26] stated, "[a] necessary predicate to the admission of scientific evidence is that the principle upon which it is based 'must be sufficiently established to have general acceptance in the field to which it belongs.'"[27]

The Ninth Circuit Court of Appeals picked up on the general acceptance language and wrote a brief opinion that relied on *Frye*.[28] The Ninth Circuit's opinion offered the Supreme Court the opportunity to resolve whether the *Frye* general acceptance standard survived the adoption of the Federal Rules of Evidence.[29]

As is well known, the Supreme Court answered in the negative.[30] Instead of adopting *Frye* or relying on Rule 703, which addresses the legitimate bases on which an expert may base an opinion,[31] the *Daubert* Court grounded its opinion in Rule 702, which refers to experts with "scientific . . . knowledge."[32] Scientific knowledge, the Court explained, is premised on reliable reasoning and methodology. This is an important point. At least since the *Frye* test, it is not sufficient that expert testimony be relevant. It must also be reliable.[33] The Court offered four non-exclusive factors courts might consider in resolving the issue of reliability: (1) peer review and publication; (2) the known or potential rate of error; (3) general acceptance; and (4) whether a theory has been tested ("falsification").[34]

The four non-exclusive factors notwithstanding, the Court offered little by way of defining the key concept of reliability except to note that it is to be measured by more than the *Frye* test, and that in the toxic tort context where the question is one of scientific expertise, evidentiary reliability is to

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[26] United States v. Kilgus, 571 F.2d 508, 510 (9th Cir. 1978).

[27] Daubert v. Merrell Dow Pharm., Inc., 727 F. Supp. 570, 572 (S.D. Cal. 1989), *aff'd*, 951 F.2d 1128, 1128 (9th Cir. 1991), *vacated*, 509 U.S. 579, 580 (1993).

[28] Focusing on the epidemiologic record for Bendectin, the court reasoned that the plaintiffs' experts, who relied on reanalyzing the published studies and found a sufficient association to support an opinion that causation existed, had not employed a proper methodology. The plaintiffs' reanalysis of epidemiologic studies fell short because of a lack of peer review and publication. *Daubert*, 951 F.2d at 1130–31. With all of their experts' opinions excluded, the plaintiffs could not demonstrate causation; therefore, summary judgment was affirmed. *Id.* at 1131.

[29] Absent the *Frye* question, it seems unlikely the Supreme Court would have granted certiorari. The Court had refused to grant certiorari in several earlier Bendectin cases and refused to review two other courts of appeals decisions after granting certiorari in *Daubert*. The Court's opinion demonstrated no interest in the specifics of the evidence on the causation issue involved in the *Daubert* case. *See* Green, *supra* note 17, at 309.

[30] *Daubert*, 509 U.S. at 587.

[31] *See* FED. R. EVID. 703 ("An expert may base an opinion on facts or data in the case that the expert has been made aware of or personally observed.").

[32] *Daubert*, 509 U.S. at 580.

[33] *Id.* at 584.

[34] *Id.* at 593–94.

be understood as scientific validity.[35] Importantly, the opinion did not offer a yardstick for assessing the quantum of reliability necessary to pass *Daubert* muster.

In the first years after *Daubert*, courts frequently focused on the so-called *Daubert* factors when making admissibility determinations.[36] However, another idea ultimately turned out to be more important. That idea was "fit." Here is what the Supreme Court said about this concept:

> Rule 702 further requires that the evidence or testimony "assist the trier of fact to understand the evidence or to determine a fact in issue." This condition goes primarily to relevance. "Expert testimony which does not relate to any issue in the case is not relevant and, ergo, non-helpful." 3 Weinstein & Berger ¶ 702[02], p. 702–18. See also *United States v. Downing*, 753 F.2d 1224, 1242 (CA3 1985) ("An additional consideration under Rule 702—and another aspect of relevancy—is whether expert testimony proffered in the case is sufficiently tied to the facts of the case that it will aid the jury in resolving a factual dispute"). The consideration has been aptly described by Judge Becker as one of "fit." "Fit" is not always obvious, and scientific validity for one purpose is not necessarily scientific validity for other, unrelated purposes. . . . The study of the phases of the moon, for example, may provide valid scientific "knowledge" about whether a certain night was dark, and if darkness is a fact in issue, the knowledge will assist the trier of fact. However (absent creditable grounds supporting such a link), evidence that the moon was full on a certain night will not assist the trier of fact in determining whether an individual was unusually likely to have behaved irrationally on that night. Rule 702's "helpfulness" standard requires a valid scientific connection to the pertinent inquiry as a precondition to admissibility.[37]

In hindsight, the *Daubert* fit discussion is confused and confusing. In the first part of this paragraph, the *Daubert* Court seems to relegate fit to a question of relevance. Does the assertion of the expert have any bearing on the issues in the case? However, the Court opens the door to a different

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[35] *Id.* at 590–91; *see* Joseph Sanders, *Scientific Validity, Admissibility, and Mass Torts After* Daubert, 78 MINN. L. REV. 1387, 1396 (1994).

[36] *See, e.g.*, Kumho Tire Co., Ltd. v. Carmichael, 526 U.S. 137, 141 (1999) ("This case requires us to decide how *Daubert* applies to the testimony of engineers and other experts who are not scientists."); Moore v. Ashland Chemical Inc., 151 F.3d 269, 276 (5th Cir. 1998) ("Procedurally, *Daubert* instructs us that the district court must determine admissibility under Rule 702 . . . ."); *In re* Paoli R.R. Yard PCB Litig., 35 F.3d 717, 745 (3d Cir. 1994) ("[A]ny step that renders the analysis unreliable under the *Daubert* factors renders the expert's testimony inadmissible.").

[37] *Daubert*, 509 U.S. at 591–92.

understanding when it cites Judge Becker's *Downing* opinion and offers up its phases-of-the-moon example. It is, to be sure, a poor example, all too easily dismissed as silliness. But lurking in the example is an important point: Why is it that an expert should not discuss the phases of the moon when the issue is a party's irrational behavior? Not presumably purely because it is irrelevant, for one must assume that the court imagines an expert who is prepared to say, "My opinion is that a full moon causes some people to behave irrationally and in my expert opinion, this person is such an individual." The problem with this testimony, as the Court points out, is not that it is irrelevant. The problem is the absence of "creditable grounds supporting such a link [between phases of the moon and irrational behavior]."[38] The problem is one of reliability,[39] a problem that is pervasive in the realm of expert opinions on causation in toxic tort cases.

After *Daubert*, the concept of fit was rarely the centerpiece of admissibility decisions. This was so for two reasons. First, because on its face the passage seems to relegate "fit" to a question of relevance and it did not seem to be on point when the question was one of reliability. Rarely will an expert whose opinion is irrelevant to the issues at hand be called to testify. And Rule 401 is fully capable of dealing with that scarce expert.[40] Second, the usefulness of the idea was seriously limited by the *Daubert* opinion's incautious and ill-advised statement that:

> The inquiry envisioned by Rule 702 is, we emphasize, a flexible one. Its overarching subject is the scientific validity and thus the evidentiary relevance and reliability—of the principles that underlie a proposed submission. The focus, of course, must be solely on principles and methodology, not on the conclusions that they generate.[41]

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[38] *Id.*

[39] This idea is reinforced in another sentence in the opinion: "Proposed testimony must be supported by appropriate validation—i.e., 'good grounds,' based on what is known." *Id.* at 590. One could say about the expert who claims that the full moon caused an individual to be irrational that the expert lacked good grounds for this position.

[40] FED. R. EVID. 401.

[41] *Id.* at 594–95.

If "fit" has nothing to do with conclusions, it is not entirely clear what role it might play.[42] Fortunately, the Court was quick to retreat from this position in *Joiner*, to which we now turn.[43]

C. Joiner

The next Supreme Court expert admissibility decision was *General Electric v. Joiner*.[44] The Court took the *Joiner* case to resolve a conflict in the circuits about the proper level of appellate review of district court admissibility decisions.[45] In *Joiner*, the Court concluded that the same "abuse of discretion" standard should be employed by appellate courts regardless of whether the trial court admitted or excluded expert testimony.[46] However, for our purposes the import of the opinion lies elsewhere. Borrowing from the *Turpin* opinion, the Court revisited the statement in *Daubert* that drew a bright line between methodology and conclusions.

> Respondent points to *Daubert's* language that the "focus, of course, must be solely on principles and methodology, not on the conclusions that they generate." 509 U.S., at 595. He claims that because the District Court's disagreement was with the conclusion that the experts drew from the studies, the District Court committed legal error and was properly reversed by the Court of Appeals. But conclusions and methodology are

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[42] In the period between *Daubert* and *Joiner*, courts struggled with the relationship between admissibility and sufficiency while at the same time they were sorting out the role of "fit" in an admissibility ruling and what to make of *Daubert*'s assertion that admissibility rules only apply to methods, not conclusions. *In re Paoli R.R. Yard PCB Litigation* is the most valuable post-*Daubert* opinion on all of these issues. Most of Judge Becker's analysis was subsequently adopted by the Supreme Court in *Joiner*. However, even the *Paoli* opinion sent mixed messages about the relationship between sufficiency and admissibility. *See In re* Paoli R.R. Yard PCB Litigation, 35 F.3d 717, 743 (3d Cir. 1994) (requiring "good grounds" for extrapolating animal toxicology studies to support an opinion about human causation while comparing concerns about the admissibility of novel scientific evidence with those for the admission of hearsay evidence).

[43] *See* Gen. Elec. Co. v. Joiner, 522 U.S. 136, 146 (1997) ("[C]onclusions and methodology are not entirely distinct from one another."). As we discuss below, although *Joiner* fundamentally retreated from the distinction between methodology and conclusions, courts desiring to admit expert testimony occasionally cite the *Daubert* passage unaccompanied by the *Joiner* reversal. *See, e.g.*, Am. Dental Ass'n v. Khorrami, 2006 WL 5105271, at *3 (C.D. Cal. 2006) (explaining that a court must consider the scientific validity of an expert's methodology, not the expert's conclusion); Martinez v. Offshore Specialty Fabricators, Inc., 2011 WL 820313, at *2 (E.D. La. 2011) (explaining that the court's analysis of the reliability of an expert's testimony focuses on methodology, not conclusions).

[44] *Joiner*, 522 U.S. at 138–39 (1997).

[45] *Id.*

[46] "A court of appeals applying 'abuse-of-discretion' review to such rulings may not categorically distinguish between rulings allowing expert testimony and rulings disallowing it. We likewise reject respondent's argument that because the granting of summary judgment in this case was 'outcome determinative,' it should have been subjected to a more searching standard of review." *Id.* at 142–43 (citations omitted).

> not entirely distinct from one another. Trained experts commonly extrapolate from existing data. But nothing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert. A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered. See *Turpin v. Merrell Dow Pharmaceuticals, Inc.*, 959 F.2d 1349, 1360 (CA6), cert. denied, 506 U.S. 826 (1992). That is what the District Court did here, and we hold that it did not abuse its discretion in so doing.[47]

With this paragraph, the Court basically rejected the *Daubert* method-conclusion distinction.[48] Going forward, the key phrase in this passage turned out to be "too great an analytical gap."[49] The idea clearly is one of sufficiency in the sense that the court should inquire whether the scientific evidence available is sufficient to support the expert's position.[50] Note that from this point of view, the question of analytical gap *always* necessitates consideration of the expert's conclusion and the connection to the available scientific data.

The *Joiner* opinion went beyond simply introducing the concept as a general proposition. Chief Justice Rehnquist's opinion discussed and critiqued animal studies and epidemiologic research cited by the plaintiff as supporting the position that exposure to PCBs either caused or "promoted"[51]

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[47] *Id.* at 146.

[48] As we note above, however, occasionally post-*Joiner* lower court opinions cite the *Daubert* passage as a justification for admitting expert opinions. *See supra* text accompanying note 43.

[49] Following is the language in *Turpin* to which the *Joiner* Court was referring: "[t]he analytical gap between the evidence presented and the inferences to be drawn on the ultimate issue of human birth defects is too wide. Under such circumstances, a jury should not be asked to speculate on the issue of causation." Turpin v. Merrell Dow Pharm., Inc., 959 F.2d 1349, 1360–61 (6th Cir. 1992). A Westlaw search found a few opinions prior to *Turpin* employing the phrase "analytical gap," but *Turpin* is the first opinion in which the phrase is used to refer to the gap between the evidence presented and the inference the expert draws from this evidence and proposes to testify about.

[50] As Susan Haack observed: "Justice Rehnquist's ruling [in *Joiner*] pushes admissibility closer to sufficiency . . . ." Susan Haack, *Mind the Analytical Gap! Tracing A Fault Line in* Daubert, 61 WAYNE L. REV. 653, 677 (2016).

[51] A cancer promoter is an agent that is not capable of inducing cellular mutagenesis but can either increase the capacity of another agent to induce mutagenesis or speed the cancer process along once mutagenesis has occurred. *See* Raymond Tennant, *What Is a Tumor Promoter?*, 107 ENVTL. HEALTH PERSP. 390–91 (1999). The National Cancer Institute web page provides a similar definition: "[a] process in which existing tumors are stimulated to grow. Tumor promoters are not able to cause tumors to form." *Tumor Promotion*, NATIONAL CANCER INSTITUTE DICTIONARY OF CANCER TERMS, https://www.cancer.gov/publications/dictionaries/cancer-terms?cdrid=390316 [https://perma.cc/6JBG-PXQL] (last visited Sept. 4, 2017).

Something like this is what the *Joiner* expert had in mind. The promotion argument was introduced by one of the plaintiff's experts who testified that: "[i]t [was] more likely than not, given Mr. Joiner's limited tobacco use, and also considering his second hand tobacco smoke exposure, and given his age at

the plaintiff's lung cancer.[52] According to Chief Justice Rehnquist, the epidemiology studies did not support the plaintiff's position. Chief Justice Rehnquist ended by saying:

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the onset of lung cancer, 37 years, that tobacco smoke served only as the initiator of the cancer and that some other agent served as the promoter of the initiated cells. It was the promotion of the initiated cells which caused Mr. Joiner to be harmed." Joiner v. Gen. Elec. Co., 864 F. Supp. 1310, 1314 (N.D. Ga. 1994), *rev'd*, 78 F.3d 524 (11th Cir. 1996), *rev'd*, 522 U.S. 136 (1997). But for the promotion effect of his PCB exposure, his cancer "would not have developed for many years, if at all." *Joiner*, 522 U.S. at 139–40 (1997). "Accelerator" of the development of the disease may be a more accurate term than promoter.

[52] Following is the Court's discussion of the animal and epidemiologic studies:

> The District Court agreed with petitioners that the animal studies on which respondent's experts relied did not support his contention that exposure to PCB's had contributed to his cancer. The studies involved infant mice that had developed cancer after being exposed to PCB's. The infant mice in the studies had had massive doses of PCB's injected directly into their peritoneums or stomachs. Joiner was an adult human being whose alleged exposure to PCB's was far less than the exposure in the animal studies. The PCB's were injected into the mice in a highly concentrated form. The fluid with which Joiner had come into contact generally had a much smaller PCB concentration of between 0-to-500 parts per million. The cancer that these mice developed was alveologenic adenomas; Joiner had developed small-cell carcinomas. No study demonstrated that adult mice developed cancer after being exposed to PCB's. One of the experts admitted that no study had demonstrated that PCB's lead to cancer in any other species.
>
> Respondent failed to reply to this criticism. Rather than explaining how and why the experts could have extrapolated their opinions from these seemingly far-removed animal studies, respondent chose "to proceed as if the only issue [was] whether animal studies can ever be a proper foundation for an expert's opinion." 864 F. Supp. at 1324. Of course, whether animal studies can ever be a proper foundation for an expert's opinion was not the issue. The issue was whether *these* experts' opinions were sufficiently supported by the animal studies on which they purported to rely. The studies were so dissimilar to the facts presented in this litigation that it was not an abuse of discretion for the District Court to have rejected the experts' reliance on them.
>
> The District Court also concluded that the four epidemiological studies on which respondent relied were not a sufficient basis for the experts' opinions. The first such study involved workers at an Italian capacitor plant who had been exposed to PCB's. Bertazzi, Riboldi, Pesatori, Radice, & Zocchetti, Cancer Mortality of Capacitor Manufacturing Workers, 11 American Journal of Industrial Medicine 165 (1987). The authors noted that lung cancer deaths among ex-employees at the plant were higher than might have been expected, but concluded that "there were apparently no grounds for associating lung cancer deaths (although increased above expectations) and exposure in the plant." *Id.*, at 172. Given that Bertazzi et al. were unwilling to say that PCB exposure had caused cancer among the workers they examined, their study did not support the experts' conclusion that Joiner's exposure to PCB's caused his cancer.
>
> The second study followed employees who had worked at Monsanto's PCB production plant. J. Zack & D. Musch, Mortality of PCB Workers at the Monsanto Plant in Sauget, Illinois (Dec. 14, 1979) (unpublished report), 3 Record, Doc. No. 11. The authors of this study found that the incidence of lung cancer deaths among these workers was somewhat higher than would ordinarily be expected. The increase,

> We further hold that, because it was within the District Court's discretion "to conclude that the studies upon which the experts relied were not sufficient, whether individually or in combination, to support their conclusions" that Joiner's exposure to PCB's contributed to his cancer, the District Court did not abuse its discretion in excluding their testimony.[53]

D. Kumho Tire

The final case in the *Daubert* trilogy is *Kumho Tire Co. v. Carmichael*.[54] The Supreme Court granted certiorari in *Kumho Tire* to make it clear that the *Daubert* admissibility standard applied to all expert testimony.[55] The plaintiffs in *Kumho Tire* were injured when the right rear tire on their minivan failed.[56] Through a rather complex line of reasoning, the plaintiffs' expert concluded that the tire failure occurred because of a manufacturing defect.[57] Here is the gist of the expert's argument: "[T]he tread of the tire at issue had separated from its inner steel-belted carcass prior to the

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> however, was not statistically significant and the authors of the study did not suggest a link between the increase in lung cancer deaths and the exposure to PCB's.
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> The third and fourth studies were likewise of no help. The third involved workers at a Norwegian cable manufacturing company who had been exposed to mineral oil. Ronneberg, Andersen, & Skyberg, Mortality and Incidence of Cancer Among Oil Exposed Workers in a Norwegian Cable Manufacturing Company, 45 British Journal of Industrial Medicine 595 (1988). A statistically significant increase in lung cancer deaths had been observed in these workers. The study, however, (1) made no mention of PCB's and (2) was expressly limited to the type of mineral oil involved in that study, and thus did not support these experts' opinions. The fourth and final study involved a PCB-exposed group in Japan that had seen a statistically significant increase in lung cancer deaths. Kuratsune, Nakamura, Ikeda, & Hirohata, Analysis of Deaths Seen Among Patients with Yusho—A Preliminary Report, 16 Chemosphere, Nos. 8/9, p. 2085 (1987). The subjects of this study, however, had been exposed to numerous potential carcinogens, including toxic rice oil that they had ingested.

522 U.S. at 144–46 (footnotes omitted).

[53] *Id.* at 146–47. We wish to make one additional observation about *Joiner*'s analytical gap. Recall, the analytical gap sentence reads in full: "A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered." *Id.* at 146. This should not be understood as a comment on a particular step in the reasoning of an expert; that is, the expert's testimony is inadmissible only when the gap in one step of the argument is too large. It is the sum of the distance from the data to the conclusion, the total gap if you will, that needs to be minded in deciding whether the data sufficiently supports the conclusion for the latter to be admissible. *See* Neal C. Stout & Peter A. Valberg, *Bayes' Law, Sequential Uncertainties, and Evidence of Causation in Toxic Tort Cases*, 38 U. MICH. J.L. REFORM 781, 787 (2005).

[54] 526 U.S. 137 (1999); David E. Bernstein & Jeffrey D. Jackson, *The* Daubert *Trilogy in the States*, 44 JURIMETRICS 351, 354 (2004).

[55] 526 U.S. at 146–47. The Eleventh Circuit had held that it applied only to "scientific evidence." Carmichael v. Samyang Tire, Inc., 131 F.3d 1433, 1435–36 (11th Cir. 1997), *rev'd*, 526 U.S. 137 (1999).

[56] *Kumho Tire*, 526 U.S. at 142.

[57] *Id.* at 142–45.

accident."[58] "[A] tire's carcass should stay bound to the inner side of the tread for a significant period of time after its tread depth has worn away," which in fact had occurred on parts of the tire.[59] The "separation" of carcass from tread caused the blowout.[60] And what caused the separation? According to the plaintiffs' expert, separation may be caused by a type of "tire misuse called 'overdeflection' (which consists of underinflating the tire or causing it to carry too much weight, thereby generating heat that can undo the chemical tread/carcass bond)."[61] If the tire has not been subjected to this type of misuse, then the cause of a separation is a tire defect.[62] Apparently the expert believed that no other possible causes needed to be considered.[63] If a visual and tactile inspection of the tire reveals the tire has not been overdeflected, it must have been defective. [64]

Without ever using the phrase "analytical gap," *Kumho Tire* reinforced the *Joiner* approach[65] and the "fit" language in *Daubert*.[66] Admissibility analyses should focus on "the case at hand," not on broad general principles and theories. That is, they should focus on the conclusions drawn by this expert and the evidence supporting these conclusions. In *Kumho Tire*, the Court confronted an expert with a novel and, according to the Court, unreliable[67] way of assessing whether the failure was due to a manufacturing defect and who made fine distinctions about tread wear on the shoulder versus the center of the tire while at the same time being unwilling to make a determination whether the tire had gone 10, 20, 30, 40,

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[58] *Id.* at 144.

[59] *Id.* at 143–44.

[60] *Id.* at 144.

[61] *Id.*

[62] *Id.*

[63] In essence, the expert employed a methodology that courts call a "differential diagnosis" when performed by medical experts. *E.g.*, Hardyman v. Norfolk & W. Ry. Co., 243 F.3d 255, 260–61 (6th Cir. 2001) ("One appropriate method for making a determination of causation for an individual instance of disease is known as 'differential diagnosis,' which is the method employed by Plaintiff's experts in this case. . . . In making his differential diagnosis, *i.e.*, ruling out other causes of Plaintiff's CTS [carpal tunnel syndrome], Dr. Linz took an extensive history of Plaintiff's non-occupational work activities."). But, there is nothing specific to medicine or any particular discipline that is required to justify the logic that if all possible causes save one can be eliminated as a cause of an outcome of interest, then the remaining potential cause is the actual one. Many different disciplines that seek causal explanations, including law enforcement, computer repair, and journalism, employ this reasoning.

[64] *Kumho Tire*, 526 U.S. at 144, 154.

[65] *See supra* pp. 10–11.

[66] *See supra* pp. 8–9.

[67] Here we mean to use the scientific meaning of "unreliable." That is, the Court suggests that others looking at the same tire would be quite likely to come to a different conclusion. *Kumho Tire*, 526 U.S. at 157. In a scathing comment directed at the expert, the Court said: "Indeed, no one has argued that Carlson himself, were he still working for Michelin, would have concluded in a report to his employer that a similar tire was similarly defective on grounds identical to those upon which he rested his conclusion here." *Id.*

or 50,000 miles prior to the accident.[68] The Supreme Court concluded that the expert's testimony was properly excluded, because although the general method he employed—a visual and tactile inspection of a tire—may be reliable in some situations, his application of the method on this occasion was not.[69] The data upon which he based his conclusion, e.g., minute differences between wear on the inside shoulder and outside shoulder of the tire, were not sufficient to support his rejection of the "overdeflection" possibility.[70]

E. *Revised Federal Rule of Evidence 702*

Following these three cases, the Federal Rules Advisory Committee proposed revisions to Rule 702 to reflect the case law. The new rule now reads:

> A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:
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> (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
>
> (b) the testimony is based on sufficient facts or data;
>
> (c) the testimony is the product of reliable principles and methods; and
>
> (d) the expert has reliably applied the principles and methods to the facts of the case.[71]

For our purposes, the most important provision is (b), the requirement that "testimony is based on sufficient facts or data."[72] This, it seems to us, is at the heart of the *Daubert* revolution as reflected in *Daubert*, *Joiner*, and *Kumho Tire*. In our earlier paper, we discuss several opinions that seemingly adopt a sufficiency approach. Here is one very good example.

Judge Barbara Rothstein presided over the multi-district litigation proceedings involving the appetite suppressant phenylpropanolamine (PPA).[73] As frequently occurs in these proceedings, she held *Daubert* hearings to resolve expert admissibility issues prior to remanding the cases to the transferor courts where they would be tried.[74] The plaintiffs claimed

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[68] *Id.* at 154–55.
[69] *Id.* at 156–58.
[70] *Id.* at 144–46, 158.
[71] FED. R. EVID. 702.
[72] *Id.*
[73] *In re* Phenylpropanolamine (PPA) Prods. Liab. Litig., 289 F. Supp. 2d 1230 (W.D. Wash. 2003).
[74] *Id.* at 1238.

that the product caused hemorrhagic and ischemic strokes, as well as seizures.[75] A comprehensive epidemiologic study of the relationship between PPA and hemorrhagic strokes in a limited demographic group had been conducted by researchers at Yale University.[76]

The plaintiffs offered the testimony of fourteen experts in pharmacology, epidemiology, neurology, toxicology, and pediatrics to testify to general causation, and the defendants challenged the admissibility of all fourteen.[77] The defendants' challenges related to the attributes of the plaintiffs (like gender and age), the time between ingestion of PPA and the relevant adverse event, and the types of injury suffered by the plaintiffs (for example, hemorrhagic strokes, ischemic strokes, and cardiac injuries).[78] Judge Rothstein's opinion systematically addressed each of these claims. After a rather thorough review of the strengths and weaknesses of the epidemiologic and non-epidemiologic research, the court concluded that although part of the Yale study was limited to women between the ages of eighteen and forty-nine, the plaintiffs' experts would be permitted to extrapolate to older and younger individuals and to men.[79] In the process, the court explained why these were reasonable inferences to draw. It concluded, however, that the plaintiffs' experts could not testify that events occurring more than three days after ingesting PPA were causally related to the drug.[80] The most "difficult question" involved the type of injury suffered by the plaintiffs.[81] The court concluded that the plaintiffs' experts could testify to a causal relationship between PPA and hemorrhagic stroke.[82] The scientific evidence with respect to ischemic strokes was a much closer call.[83] Ischemic stroke had not been investigated in the Yale study,[84] and one senses that this decision could easily have gone either way. In the end, the court concluded that experts could testify about a PPA-ischemic stroke association.[85] On the other hand, the court ruled that the evidence linking PPA and other cardiac injuries was too attenuated to permit the plaintiffs' experts to testify to this relationship.[86]

As we noted in our earlier article, what is most notable about this opinion is that it canvassed the scientific literature to determine which asserted

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[75] *Id.* at 1236.

[76] *Id.* at 1235.

[77] *Id.* at 1236.

[78] *Id.* at 1238, 1244, 1246, 1249.

[79] *Id.* at 1235, 1239–41, 1244.

[80] *Id.* at 1251.

[81] *Id.* at 1249.

[82] *Id.*

[83] *See id.* at 1246 ("[I]n comparison to hemorrhagic stroke, plaintiffs' experts on ischemic stroke unquestionably rely on a smaller volume of evidence directly relating to PPA.").

[84] *Id.* at 1235.

[85] *Id.* at 1251.

[86] *Id.* at 1250–51.

causal relationships were sufficiently supported by the scientific evidence and which were not. Moreover, the court reached its conclusions without reference to the work or methods of any of the fourteen experts proffered by the plaintiffs; rather, the court determined which causal inferences could reasonably be drawn from the scientific evidence, and sanctioned expert testimony, presumably by any qualified expert, on those matters.[87]

II. CRITIQUES OF OUR ARGUMENT

The argument we advanced in the earlier paper generated two types of criticisms: a normative criticism that our proposal fundamentally alters the probability that testimony will be admitted; and an empirical criticism that, notwithstanding our proffering a number of cases like *In re Phenylpropanolamine*, in point of fact, many courts routinely make admissibility rulings without the use of any type of sufficiency analysis. In essence, the criticism is similar to that for case reports: we employed a numerator without providing a denominator.

A. *The Normative Critique: Altering the probability of admissibility.*

The first critique is that our proposed approach will inappropriately reduce the probability that testimony will be admitted. This position was expressed by Professor Aaron Twerski and his co-author Lior Sapir.[88] They argued that adoption of a sufficiency test is inappropriate because it is too liberal.[89] They arrive at this position by comparing their understanding of the standard for admissibility, which they claim is a requirement that the court "must have a high degree of confidence in the integrity of scientific evidence before it qualifies for consideration"[90]—the test used when a party moves for summary judgment, which requires that all reasonable inferences from the evidence must be drawn in the light most favorable to the non-moving party before deciding whether the evidence is sufficient for submission to the jury.[91]

As we noted in our response to their critique, the nub of our disagreement is their claim that weak and frivolous toxic tort cases must be screened by judges because of the high costs of false positives in such cases.[92] We find no warrant in *Daubert*, its progeny, or Rule 702 (none of

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[87] *Id.* at 1246–51.

[88] *See* Aaron D. Twerski & Lior Sapir, *Sufficiency of the Evidence Does Not Meet* Daubert *Standards: A Critique of the Green-Sanders Proposal*, 23 WIDENER L.J. 641, 642, 660–61 (2014) (arguing that our approach is "simply wrong" and will "loosen[] . . . the standards of admissibility").

[89] *Id.* at 648–651.

[90] *Id.* at 650.

[91] *Id.* at 649.

[92] We have previously responded to the Twerski/Sapir critique in detail. Michael D. Green & Joseph Sanders, *In Defense of Sufficiency: A Reply to Professor Twerski and Mr. Sapir*, 23 WIDENER L.J. 663, 666 (2014).

which are limited to toxic tort cases) for changing the preponderance-of-the-evidence standard of proof in toxic tort cases. That preponderance test reflects a norm that errors on behalf of plaintiffs are equally costly as errors for defendants, and thus the civil standard of proof does not tilt in either party's direction, unlike criminal cases. Moreover, as we demonstrate in the next Part, a sufficiency approach does not lessen the probability that testimony will be admitted.

Some courts and commentators are concerned about the opposite outcome. They believe the standard for admissibility of evidence is, or should be, lower than the standard used to assess sufficiency, and thus courts err when they engage in any type of sufficiency analysis when making a *Daubert* decision.[93]

We believe that the latter concern misses an important distinction. The distinction is between what might be called local sufficiency and global sufficiency, or, as some courts describe the issue, sufficiency of the basis versus sufficiency of the evidence.[94] We admit to not having been clear on this point in our earlier article, but when we discuss sufficiency in the context of admitting expert opinions, we are talking about local sufficiency. For example, the question of sufficiency surrounding the expert's proffered causal testimony, which of course is a different question from the question of whether the entire body of evidence bearing on causation, from both the plaintiff and the defendant, warrants summary judgment on sufficiency grounds.[95]

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[93] *See, e.g.*, City of Tuscaloosa v. Harcros Chems., Inc., 158 F.3d 548, 564–65 (11th Cir. 1998) (stating that courts should avoid "the confusion and conflation of admissibility issues with issues regarding the sufficiency of the plaintiff's evidence to survive summary judgment"); Lucinda M. Finley, *Guarding the Gate to the Courthouse: How Trial Judges Are Using Their Evidentiary Screening Role to Remake Tort Causation Rules*, 49 DEPAUL L. REV. 335, 337 (1999) ("By calling what is really a sufficiency of the evidence determination an admissibility decision, judges are using their evidentiary gatekeeper power to close the gate on plaintiffs' opportunities to have their proof evaluated as a cumulative whole."); Haack, *supra* note 50 (discussing how the Supreme Court's ruling in *Gen. Elec. Co. v. Joiner*, 522 U.S. 136 (1997), pushed the admissibility standard closer to sufficiency); Edward J. Imwinkelried, Daubert *Revisited: Disturbing Implications*, 22 CHAMPION 18, 20 (May 1998) ("Shortly after the rendition of the Supreme Court's *Daubert* decision, one perceptive commentator voiced the fear that in applying *Daubert*, the lower courts would improperly conflate the standards for admissibility and legal sufficiency. That fear seems to have been realized.").

[94] McBride v. Houston Cty. Health Care Auth., No. 1:12CV1047-MHT, 2015 WL 3648995, at *2 (M.D. Ala. June 11, 2015).

[95] Perhaps our lack of clarity on this point caused some to conclude that we meant to conflate admissibility and global sufficiency decisions. Haack, *supra* note 50, at 680. In this regard, we should make one more point. Occasionally there is a lack of clarity on the consequences of a finding of sufficiency. A finding of either global or local sufficiency is not an ultimate finding of fact. Rather, it is a finding that the proof would permit a jury or other fact finder to find in the party's favor. Sometimes this important distinction is overlooked in articles addressing the admissibility-sufficiency issue. *Id.* at 680, 685; *see also* Edward J. Imwinkelried, *The Second Prong of the* Daubert *Test: Disturbing Implications of Two Recent Civil Cases*, 33 CRIM. L. BULL. 570, 575 (1997) (stating that "standing alone purported scientific testimony must possess *sufficient* probative value to prove the fact in issue").

These two sufficiency questions become one in cases in which the court excludes all testimony from the plaintiff's causation expert(s). Once that happens, there is *no* evidence to support a finding of causation and thus, summary judgment on global sufficiency grounds will inevitably follow. The local sufficiency and global sufficiency collapse into a single determination.

A particularly useful case illustrating the relationship between local and global sufficiency is *In re Zoloft (Sertraline Hydrocloride) Products Liability Litigation*.[96] The issue in the case was the admissibility of the plaintiffs' experts' testimony on two separate questions. The first was whether in vitro and in vivo research permitted them to reach the conclusion that there was a plausible biological mechanism by which the antidepressant altered embryonic development.[97] The second was whether the antidepressant, used at prescribed doses, could cause human birth defects.[98] After a review of the data, the court concluded that with one exception it "[would] not exclude the opinions of these experts to the extent that they opine as to plausible biological mechanisms of injury."[99] But the court reached a different conclusion with respect to their opinion on human causation. Among other things, it focused on the fact that the experts had little to say about existing epidemiologic evidence that generally failed to find an association between use of the drug and birth defects:

> Where [epidemiologic] research does not support the conclusions drawn by the experts, the experts must endeavor to reconcile the inconsistent epidemiological data with their opinions. Here, the experts have given scant attention to the epidemiology research in their reports, and have failed to reconcile inconsistent epidemiological evidence with their opinions on human causation. . . . The experts' failure to reconcile inconsistent epidemiological research with their

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[96] *In re* Zoloft (Sertraline Hydrochloride) Prods. Liab. Litig., 26 F. Supp. 3d 466, 481 (E.D. Pa. 2014), *aff'd,* 858 F.3d 787 (3d Cir. 2017).

[97] *Id.* at 468.

[98] For example, the court reported about one expert:

> Dr. Cabrera opines that serotonin is an important signaling molecule for organ development in a developing embryo, regulating "cell proliferation, migration, differentiation, and gene expression . . . processes [ ] fundamental to creating a normally formed embryo." He further opines that SSRI exposure "alters normal serotonin signaling pathways," and that "[t]here exists a biologically plausible mechanism of teratogenic action (MOA) . . . [A]lteration of serotonin signaling by SSRIs, including sertraline, can impact embryonic development resulting in several different congenital malformations, involving various body and organ systems. . . ." Thus SSRIs, including Zoloft, are "capable of causing birth defects."

Id. at 469 (footnotes omitted).

[99] *Id.* at 473.

> opinions regarding human causation is a significant methodological flaw, undermining their reliability under *Daubert*. . . . Because of the current state of the science, Drs. Sadler, Cabrera, and Levin's opinions about human causation require speculative leaps which are unacceptable in science and in the courthouse; their opinions about human causation are therefore inadmissible under *Daubert*.[100]

The court did not stop there, however. It added the following observation in response to the defendant's request that all of the plaintiffs' experts' testimony be excluded:

> Pfizer argues that the testimony of Drs. Sadler, Cabrera and Levin should be excluded in its entirety because the experts' opinions on human causation do not meet the *Daubert* standard. However, this argument conflates the sufficiency of the evidence with the admissibility of the testimony. The experts at issue here have conducted and reviewed *in vitro* and *in vivo* research which they believe demonstrates the existence of one or more plausible biological mechanisms by which altered concentrations of serotonin in a developing embryo may cause birth defects. The Court finds that the methodology these experts used to reach their conclusions about biological plausibility is generally reliable, and will not exclude their opinions regarding biological mechanisms, if they are otherwise admissible . . . .[101]

At first reading, this passage seems to distinguish admissibility from sufficiency, but a closer reading reveals that the distinction the court is drawing is one between local and global sufficiency. The court accepted the biological plausibility opinions because they are supported by sufficient data and rejected the human causation opinions because they are not. Each of these determinations focuses on the sufficiency of the data available to support the conclusion the expert wishes to draw.[102]

We think the *Zoloft* opinion got it just right. The court ruled on the admissibility of the general causation experts based on the evidence they proffered to support their general causation assertion. However, there was other admissible evidence in support of causation, so the inadmissibility of the general causation experts did not conclusively resolve the matter of

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[100] *Id.* at 476–77, 481 (footnotes omitted).

[101] *Id.* at 481.

[102] For a similar analysis, see *In re* Lipitor Prods. Liab. Litig., 174 F. Supp. 3d 911 (D.S.C. 2016) (holding that the expert's opinion that doses of 80 milligrams per day of drug could cause Type-2 diabetes was based on sufficient scientific facts and data, but his opinion that ten milligrams per day caused Type-2 diabetes was not).

global sufficiency in *Zoloft*. Global sufficiency required attention to the stray evidence that the plaintiffs proffered outside that had been relied on by their general causation experts.[103]

Two years later, after ruling that another general causation expert's testimony was inadmissible (in our language, not locally sufficient), the court addressed the sufficiency of the totality of the admitted evidence of biological plausibility, case reports, and other materials submitted by the plaintiffs and concluded: "Plaintiffs have not produced sufficient admissible evidence from which a reasonable factfinder could determine, by a preponderance of the evidence, that Zoloft could have caused Plaintiffs' injuries."[104] Based on this global sufficiency judgment, it granted summary judgment for the defendant.[105]

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[103] Parenthetically, we note that we expect that circumstance—supportive evidence of causation that is not relied on by general (or specific) causation expert witnesses—is rare.

[104] *In re* Zoloft (Sertraline Hydrochloride) Prods. Liab. Litig., 176 F. Supp. 3d 483, 499 (E.D. Pa. 2016).

[105] *Id.* at 499, 500. Susan Haack seems to fail to recognize what Judge Rufe did here—that even if there is admissible evidence, a global sufficiency determination may also be required. Haack, *supra* note 50, at 682.

The failure to distinguish global and local sufficiency helps to explain confusion others have expressed about the admissibility-sufficiency distinction. For example, shortly after *Daubert* was decided, Thomas J. Mack wondered how expert testimony admitted under the new rule could fail to be sufficient. He believed that *Daubert* "carries the seemingly contradictory assumption that scientific testimony can be admissible as relevant and reliably grounded in scientifically valid reasoning and methodology and also be so 'shaky' that it is insufficient to establish what it asserts." Thomas J. Mack, *Scientific Testimony After* Daubert*: Some Early Returns from Lower Courts*, 30 TRIAL 23, 30 (1994). Our answer to this question is clear. It couldn't if, by the phrase "what it asserts," we mean the conclusion drawn by the expert. This, of course, does not preclude a global sufficiency judgment based on the totality of the evidence where the expert's opinion does not address the ultimate issue.

Professor Imwinkelried's sufficiency-admissibility argument also suffers from conflating local and global sufficiency. For example, in his comments concerning *Daubert II*—the opinion in which Judge Kozinski refused to send the case back to the trial court and ruled as a matter of law that the plaintiffs had insufficient evidence to prevail because the epidemiological evidence did not indicate a relative risk of 2.0 or greater—Professor Imwinkelried noted that the epidemiology evidence was not the only causation testimony. Toxicology experts also testified that Bendectin was a teratogen based on animal studies and chemical structure similarities with other, known teratogens. He seems to conclude that an insufficiency judgment is rarely, if ever, appropriate: "When the various experts vouch for several different types of evidence pointing to a connection, it seems arbitrary to rule that it would be irrational for the jurors to find a connection." Imwinkelried, *supra* note 93, at 25.

Surely, however, the question of global sufficiency is not to be determined by how many "pieces" of evidence exist regardless of the probative value of the sum of the pieces. To see that this is the case, assume that none of the expert witnesses testifying on the findings of animal study and chemical structure research had opined as to the ultimate question of whether Bendectin caused the *Daubert* injury. They simply reported the findings of these investigations. Their testimony might well be admitted under a local sufficiency test. That is, the studies do support their testimony, and their statements are relevant as making the issue of causation more likely to exist. This does not mean that when asked to rule on a global sufficiency motion, a judge is required to accept this admitted testimony as sufficient to prove Bendectin caused the plaintiff's injury. Moreover, contrary to the implication of the Imwinkelried quotation, the sufficiency standard is not that finding against the non-moving party would be irrational. Rather, it is that it would require impermissible speculation rather than a reasonable inference.

Normally, once a causation expert's testimony on an ultimate issue is admitted, that is sufficient for the jury to find for a party on that issue. If, for example, a judge admits the testimony of an expert who proposes to testify that a substance causes the type of injury from which the plaintiff suffers and also rules admissible the testimony of a specific causation expert, local and global sufficiency collapse and the judge should rule against a motion challenging the sufficiency of the plaintiff's evidence on causation.

However, the subsequent grant of summary judgment in the *Zoloft* case reveals that this may not always be the case. We pointed out this possibility when discussing global sufficiency in our earlier article. The success of a summary judgment sufficiency motion turns not only on the evidence presented by the party against whom the motion is directed, but also on the evidence presented by the moving party. Our example of this situation came from *O'Connor v. Pennsylvania Railroad*.[106] In that case, the plaintiff slipped on ice at the entrance of the defendant's station. The issue was how long the ice had been there and, therefore, whether the defendant had been negligent in failing to remove it. The plaintiff testified that he slipped on dirty, grey ice, not fresh snow. Uncontroverted, this would be sufficient to submit to a jury the question of the defendant's notice and unreasonable delay in addressing the hazard, just as an expert's testimony that causation exists would be sufficient. However, the defendant introduced evidence from the United States Weather Bureau that virtually ruled out the possibility that any snow and ice remained from a prior storm. The court granted the defendant's motion for summary judgment.[107]

A similar situation arises with some frequency with respect to expert admissibility rulings. In the toxic tort arena, perhaps the best example comes from the many opinions that exclude causation testimony based on case reports, chemical structural similarity, and in vitro and/or animal studies when there exists a substantial body of epidemiologic evidence tending to show that the agent does not cause the disease in question.

Among the many cases expressing this position is a silicone-gel implant case, *Norris v. Baxter Healthcare Corp.*[108] There, the court made the following pronouncement:

In *Daubert II*, Judge Kozinski acted similarly with respect to the epidemiologic evidence. He ruled that because this evidence and all of the other evidence presented by the plaintiffs was insufficient to support a specific causation conclusion, it was inadmissible. Daubert v. Merrell Dow Pharms., Inc., 43 F.3d 1311, 1321–22 (9th Cir. 1995).

[106] 308 F.2d 911 (2d Cir. 1962).

[107] *Id.* at 912. *See also* City of Keller v. Wilson, 168 S.W.3d 802, 813 (Tex. 2005) ("[I]f an expert's opinion is based on certain assumptions about the facts, we cannot disregard evidence [submitted by the moving party] showing those assumptions were unfounded.").

[108] 397 F.3d 878 (10th Cir. 2005); *see also* Turpin v. Merrell Dow Pharm., Inc., 959 F.2d 1349 (6th Cir. 1992) (holding that evidence regarding animal studies was not sufficient to allow a rational jury to find that the drug in question led to plaintiff's birth defects); Merrell Dow Pharm., Inc. v. Havner,

> This is not a case where there is no epidemiology. It is a case where the body of epidemiology largely finds no association between silicone breast implants and immune system diseases. We are not holding that epidemiological studies are always necessary in a toxic tort case. We are simply holding that where there is a large body of contrary epidemiological evidence, it is necessary to at least address it with evidence that is based on medically reliable and scientifically valid methodology.[109]

One may usefully compare this statement with the following statement in *In re Heparin Products Liability Litigation*:[110]

> Courts have rejected non-epidemiological evidence as unreliable where there is an overwhelming body of epidemiological evidence to the contrary. . . . Here, however, there is no such overwhelming body of contrary epidemiological evidence. Defendants point to two epidemiological studies, neither of which were designed to determine whether there was an association between contaminated heparin and any of the conditions identified in defendants' motion for summary judgment. Absence of proof is not proof of absence, and while these studies do not provide

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953 S.W.2d 706 (Tex. 1997) (holding that, everything considered, there was not enough evidence to show that the child's exposure to the drug in question caused his birth defect).

[109] *Norris*, 397 F.3d at 882; *see also* Rimbert v. Eli Lilly and Co., No. CIV 06-0874 JCH/LFG, 2009 WL 2208570, at *13 (D.N.M. July 21, 2009) ("Dr. Jackson's report does not contain any citation to any controlled clinical trial or other epidemiological study which demonstrates that the ingestion of Prozac creates an increased risk or an increased incidence of the following conditions: akathisia, suicidal thinking, suicidal behavior or completed suicide, violence or homicidal behavior, worsening depression, psychotic decompensation, psychiatric rage, impulsivity or impulsive behavior, or disinhibition or diminished capacity to resist engaging in homicidal or suicidal behavior. . . . Even more damaging to Dr. Jackson's reliability than her lack of reliance on epidemiological studies to generate and support her conclusions is her failure to grapple with any of the myriad epidemiological studies that refute her conclusion. At the time she wrote her report, Dr. Jackson was aware of a body of published medical and scientific literature, including controlled clinical trials and other epidemiological studies, which supports the proposition that Prozac is not associated with suicidality, but she did not consider that literature in the formation of her opinions and report in this case."); Doe v. Ortho-Clinical Diagnostics, Inc., 440 F. Supp. 2d 465, 474 (M.D.N.C. 2006) ("Dr. Geier's conclusion that the peer-reviewed literature he has relied upon supports his theory that autism can be caused by thimerosal is flatly contradicted by all of the epidemiological studies available at this time."); Parker v. Mobil Oil Corp., 857 N.E.2d 1114, 1122 (N.Y. 2006) ("Key to this litigation is the relationship, if any, between exposure to gasoline containing benzene as a component and AML. Landrigan fails to make this connection perhaps because, as defendants claim, no significant association has been found between gasoline exposure and AML. Plaintiff's experts were unable to identify a single epidemiologic study finding an increased risk of AML as a result of exposure to gasoline."). For a discussion of the *Parker* case, see Dwight A. Kern & Robert J. Kenney, Jr., Frye *Meets* Parker *and the Effect on Toxic Exposure Cases*, 79 N.Y. ST. B.J. 26, 27–29 (2007).

[110] 803 F. Supp. 2d 712 (N.D. Ohio 2011).

> support for plaintiffs' theories, neither do they contradict them. I will not, therefore, exclude plaintiffs' evidence on these grounds.[111]

Of course, there remains the question of whether a particular court in a particular case will or will not conclude there is insufficient support for a conclusion the expert wishes to draw. This is what we were referring to in our earlier paper when we said that inevitably, in close cases, courts may come to contrary conclusions as to whether some evidence is admissible.[112] This, however, is not an attribute of thinking about admissibility in sufficiency terms. Rather, as the Restatement (Third) of Torts notes, it is because "the line between reasonable inference and prohibited speculation is one of the more indistinct lines that exists in law."[113] We hope that a straightforward acknowledgment that courts are making local sufficiency judgments when they rule on expert admissibility will, if anything, reduce the variance in such decisions.

Interestingly, one of us has had an opportunity to discuss the *In re Phenlypropanolomine (PPA)* and *In re Zoloft* opinions with the judges who authored them. Both judges initially denied that they had employed a sufficiency standard in deciding the *Daubert* motion. When pressed, they suggested they were informed by assessing the reliability of the expert witness's testimony based on the *Daubert* factors—much closer to an admissibility than a sufficiency standard. Yet, upon being pointed to the sufficiency aspect of their opinions, both acknowledged that they had used sufficiency language in their opinions. We take from this that, often, even judges who use a sufficiency approach are unaware of it, and that a survey of judges to determine their views on the proper methodology for deciding expert admissibility could, unless cleverly constructed, be seriously biased by this cognitive dissonance.

B. *The Empirical Critique: Many courts reject the application of any type of sufficiency analysis to admissibility decisions.*

The second critique of our earlier paper is, from one perspective, more fundamental. It is that we cherry-picked our cases without fairly accounting for cases that reject an admissibility approach that relies on sufficiency.[114] In assessing what courts do in their *Daubert* determinations, it is only fair to

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[111] *Id.* at 727–28. As an aside, one point to note about these opinions is that, like global sufficiency, local sufficiency is not a decision to be made entirely within the four corners of an individual witness opinion. In cases such as *Norris*, the court has compared an expert's proffered testimony to that of her counterparts on the other side to assess the total evidence available with respect to a particular conclusion.

[112] Green & Sanders, *supra* note 4, at 1092–93.

[113] RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 28 cmt. b (AM. LAW INST. 2010).

[114] *See* Haack, *supra* note 50, at 680 (critiquing the authors' approach to case selection).

observe that there is conflict and confusion in the cases which, of course, was part of the motivation for writing the first paper.

In the next Part, we discuss our initial efforts to assess when courts do and do not account for sufficiency in *Daubert* challenges to expert testimony on causation. We hope that this discussion will not only lead to a better understanding of what courts are doing, but that it will also address the first critique—that adopting a sufficiency approach systematically alters admissibility outcomes.

III. COUNTING AND ASSESSING CASES

A. *Case Selection and Data Coding*

As have others before us, we concluded that the best way to get a handle on the issue of when courts do and do not employ a sufficiency analysis when assessing admissibility was to look at a group of cases drawn from a legal database: in our case, Westlaw.[115]

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[115] This study follows in the footsteps of a number of other studies that have used legal databases to study the effect of *Daubert* on judicial decision making. They include LLOYD DIXON & BRIAN GILL, CHANGES IN THE STANDARDS FOR ADMITTING EXPERT EVIDENCE IN FEDERAL CIVIL CASES SINCE THE *DAUBERT* DECISION (RAND Inst. for Civil Justice 2001); Jennifer L Groscup et al., *The Effects of* Daubert *on the Admissibility of Expert Testimony in State and Federal Criminal Cases*, 8 PSYCHOL. PUB. POL'Y & L. 339 (2002); Mark Haug & Emily Baird, *Finding the Error in* Daubert, 62 HASTINGS L.J. 737 (2011); Andrew Jurs, *Gatekeeper with a Gavel: A Survey Evaluating Judicial Management of Challenges to Expert Reliability and Their Relationship to Summary Judgment*, 83 MISS. L.J. 325 (2014); John B. Meixner & Shari Seidman Diamond, *The Hidden* Daubert *Factor: How Judges Use Error Rates in Assessing Scientific Evidence*, 2014 WIS. L. REV. 1063 (2014). This research is in addition to another body of research that surveys judges to assess their knowledge and use of *Daubert*. *See generally* Veronica B. Dahir et al., *Judicial Application of* Daubert *to Psychological Syndrome and Profile Evidence: A Research Note*, 11 PSYCHOL. PUB. POL'Y & L. 62 (2005); Sophia I. Gatowski et al., *Asking the Gatekeepers: A National Survey of Judges on Judging Expert Evidence in a Post*-Daubert *World*, 25 L. & HUM. BEHAV. 433 (2001).

The study that is perhaps most relevant to the present paper is that by Meixner and Diamond. In that study, they examined how judges assess the admissibility of expert opinion. They found that judges faced with a *Daubert* challenge often undertook a rather detailed assessment of the quality of the methodology employed by the expert. They did not, as some have suggested, rely on the peripheral *Daubert* factors of peer review and general acceptance. In conducting their assessment, judges focus most attention on what they call an "implicit error rate analysis" and to a somewhat lesser extent on the *Daubert* testability factor.

From our reading of the Meixner and Diamond paper, we believe that what they label an implicit error-rate analysis is very similar to what we would label an analytical-gap analysis. Here, for example, are two passages they cite as examples of an implicit error rate analysis:

> The case reports upon which [the experts] rely make little attempt to isolate or exclude possible alternative causes, lack adequate controls, and lack any real analysis. Granted, an overwhelming amount of case reports of a temporal proximity between a very specific drug and a very specific adverse event might, as [the opposing expert] admits, be enough to make a general causation conclusion sufficiently reliable. In this case, however, we have a scant number of case reports indicating that Parlodel is temporally associated with all types of adverse events. There is not the volume of or

It is easy to say, "just count the cases," but as anyone who has used a legal database as a source of data can attest, counting cases is more difficult than it first appears because of the difficulty of determining, inter alia, which cases to count. Searches tend to be either under-inclusive or over-inclusive. Because our focus in this and our earlier paper has been on the use of expert testimony to prove causation in toxic tort cases, we sought to choose a set of cases that reflect this focus. However, a simple search of cases in the "All State and Federal" database on Westlaw that uses the terms "*Daubert*" and "causation" returns over 10,000 cases, and, of course, a very large percentage are not on point. On the other hand, searching for the term "toxic tort" proved to be remarkably under-inclusive. Many toxic torts, especially those involving drug-induced injuries, do not use the term. We did discover, however, that most cases involving toxic torts do use one or both of two other phrases: "general causation" and "specific causation."[116] Our initial search of cases using the terms "*Daubert*" and "general causation" in the text of the opinion returned over 900 cases.[117] We achieved a similar result with a search of "*Daubert*" and "specific causation." Given this large number of cases, we decided to restrict the search further by including the

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> specificity within these case reports to reliably show that [the drug caused the plaintiff's injuries].

Meixner & Diamond, *supra*, at 1117 (citing Caraker v. Sandoz Pharm. Corp., 172 F. Supp. 2d 1046, 1050 (S.D. Ill. 2001) (citation omitted));

> Does an [adult's] ability to appreciate wrongfulness only at the level of a child between 8 and 12 years of age make one insane? The court has found no authority for such a sweeping generalization. Courts have long allowed children as young as six years old to testify because "there is no precise age which determines the question of competency. This depends on the capacity and intelligence of the child, his appreciation of the difference between truth and falsehood, as well as of his duty to tell the former."
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> . . . .
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> The analytical gap between tests which show "low normal" functioning and an immature thought process on one hand and a conclusion of insanity on the other is just too great. The gap between the evidence concerning Klinefelter Syndrome and a diagnosis of insanity is even greater. This factor weighs heavily against admission of the testimony.

Id. at 1117–18 (citing United States v. Eff, 461 F. Supp. 2d 529, 535 (E.D. Tex. 2006)).

[116] Toxic tort cases employ both terms because the question of whether a substance causes injury is very often separated from the question of whether the substance caused the plaintiff's injury. *See* S.C. Gold et al., *Epidemiologic Evidence in Toxic Torts*, *in* FORENSIC EPIDEMIOLOGY: PRINCIPLES AND PRACTICE 25, 34–36 (Michael D. Freedman & Maurice P. Zeegers eds., 2016) (defining "general causation" and "specific causation" in an epidemiological context).

[117] The actual search was "OP(daubert & general /1 causation)," where the term "OP" restricts the search to the use of the terms in the opinion itself. All the searches discussed below were limited in this way. The phrase "general /1 causation" restricts the search to the use of the words next to each other. Although this search would also return cases which contained the phrase "causation general," in fact we encountered no such cases.

term "admissibility" into the search. These searches—one with the term "general causation" and one with the term "specific causation"—each returned over 700 cases, although there was substantial overlap.

We could have chosen to sample a subset of these cases, and perhaps we might do so in the future. In this initial effort, however, we decided to add one more term to our search. Because we are particularly interested in courts' use of the concept of sufficiency, we added that term as well.[118] A pair of searches were conducted in mid-April 2016. The search using the term "general causation" returned 165 opinions and the search using the term "specific causation" returned 168 opinions,[119] some published and some appearing only on Westlaw.

We read each of these cases to determine whether to include them in the final data set. A large percentage of cases were excluded for various reasons. First, we excluded all cases where the judge did not make an admissibility ruling.[120] We also excluded all opinions that had been overruled, even when they were overruled on other grounds. Cases that did not employ a *Daubert* standard of admissibility were also excluded. Most of these were state cases that explicitly employed a state version of the "*Frye*" standard. Finally, we excluded cases that did not address a question of general causation or specific causation in spite of the fact that they had used one of those terms. This meant we excluded cases in which the expert admissibility decision did not involve a question of causation, and cases that did not sound in tort, of which there were only one or two. We also excluded all but one of a group of cases if they were written by the same judge on the same legal issue in the same underlying case. This occurred when a group of cases were involved in a federal multi-district litigation (MDL), and the transferee judge made the same global causation-admissibility determination for multiple cases in multiple opinions.

These exclusions left us with eighty-six cases. Of those, seventy-three employed the term "general causation," and sixty-eight employed the term "specific causation." For each case, we coded whether it was a state or a

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[118] This decision had the potential to eliminate some cases where expert testimony was excluded without a sufficiency analysis. However, without using this term, the search produced a large number of cases that were not on point, and the inclusion of the term allowed us to capture cases in which the courts explicitly say that an admissibility judgment is not a sufficiency judgment.

[119] The exact searches were: "OP(daubert & general /1 causation & admissibility & sufficiency)" and "OP(daubert & specific /1 causation & admissibility & sufficiency)." As we discuss below, the great majority of these cases employed both terms, so the overlap in the two sets of cases was substantial.

[120] Many of these cases were not about admissibility. They included cases in which the judge chose to reserve admissibility determinations to later in the trial process, cases heard in the vaccine court in which the special master hears all the testimony, and cases in which the judge only addressed the question of global sufficiency. Finally, we excluded cases where there was an admissibility ruling but it was based solely on the qualifications of an expert witness.

federal opinion, whether it involved what we call a "toxic tort,"[121] whether it involved a prescription drug, and the year the case was decided. Most significantly, we coded whether the expert testimony had or had not been admitted, and whether the judge, in our opinion, had employed a sufficiency analysis.[122]

Coding admissibility was fairly straightforward. The codes were "admit," "exclude," or "both," with one case coded "other."[123]

Coding for sufficiency was a far more difficult task. We began by coding cases using the term "general causation" and coding general causation experts. We then looked to determine if there were specific causation experts for which the court made an independent admissibility determination. In general, this only occurred if the court admitted the testimony of at least one general causation expert. This is the case because almost all courts follow the rule that the plaintiff must "rule-in" the purported cause (thereby satisfying general causation) before "ruling-out" other causes, which is the task of the specific causation expert. If the court excluded the general causation expert, it often simply made a conclusory assertion that the specific causation testimony was also excluded. When the court admitted the testimony of a general causation expert, however, it needed to make an independent assessment of the admissibility of the specific causation witnesses. We looked at each of these determinations separately to see if our sufficiency code for these specific causation experts was different from the

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[121] The term "toxic tort" is subject to multiple definitions. We use the term for situations in which the plaintiff's exposure allegedly led to a non-traumatic injury, i.e., a disease that involved some latency period. As we note below, this definition excluded some drug cases, but by and large we did retain a good proportion of drug cases in the data base.

[122] As we note below, coding of this nature inevitably involves the exercise of judgment. We, like others who have coded cases in this way, have found that it is impossible to develop a rigid set of coding rules that cleanly sorts opinions. Our choice does create the risk of unconscious bias that could skew our results.

[123] We coded a case as "both" if there were multiple causation experts, some of whom were allowed to testify, and some of whom were not. Cases were also coded "both" if some of an expert's testimony was admitted and some excluded. The one case coded "other" was *King v. Burlington Northern Santa Fe Railway Co.*, 762 N.W.2d 24 (Neb. 2009). It violated our rule of exclusion for all cases in which there was no admissibility decision. In *King*, the Nebraska Supreme Court adopted a *Daubert* standard and remanded the case for further proceedings. This violated our general rule to exclude cases where there was no admissibility finding, but we included the case anyway because of its clear adoption of a sufficiency standard:

> We recognize that a court's wrestling with this type of evidence is no small task. On remand, however, the district court may conduct a *Daubert/Schafersman* hearing. It should resolve any questions that it has, or that BNSF raises, regarding the sufficiency of the underlying studies or the reliability of Frank's opinion testimony. But the court should remember that regarding the sufficiency of the underlying studies, it should focus on whether no reasonable expert would rely on the studies to find a causal relationship—not whether the parties dispute their force or validity.

King, 762 N.W.2d at 49.

code we gave the general causation witness. If not, we gave the case a single code. If our code was different, we included the case a second time in the data base. This occurred only twice, producing a total of eighty-eight observations.

Fourteen cases did not include the term "general causation" and we only coded the admissibility determination of the specific causation expert. In most of these cases, the court did not rule on a general causation expert. Several of these cases were remands to the transferor court from an MDL proceeding in which the MDL judge had already made general causation determinations.

Recall that our objective is to determine whether the judge admitted or excluded evidence based on a judgment that the evidence relied on by the expert was sufficient to support his or her opinion on causation. Coding "yes" on sufficiency was easiest in cases in which the court explicitly used the language of revised Rule 702, which requires that there be sufficient data to support the expert's conclusion.[124] In most cases,

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[124] For example, in *McClellan v. I-Flow Corp*., the court quoted *United States v. W.R. Grace*, 504 F.3d 745, 765 (9th Cir. 2007): "[E]valuation of an expert's opinion testimony 'requires consideration of the *overall* sufficiency of the underlying facts and data, and the reliability of the methods, as well as the fit of the methods to the facts of the case.'" 710 F. Supp. 2d 1092, 1114 (D. Ore. 2010). And in *Ashburn v. Gen. Nutrition Ctrs., Inc*., the court stated:

> This matter clearly comes under [Rule] 702, which mandates that expert testimony must be based on sufficient underlying facts or data. The term "data" is intended to encompass the reliable opinions of other experts. The advisory note to Rule 702 is instructive: "Rule 702 sets forth the overarching requirement of reliability, and an analysis of the sufficiency of the expert's basis cannot be divorced from the ultimate reliability of the expert's opinion."

No. 3:06-CV-2367, 2007 WL 4225493, at *4 (N.D. Ohio Nov. 27, 2007) (quoting FED. R. EVID. 702 advisory committee's note to 2000 amendments). One of the clearest examples of a sufficiency approach is found in *Rudd v. Gen. Motors Corp.*, which contains the following passage:

> While the inquiry into "reliable principles and methods" has been a familiar feature of admissibility analysis under *Daubert*, the new Rule 702 appears to require a trial judge to make an evaluation that delves more into the facts than was recommended in *Daubert*, including as the rule does an inquiry into the sufficiency of the testimony's basis ("the testimony is based upon sufficient facts or data") and an inquiry into the application of a methodology to the facts ("the witness has applied the principles and methods reliably to the facts of the case").

127 F. Supp. 2d 1330, 1336 (M.D. Ala. 2001) (footnote omitted). This passage ends with the following footnote:

> As will be clarified further below, this sufficiency-of-basis inquiry is formally quite distinct from the sufficiency-of-evidence inquiry involved in summary-judgment analysis, that is, Rule 702 mandates a determination of whether the expert had sufficient evidence (evidence which itself may or may not be admissible) to support his or her testimony, not a determination of whether that testimony standing alone provides sufficient evidence to allow a reasonable fact-finder to find for the plaintiff on an issue of substantive law. *See, e.g.,* Fed. R. Evid. 702, advisory committee notes, 2000 amendment (under the new rule, for purposes of determining the sufficiency of

however, courts did not employ this language. Cases were generally coded "yes" on sufficiency when the court engaged in an "analytical gap" discussion.[125] In other cases, we coded "yes" on the sufficiency variable when the judge clearly envisioned a sufficiency threshold below which testimony would have been inadmissible.[126]

> the basis of an expert's testimony, the expert's "facts or data" may include inadmissible testimony, hypothetical facts and the reliable opinions of other experts). Although these two inquiries turn out to resemble each other in the present case, they could easily diverge in other circumstances. For example, Rudd could have offered an expert whose testimony was geared solely towards excluding one of several alternative theories of accident causation. If there were a sufficient basis to establish the reliability of that testimony, it would be immaterial for admissibility purposes that that testimony, standing alone, would not also be sufficient to withstand summary judgment.

Id. at 1336 n.5.

We agree with the *Rudd* court that there can be instances in which an expert's testimony is admissible based on sufficiency, but is not sufficient to meet the party's burden of production; the example proffered by the court is one such instance. This reflects the local sufficiency versus global sufficiency distinction we raised previously. *See supra* text accompanying notes 92–105. However, when an expert's opinion that the plaintiff's disease was caused by the defendant's agent is admitted, that opinion is sufficient for plaintiff to meet her burden of production on factual causation, full stop.

[125] *See, e.g.*, Rhodes v. Bayer Healthcare Pharm., Inc., No. 10-1695, 2013 WL 1289050, at *4–5 (W.D. La. Mar. 26, 2013) (finding an "analytical gap" where the expert failed to reference any epidemiological studies in support of his proffered opinion testimony on drug toxicity); Amorgianos v. Nat'l R.R. Passenger Corp., 137 F. Supp. 2d 147, 185 (E.D.N.Y. 2001) (finding that an "analytical gap" existed between the conclusions reached by authors cited in an expert's work, and the conclusions drawn by the expert based on those authors). Not every case that had such a discussion was coded yes, because the court seemed to be more focused on relevancy than reliability. *See, e.g.*, Blanchard v. Eli Lilly & Co., 207 F. Supp. 2d 308, 319–321 (D. Vt. 2002) (finding that the lack of probative value of proffered testimony would require exclusion under *Daubert* even if an analytical gap did not exist regarding the reliability of the testimony).

[126] For example, in *Soldo v. Sandoz Pharm. Corp.*, the court made the following statement:

> Although the Court recognizes that courts in other Parlodel[] cases have been willing to lower the bar of sufficiency to conform to the lack of informative data, . . . this Court concludes that adoption of such a shifting standard would strip Rule 702 and *Daubert* of their objective anchors by lowering the admissibility standard to meet whatever evidence happens to be available, regardless of its scientific unreliability.

244 F. Supp. 2d 434, 558 (W.D. Pa. 2003) (internal citation omitted). And in *In re Human Tissue Products Liability Litigation*, the court noted:

> Dr. Parisian's conclusion, to the extent that she purports to opine that HIV, HBV, HCV, and syphilis are capable of being transmitted by unprocessed, cadaveric bone tissue that has stored [sic] at room temperature for more than thirty days, is woefully deficit. At no point during either her affidavit or deposition did Dr. Parisian adequately explain how her conclusions could be extrapolated from the results or conclusions of any of the studies.

582 F. Supp. 2d 644, 666 (D.N.J. 2008) (footnote omitted). Similarly, in a state case, *Valentine v. PPG Indus., Inc.*, 821 N.E.2d 580, 596 (Ohio Ct. App. 2004), the court stated that "[b]ecause appellant's experts relied on studies that do not support the experts' conclusions, those opinions are not scientifically

Opinions coded "no sufficiency" presented, if anything, even more problems. In no case did a judge simply say, as sometimes occurs in *Frye* jurisdictions, that the only issue is relevance. Ipse dixit, i.e., an expert's bare unsupported conclusion, never sufficed. Nevertheless, there are a number of cases where the admissibility threshold seems to be very low. The primary candidates for a no-sufficiency coding were the cases that pushed aside objections by stating that these simply went to weight and not admissibility.[127] A second indicator of a court with minimal sufficiency concerns is an opinion that favorably quotes *Daubert* for the proposition that the admissibility focus should be on methodology, not conclusions.[128] However, a good deal of caution is needed here. Opinions were not coded "no sufficiency" simply because they used this phraseology. Sometimes judges interject these phrases, especially the first one, at the end of their analyses, but a careful reading of the opinion reveals that the judges reasonably believed there was sufficient evidence to support the experts' positions. When the court clearly stated that there was sufficient data to support an expert's position, we coded the case as "sufficiency" even if the court ultimately said that objections (often pointing to flaws in the quality of the underlying scientific studies) go to weight rather than admissibility.

Even with a close reading, a substantial number of cases could not be placed in either category with reasonable confidence.[129] Some of these cases employed the no-sufficiency terms discussed above, and none of the terms suggested a sufficiency analysis, but nevertheless the body of the opinion did contain a discussion of the data upon which the expert relied. In another important group of cases, the court stated that in order to be admissible the

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reliable. These studies fall far short of proving their hypothesis. They are a starting point for further research, not scientific proof of causation."

[127] *See* Lopez v. I-Flow Inc., No. CV 08-1063-PHX-SRB 2011 WL 1897548, at 2–3, 5, 6, 8 (D. Ariz. Jan. 26, 2011) (finding lack of certainty is not grounds to exclude a doctor's testimony).

[128] *See* Bowers v. N. Telecom, Inc., 905 F. Supp. 1004, 1007 (N.D. Fla. 1995) (citing *Daubert*'s methodology requirements).

[129] To be clear, our inability to code cases in either category was based on what was written in the opinion and, as noted below, in some cases on our underlying knowledge of the scientific knowledge on the issue at hand. That is, "uncertain" is a coding category, not a statement about a judge's true state of mind. If one moves beyond the four corners of a specific opinion, however, we can find cases where the judge reveals inconsistency or is simply uncertain about the relationship between sufficiency and admissibility. *Meister v. Med. Engineering Corp.* provides a useful example. 267 F.3d 1123, 1127 (D.C. Cir. 2001). Several times during the trial, the judge refused to exclude the plaintiff's experts on Rule 702 grounds. At the end of the plaintiff's case, the judge refused to grant the defendant a judgment as a matter of law, observing that one of the plaintiff's experts "has a theory that may or may not be viable, but he has testified in other cases that have no more evidence than we have here." *Id.* at 1125. After a $10-million verdict for the plaintiff, the defendant renewed its motion. This time, the judge granted the motion. He ruled that the plaintiff's expert's testimony failed to carry plaintiff's burden because his reliance on case reports was an unacceptable basis for his causation opinion. It seems to us that it would be improper to think that the lower court applied a different standard for admissibility and sufficiency because, ultimately, its JMOL ruling turned on the insufficiency of the plaintiff's expert's opinion.

expert must use reliable methods, but made no effort to analyze whether in the case at hand the evidence supported the expert's conclusions.[130] In one or two cases, even though the opinion offered little by way of analysis of the data upon which the expert based her opinion, our knowledge of the issue at hand and the existence of data linking the substance to the illness (e.g., Prempro and breast cancer) caused us to reject the conclusion that the sufficiency of the data played no role in the court's decision. In all of these situations, we coded the case as "ambiguous."[131]

B. *Data Analysis*

In this Section, we report the results of an analysis of our eighty-eight cases. Initially, we start with some descriptive statistics.

1. *General Causation or Specific Causation*

Seventy of our eighty-eight cases were coded based on statements about a general causation expert. Eighteen were coded based on statements about a specific causation expert. Recall, however, that we coded two cases twice, once for a general causation expert and once for a specific causation expert.

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[130] Coding as "ambiguous" cases that discuss method but not data sufficiency highlights the relationship between the two issues. We would argue that in all admissibility decisions the primary issue is data sufficiency. If the data is insufficient to draw a conclusion, even the best methodology properly applied cannot save the day. On the other hand, when there is sufficient data, an expert can reach unsupported conclusions by employing inferior, shoddy methodology, i.e., drawing inferences not justified by the underlying data due to measurement error. What is worth noting is that the reason this is a problem is not because of the "unreliable" methodology per se, but because by employing it the expert has created a situation in which the data is no longer sufficient to support the expert's conclusion. Had the expert employed a reliable method, the data would be sufficient. Understood in this way, data sufficiency is central to all admissibility decisions. Nevertheless, for purposes of this paper we thought it was preferable to keep court discussions of reliable methods and data sufficiency separate.

From a broader perspective, one could argue that any time a judge engages significantly with the data that bears on the expert's testimony, regardless of what language is used, this is a sufficiency analysis. But for the purposes of this paper such an expansive definition seemed ill advised as stacking the deck too much in our favor.

[131] Students of *Daubert* will note that our coding paid little attention to most of the "*Daubert* factors": testing, error rate, peer review and publication, and general acceptance. As mentioned above, testing does get some attention when courts discuss methods. The other factors seem to play a very small role and admissibility decisions never seem to turn on them. In this regard, our experience is consistent with the findings of Meixner and Diamond: "On the whole, we found that judges faced with a *Daubert* challenge often undertake a detailed analysis of the quality of the methodology used by the expert rather than simply relying on proxies for the quality of the method such as peer review and general acceptance." Meixner & Diamond, *supra* note 115, at 1115.

In an early *Daubert* article, Professor Saks made the following observation: "But perhaps the purpose of the rules is simply to hold up a target to the courts; call one the *Frye* target and the other the *Daubert* target. The *Frye* ideal says: do whatever the experts tell you to do. The *Daubert* ideal says: figure out the science yourself." Michael J. Saks, *Merlin and Solomon: Lessons From the Law's Formative Encounters with Forensic Identification* Science, 49 HASTINGS L.J. 1069, 1139 (1998). Saks notes that inevitably judges will do a bit of both and the *Daubert* factors of peer review and general acceptance recognize this reality. *Id.* But now, nearly a quarter of a century after the *Daubert* opinion, it seems clear that courts spend a majority of their effort shooting at the *Daubert* target.

Expert Admitted?	
Yes	33
Both	8
No	45
Other	2

Sufficiency Analysis?	
Yes	53
Ambiguous	23
No	11
Other	1

Was the Case About a Toxic Tort?	
Yes	76
No	12

Was the Case a Drug Case?	
Yes	28
No	60

Was the Case State or Federal?	
State	21
Federal	67

As one can see, our search and review generated mostly federal cases and, as we had hoped, mostly toxic tort cases. Several of the cases that did not involve toxic torts were drug cases which we kept even though the injury caused by the drug would not fit a narrow definition of a toxic injury, e.g., Prozac allegedly causing a suicide.

Using our search terms, we generated a substantial proportion of cases in which all or some of the experts were excluded. Unfortunately, we do not possess a relevant base rate by which we could say that this is a low or high percentage. Our intuition, however, is that this is higher than one would observe in all expert admissibility decisions because we think decisions denying admissibility are more likely result in written opinions. As we discuss below, this may have an impact on whether a court engages in a sufficiency analysis.[132]

[132] We did check to see if the year a case was decided influenced whether testimony was admitted. Our eighty-eight cases run from 1994 to 2016, but the distribution is lumpy and there are relatively few cases before 2000. There is a weak correlation between year and admissibility such that expert opinions are more likely to be admitted in later years. If reported cases are more likely to be ones in which the testimony is excluded, then this set of cases would not be good evidence of what was going on over time.

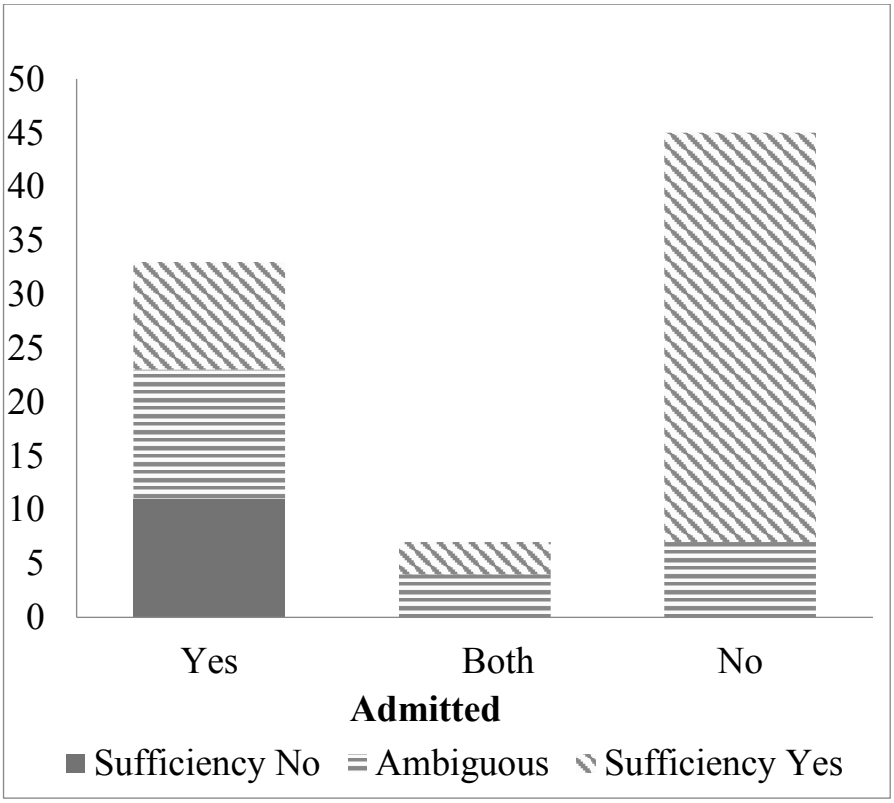
Finally, and most importantly, of our eighty-eight coded admissibility decisions, we concluded that well over half (fifty-three; 60%) did indeed engage in a sufficiency analysis while only eleven (13%) did not, with another twenty-three (26%) coded as ambiguous. This result, standing by itself, lends some support to our overall thesis that courts engage in a sufficiency analysis as we have defined it. One might fairly ask, however, what about the eleven cases that we coded no-sufficiency as well as the substantial number of ambiguous cases? In order to explore this issue, we looked at the correlation of several other variables on a court's sufficiency judgment. Most importantly, what is the relationship between a decision to admit or exclude and whether the opinion engages in a sufficiency analysis? As one can see in Table 1, there is a strong correlation between the two.

Table 1: Sufficiency Analysis by Whether the Expert's Testimony Is Admitted (percentages in parentheses)

		Admitted				
		Yes	*Both*	*No*	*Other*	*TOTAL*
Sufficiency Analysis	*No*	11 (33)	0 (0)	0 (0)	0 (0)	11 (13)
	Ambiguous	12 (36)	4 (50)	7 (15)	0 (0)	23 (26)
	Yes	10 (30)	3 (37)	38 (84)	2 (100)	53 (60)
	Other	0 (0)	1 (13)	0 (0)	0 (0)	1 (1)
	TOTAL	33 (100)	8 (100)	45 (100)	2 (100)	88 (100)

Obviously, whether or not an expert's opinion is admitted is highly correlated with the opinion's sufficiency analysis. If we exclude the "other" cases, the correlation coefficient for the remaining eighty-five cases is 0.58 and the $\chi^2 = 32.61$, df 4, $p < .001$. Perhaps more importantly, in 84% (38/45) of the cases where the testimony was excluded the court engaged in a sufficiency analysis, and in none of these cases did we code the opinion as a no sufficiency analysis. On the other hand, in every case where we coded the opinion as not undertaking a sufficiency analysis, the court admitted the expert testimony. Figure 1 presents this data in graphic form, excluding the "other" categories.

Figure 1: Sufficiency Analysis by Whether the Expert's Testimony Is Admitted ("other" category excluded)



What should we make of this result? First, it is important to note that with this data we cannot attribute causation. That is, we do not know whether a court chose whether or not to admit the expert and to accomplish this result it chose to engage in a non-sufficiency or a sufficiency analysis or, on the other hand, the court adopted a type of analysis and this led it to the decision to admit or exclude.[133] At this point, the most we can say is that these results are probably a product of both processes. If this is the case, the results lend

[133] In order to tackle this critical question, we would need a sample where the same judge ruled evidence admissible in some cases and not in others. If judges remained consistent in their analysis across cases, this would lend support to the argument that a judge's analysis of local sufficiency affects admissibility. If, on the other hand, one found judges change their rhetoric depending on whether they admit or exclude evidence, that would support a conclusion that the outcome drives the opinion's rhetoric.

some mild support to those who argue a sufficiency analysis is more restrictive than an analysis that explicitly rejects a sufficiency analysis.[134]

Second, we coded cases as employing a sufficiency analysis if they engaged in the kinds of discussions we outlined above. This does not mean that the sufficiency analysis is the only thing the court did. Many also discussed methodology and many mentioned one or more of the *Daubert* factors. It is of course impossible to know which, if any, of these analyses was dispositive in the judge's eyes.

Given these limitations, there are things that can be concluded from this result. Most importantly, when courts exclude testimony they generally do engage in some sufficiency analysis. Moreover, there seems to be a weak trend toward using a sufficiency analysis. Of the seven cases in which testimony was excluded and the court engaged in what we coded an ambiguous analysis, only two were decided after 2002.

Another point to be made from this data is that courts do not always, or even usually, employ a non-sufficiency analysis when admitting evidence. In only one-third (11/33) of the cases in which the expert causation testimony was admitted did the opinion adopt this approach. Moreover, some of the twelve admitted expert opinion cases that we coded as ambiguous may have earned this code in part because the court simply did not make the effort to write a full analysis of its reasoning. This interpretation is consistent with a general observation that opinions tend to be more frequent and more thorough when a court excludes an expert's opinion than when a court admits it.

We were also curious as to whether courts' opinions were more likely to employ a non-sufficiency analysis when assessing the admissibility of specific causation witnesses. We believed this might be the case because the evidence available to experts to assess specific causation is much softer than evidence on general causation.[135] In fact, there is some evidence supporting this position. Table 2 reports the type of sufficiency analysis by type of expert. In 28% of the cases involving specific causation experts, the courts engaged in a non-sufficiency analysis. This result is marginally statistically significant at .10.[136]

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[134] However, we should add that even if a group of judges all use a sufficiency analysis they will not necessarily come to the same admissibility decision because, as we noted above, the line between reasonable inference and prohibited speculation is indistinct and this is true whether one is engaging in a local or a global sufficiency assessment.

[135] For discussions of this issue, see David Faigman et al., *Group to Individual (G2I) Inference in Scientific Expert Testimony*, 81 U. CHI. L. REV. 417, 417–18, 440 (2014) (discussing the challenge courts face in determining "whether and how scientific knowledge derived from studying groups can be helpful in the individual cases before them"); Sanders, *supra* note 4, at 1367, 1369, 1374–75 (arguing that the "liberal standards applied with respect to specific causation and forensic experts" are the result of "the needs of law and products of science" to grapple with one another, presenting difficulties in expert witness admissibility standards).

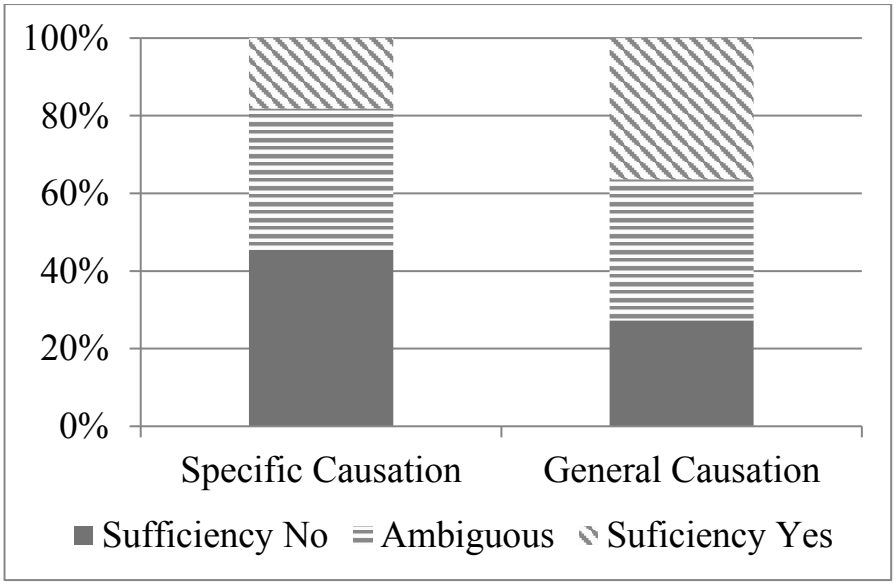
[136] $\chi^2 = 4.71$, df 2, $p < .095$.

Table 2: Sufficiency Analysis by Type of Expert (percentages in parentheses)

		Specific or General Causation Expert		
		Specific	*General*	*TOTAL*
Sufficiency Analysis	*No*	5 (28)	6 (9)	11 (13)
	Ambiguous	4 (22)	19 (27)	23 (26)
	Yes	9 (50)	44 (64)	53 (61)
	TOTAL	18 (100)	69 (100)	87 (100)

This result is skewed because specific causation experts are more likely to be admitted than general causation experts. Figure 2 presents the results only for the cases where the testimony was admitted.

Figure 2: Sufficiency Analysis by Type of Expert for Cases Where the Expert Was Admitted



In only 18% (2/11) of the specific causation expert cases did the court engage in a sufficiency analysis. On the other hand, in 36% (8/22) of the general causation expert cases, the court engaged in a sufficiency analysis. The N is too small for this to be statistically significant but the data do trend in the expected direction.[137]

[137] We ran several regressions and binary logistic regressions with sufficiency as the dependent variable (combining no sufficiency and ambiguous into one category for the binary regression) against

IV. CASES WHERE COURTS COMPARE SUFFICIENCY AND ADMISSIBILITY

Our data selection strategy was designed to maximize the inclusion of toxic tort cases. One might fairly ask if our results are peculiar to this rather unique set of cases. It is not the purpose of this paper to make a global assertion concerning the usage of a sufficiency analysis. However, it did seem important to us to engage in at least some check of other cases to see how the court handled admissibility decisions.

Ultimately, we chose to look at cases that were likely to maximize the discovery of non-sufficiency judgments. After reading many cases, we determined that one way to find such cases was to search for cases that use both "sufficiency" and "admissibility" in the same paragraph because many of these cases are drawing a distinction between the terms, often to say that sufficiency should be understood only in the global sufficiency sense. We do not mean to suggest these are a representative sample of other admissibility cases, but they do offer a fair opportunity to see if the toxic tort cases are far off the mark.

The search term "OP(daubert & sufficiency /p admissibility)" generated approximately 490 cases in May 2016. We examined the first 245 cases generated by this search. Of those cases, we ended up coding ninety-seven on grounds similar to those discussed above. Not surprisingly, the two searches generated some of the same cases, but we did not delete these cases from the second group.[138] Here are a few descriptive statistics concerning these cases:

Expert Admitted?	
Yes	59
Both	11
No	27

Sufficiency Analysis?	
Yes	39
Ambiguous	38
No	18
Other	2

admitted, whether the expert was testifying as to general or specific causation, and year. In these models only whether the evidence had been admitted affected sufficiency. Similar results were obtained when we made the dependent variable whether testimony was admitted.

[138] Our decision not to exclude was based on the idea that, if our purpose was to include cases in which there was a heightened possibility of a non-sufficiency analysis, we should keep these cases in this analysis as well.

Federal Cases	
Yes	88
No	9

Was the Case About a Toxic Tort?	
Yes	36
No	61

One of the first things worth noting is that a much higher percentage of these opinions admitted the expert testimony. This lends weak support for a general intuition that experts face a greater chance of exclusion in toxic cases, and indeed if we subdivide this sample into toxic and non-toxic tort cases, the great majority of cases not involving toxic torts admit the expert (46/61). Also, as we anticipated, a larger percentage of cases engaged in a non-sufficiency analysis. Disregarding "other" cases in both data sets, 19% (18/95) of these cases involved non-sufficiency analyses, while 13% (11/86) of the cases in the toxic sample did so.[139] Again, the cases were strongly skewed to federal cases.

If we once again look at the relationship between sufficiency and admissibility we observe the now familiar pattern set forth in Table 3:

Table 3: Sufficiency Analysis by Whether the Expert's Testimony Is Admitted (percentages in parentheses)

		Admitted			
		Yes	*Both*	*No*	*TOTAL*
Sufficiency Analysis	*No*	18 (31)	0 (0)	0 (0)	18 (19)
	Ambiguous	26 (45)	7 (64)	5 (19)	38 (40)
	Yes	14 (24)	4 (36)	21 (81)	39 (41)
	TOTAL	58 (100)	11 (100)	26 (100)	95 (100)

The type of sufficiency analysis is strongly related to the admissibility decision ($\chi^2 = 30.25$, df 4, $p < .001$.) All of the non-sufficiency opinions involved cases in which experts are admitted. If we look only at the non-toxic cases (Table 4), the pattern remains the same, although the relationship is not quite significant at .05 ($\chi^2 = 8.78$, df 4, $p < .067$).

[139] One should keep in mind that not every case in the "toxic" sample was actually a toxic tort case; as explained above, seventy-six of eighty-eight cases were toxic tort cases.

Table 4: Sufficiency Analysis by Whether the Expert's Testimony Is Admitted in Non-toxic Tort Cases (percentages in parentheses)

		Admitted			
Sufficiency Analysis		*Yes*	*Both*	*No*	*TOTAL*
	No	14 (31)	0 (0)	0 (0)	14 (23)
	Ambiguous	19 (42)	3 (50)	3 (33)	25 (42)
	Yes	12 (27)	3 (50)	6 (67)	21 (35)
	TOTAL	45 (100)	6 (100)	9 (100)	60 (100)

This sample of cases does suggest that a sufficiency analysis is somewhat more prevalent in toxic tort cases, but ultimately this appears to be so because more experts are excluded in these toxic cases. Again, we must caution that this data does not allow us to make a cause-and-effect assessment of admissibility and sufficiency, but it does allow us to say that when courts exclude expert testimony they most often do so using a sufficiency analysis.

SUMMARY AND CONCLUSION

Our two goals were to clarify the nature of sufficiency judgments used to rule on the admissibility of expert testimony in toxic tort and other cases, and to see whether an examination of a set of toxic tort cases supported the position of our earlier paper that courts engage in a sufficiency analysis when assessing the admissibility of expert testimony.

With respect to the first goal, we discussed several criticisms of a sufficiency approach. Some critics argue that our approach will be more lenient than the current situation, while others argue that it will be more restrictive. We believe that these critiques frequently fail to distinguish between a local sufficiency decision—whether there is sufficient data to support an expert's assertions—and a global sufficiency decision—whether the total body of admitted evidence is sufficient to create a jury question.

Viewed from this perspective, we continue to believe that when they are asked to rule on an admissibility, judges should recognize that they are being asked to make a local sufficiency judgment. This is the import of both the *Joiner* opinion's analytical gap analysis and the *Kumho Tire* opinion's focus on the case at hand. Is the science sufficient to support the expert's conclusion?

With respect to the second goal, our analysis of two samples of cases indicates that judges do employ a sufficiency analysis in *Daubert* rulings. However, the results are not simply random. The choice of a sufficiency analysis is strongly correlated with a court's decision to admit or exclude

expert testimony.[140] When testimony is admitted, courts are more likely to fall back on a non-sufficiency analysis and state that challenges to the expert's methods or reliability go to the weight a fact finder should give the evidence, not whether it is admissible.[141] This seems especially likely to be the case when the court admits the testimony of a specific causation witness.

We should note that courts do not universally use a non-sufficiency analysis when admitting testimony. Just as frequently, they do undertake a sufficiency analysis and conclude that the data supporting the expert's opinion is sufficient for the opinion to be admissible.

On the other hand, when courts do exclude expert testimony, unsurprisingly, they never employ a non-sufficiency analysis. And of course, how could they? For, by definition, they have concluded that this is not a situation in which conclusions don't matter and questions of evidentiary adequacy should simply be relegated to a jury's weight assessment.

Just because a court does not employ a non-sufficiency analysis does not mean, however, that it has engaged in what we have defined as a sufficiency analysis. From one perspective, the empirical argument in our earlier paper is that courts do in fact conduct a sufficiency analysis when excluding an expert on a *Daubert* motion. These results suggest that while courts do not universally do so, we are more on the mark than not. Of the forty-five cases where the expert was excluded, we coded thirty-eight as engaging in a sufficiency analysis and the other seven as ambiguous.

And even in the group of cases discussed in Part V, a group we selected in an attempt to maximize the likelihood that the court would employ a non-sufficiency analysis, in almost all such cases when experts were excluded, the court engaged in a local sufficiency analysis.

Our small, carefully selected set of cases certainly does not provide much evidence about how courts approach admissibility in the *Daubert* context more generally. However, it does confirm that in this particular corner of admissibility law, sufficiency analyses are well embedded and, if anything, this way of approaching admissibility is growing in favor.

We believe this to be a promising development. We hope that this Article will facilitate this trend by providing a clearer understanding as to how admissibility decisions do and should fit within the larger trial process.

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[140] This result is consistent with the findings of Meixner and Diamond, *supra* note 115, at 1075.

[141] Of course one could argue that even "goes to weight" statements simply constitute a different way of saying the data are sufficient to support the expert's conclusion, i.e., create a jury question. But this approach does not focus on what the judge actually says, which is the focus of our analysis.